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CORRELATION OF PHYTOPLANKTON ABUNDANCE TO DISSOLVED OXYGEN IN JATIGEDE RESERVOIR

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ABSTRACT

Research aims to find out the correlation of phytoplankton abundance to dissolved oxygen concentration in Jatigede Reservoir. Research was conducted six times in June-September 2018. The sampling station covers the entire area of Jatigede Reservoir. Based on the measurement results, the highest concentration of dissolved oxygen in Jatigede Reservoir was 7,3 mg/L. The results of the calculation of the highest phytoplankton abundance was at station 2, the 6th observation which was equal to 3,136,623 ind/L. While the lowest abundance was at station 4, the second observation is 191.259 ind/L. Species with highest abundance was *Peridinium* sp. and *Ceratium* sp. The abundance of phytoplankton is strongly related to the dissolved oxygen concentration, where the increase in phytoplankton abundance is also followed by an increase in dissolved oxygen concentration in the waters.

Keywords: Phytoplankton, Dissolved Oxygen, Jatigede

1. INTRODUCTION

Jatigede Reservoir is located in Sumedang Regency, West Java Province. This reservoir was built by damming the Cimanuk River in the Jatigede District, Sumedang Regency. Jatigede Reservoir has a variety of functions, including irrigation irrigation covering an area of 90,000 Ha in the North-West Java region, controlling floods of 14,000 Ha, potential hydroelectric power sources capable of producing 690 GWh/year of electricity with a capacity of 110 MW, 3,500 liters/second of raw water capacity to serve the people of Sumedang, Indramayu, and Cirebon, as well as the tourism sector and the fisheries sector (Fitriani 2013).

The area affected by the Jatigede Dam is in a basin surrounded by mountains and hills with very fertile flora, both in the form of paddies, mangroves, teak trees, and other productive trees such as mangoes, guava, rambutan, etc. (Purnama 2015). Fertile, green, and overgrown with various productive plants before being inundated, the waters of the Jatigede Reservoir have high potential nitrogen and phosphate elements.

Many nitrogen and phosphate elements also enter Jatigede Reservoir after a period of flooding. The entry of these elements is caused by waste water from residential areas carried by the river flow (Nugroho et al. 2014). Oxygen is also produced through process photosynthesis by phytoplankton and diffusion between water and air (Nybakken 1992) which enters Jatigede Reservoir.

Phytoplankton is one of the biological parameters that is closely related to oxygen, nitrogen and phosphate (Paikia et al. 2017). The abundance of phytoplankton in the waters affects the concentration of dissolved oxygen in these waters (Nontji 2008). The purpose of this research is to analyze correlation of phytoplankton abundance to dissolved oxygen concentration in Jatigede Reservoir.

2. MATERIALS AND METHODS

The sampling location covers the entire reservoir area which is divided into four stations, namely: Station 1 in the input area of the Cimanuk River, Station 2 and 3 in the middle area, and Station 4 in the dam area (Figure 1). Identification of phytoplankton abundance was carried out at the Ecology Laboratory of the Center for Natural Resources and Environmental Research at Padjadjaran University.

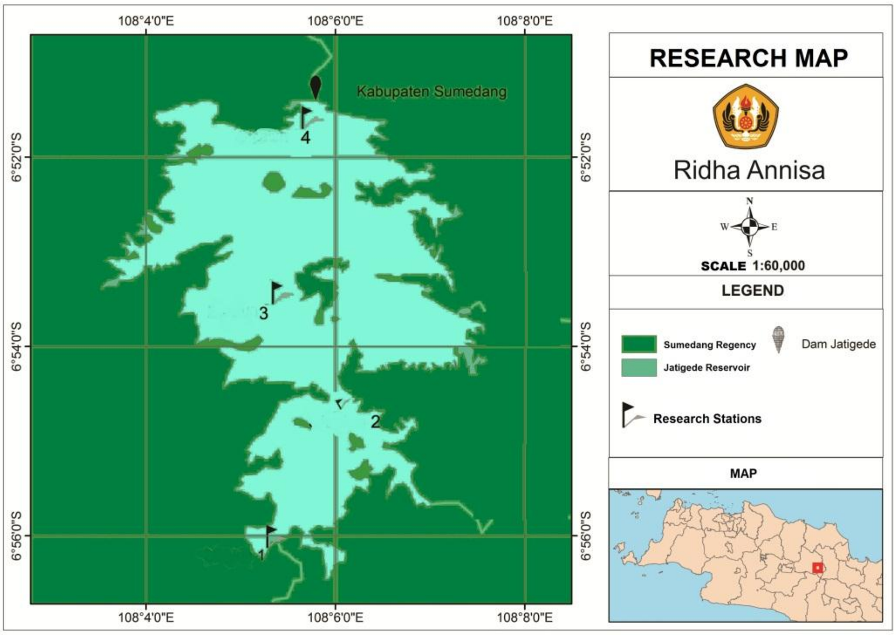

Figure 1. Jatigede Reservoir, Sumedang Regency, West Java, Indonesia.

2. PHYTOPLANKTON ABUNDANCE IN JATIGEDE RESERVOIR

The results of phytoplankton sampling at four stations in Jatigede Reservoir can be seen in Table 1 to Table 4 .

Table 1. Phytoplankton Abundance at Station 1

		Abundance (ind/Liter)					
No.	**Phylum**	**1**	**2**	**3**	**4**	**5**	**6**
1	Pyrrophyta	2.303.078	3.577.997	4.544.467	1.178.135	241.896	1.042.440
2	Euglenophyta	9.996	3.713	5.141	36	2.278	10.196
3	Charophyta	10.567	9.425	29.274	168.161	7.140	5.726
4	Chlorophyta	11.924	32.697	14.347	5.162	8.040	71.500
5	Ochrophyta	5.676	70.226	286	843	1.928	11.010
6	Xanthophyta	143	12.852	5.998	2.428	207	4.284
7	Cyanophyta	393	2.428	785	878	1.878	18.807
8	Rhodophyta	36	0	0	0	0	0
	Abundance	2.341.813	3.709.337	4.600.298	1.355.642	263.366	1.163.963

Based on the table above, it can be seen that the highest abundance of phytoplankton at station 1 is the Pyrro phyta phylum , while the abundance deposited is in the Rhodophyta phylum. The highest total abundance is found in the 3rd observation which is equal to 4,600,298 ind/Liter.

Table 2. Phytoplankton Abundance at Station 2

		Abundance (ind/Liter)					
No.	**Phylum**	**1**	**2**	**3**	**4**	**5**	**6**
1	Pyrrophyta	1.213.229	514.080	956.189	1.178.100	132.804	2.049.180
2	Euglenophyta	36	107	0	21	1.721	10.139
3	Charophyta	257.111	257.040	257.504	204.918	252.832	892.571
4	Chlorophyta	357	1.214	12.495	1.257	6.076	58.784
5	Ochrophyta	108.885	19.171	6.890	1.528	3.591	21.706
6	Xanthophyta	143	3.427	0	1.357	14	71.400
7	Cyanophyta	393	393	750	1.614	5.056	32.915
8	Rhodophyta	36	36	0	0	0	0
	Abundance	1.580.189	795.467	1.233.828	1.388.794	402.094	3.136.695

Based on the table above it can be seen that the highest phytoplankton abundance at station 2 is the Pyrrophyta phylum, while the lowest abundance is in the Rhodophyta phylum. The highest total abundance is found in the 6th observation which is equal to 3.136.695 ind/Liter.

Table 3. Phytoplankton Abundance at Station 3

No.	Phylum	Abundance (ind/Liter) 1	2	3	4	5	6
1	Pyrrophyta	401.510	1.078.251	152.168	492.660	146.870	614.040
2	Euglenophyta	36	179	7	0	43	214
3	Charophyta	534.643	77.540	81.567	2.813	119.238	329.440
4	Chlorophyta	36	179	821	828	1.578	1.571
5	Ochrophyta	75.506	6.997	3.113	1.035	8.939	2.570
6	Xanthophyta	71	36	1.028	1.071	1.499	571
7	Cyanophyta	143	143	186	343	1.928	10.915
	Abundance	1.011.944	1.163.324	238.890	498.750	280.095	959.321

Based on the table above it can be seen that the highest phytoplankton abundance at station 3 is the Pyrrophyta phylum, while the lowest abundance is in the Rhodophyta phylum. The highest abundance is found in the second observation that is equal to 1.163.324 ind/Liter.

Table 4. Phytoplankton Abundance at Station 4

No.	Phylum	Abundance (ind / Liter) 1	2	3	4	5	6
1	Pyrrophyta	619.038	131.604	925.344	485.520	37.128	128.520
2	Euglenophyta	36	0	36	0	800	428
3	Charophyta	205.632	57.577	158.972	217.991	164.934	428.471
4	Chlorophyta	36	29	214	57	64	571
5	Ochrophyta	80.575	1992	7.176	1.542	7.154	21.563
6	Xanthophyta	71	7	3.856	1.999	1.071	2.142
7	Cyanophyta	107	50	2.071	914	3.606	22.919
	Abundance	905.495	191.259	1.097.668	708.024	214.757	604.615

Based on the table above, it can be seen that the highest phytoplankton abundance at station 4 is the Pyrrophyta phylum, while the lowest abundance is in the Euglenophyta phylum. The highest abundance is found in the third observation which is equal to 1.097.668 ind/Liter.

The four tables above show that the highest abundance of phytoplankton is at station 2, 6th observation. While the lowest abundance is at station 4, 2nd observation. Where the species with the highest abundance is *Ceratium sp.* amounting to 2.467.584 ind/Liter at the 3rd observation at station 1.

The composition of species between stations is different, where at station 1 there were 50 species, at station 2 found as many as 49 species, at station 3 found as many as 37 species, and at station 4 found as many as 34 species. There are large fluctuations in abundance and type composition at each sampling station.

3. CORRELATION OF PHYTOPLANKTON ABUNDANCE TO DISSOLVED OXYGEN IN JATIGEDE RESERVOIR

The correlation coefficient of linear regression between phytoplankton abundance to dissolved oxygen in the Jatigede Reservoir on stations 1,2,3 and 4 that was obtained based on the results of the analysis were 0.967; 0,867; 0,936; and 0.964. These values show a very strong correlation, because they are in the interval of 0.80-1.00 (Sugiyono 2005).

The correlation of phytoplankton abundance (orange) to dissolved oxygen (blue) at each stations can be seen in the following graphs:

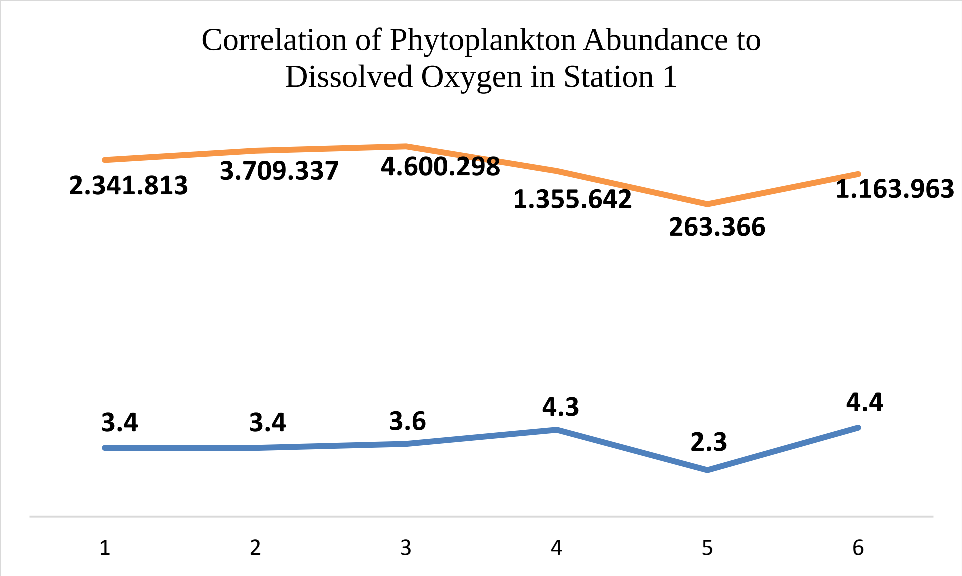

Figure 2. Correlation of Phytoplankton Abundance to Dissolved Oxygen at Station 1

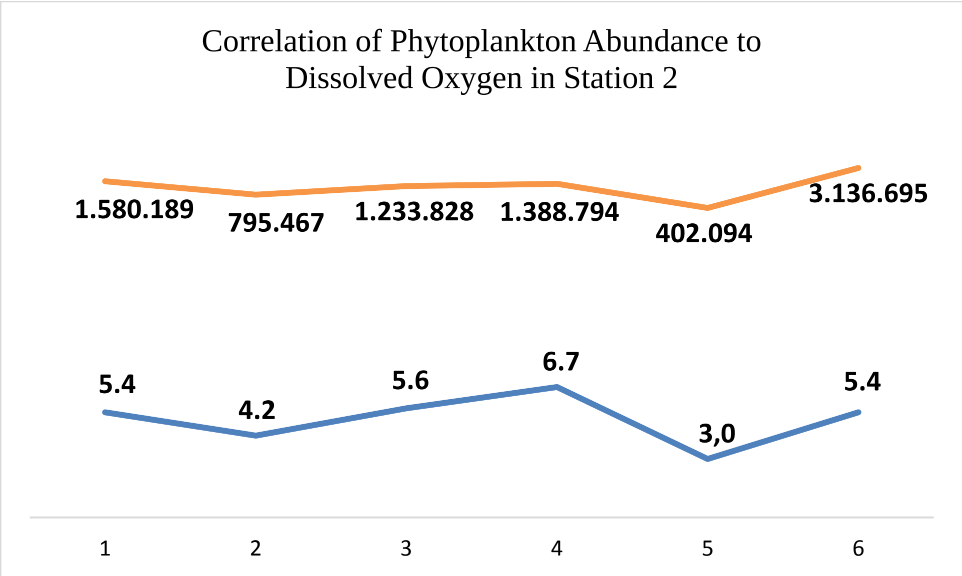

Figure 3. Correlation of Phytoplankton Abundance to Dissolved Oxygen at Station 2

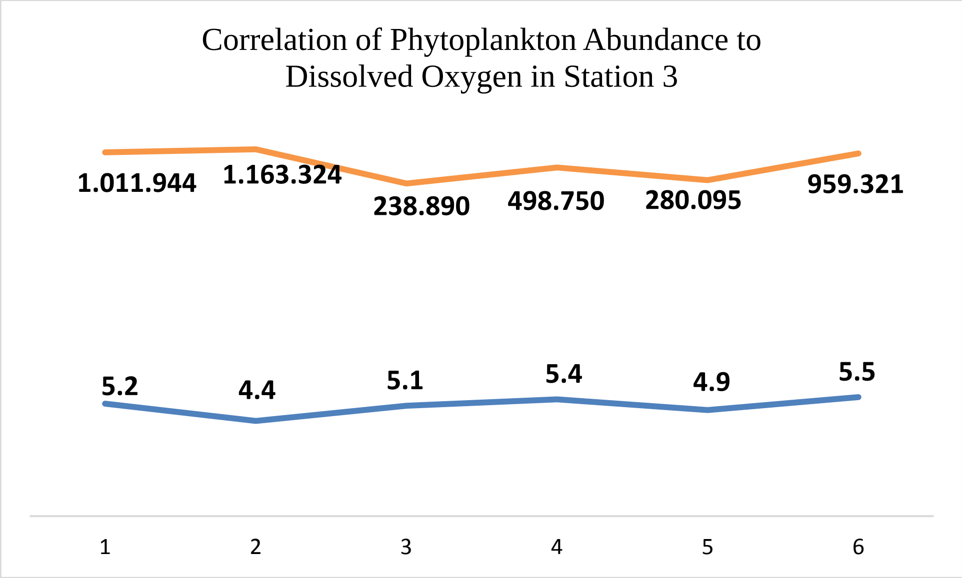

Figure 4. Correlation of Phytoplankton Abundance to Dissolved Oxygen at Station 3

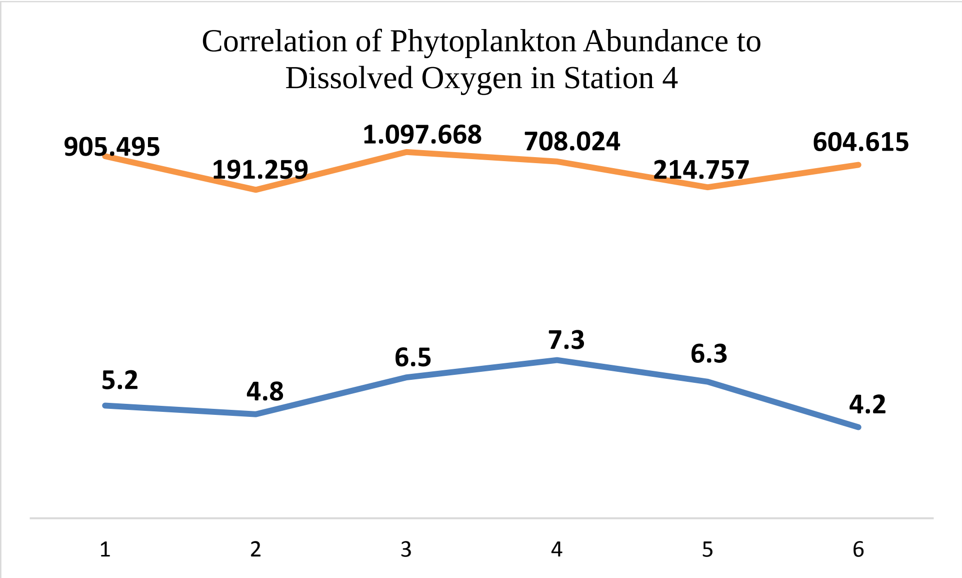

Figure 5. Correlation of Phytoplankton Abundance to Dissolved Oxygen at Station 4

Based on the graphs above, it can be seen that the changes are always in line between the abundance of phytoplankton and dissolved oxygen concentration. This proves that abundant phytoplankton in Jatigede Reservoir caused photosynthesis to produce dissolved oxygen into the waters. The highest abundance of phytoplankton is at station 2, 6th observation. While the lowest abundance is at station 4, 2nd observation. Where the species with the highest abundance are Ceratium sp. amounting to 2.467.584 ind/Liter at the 3rd observation at station 1.

The large difference in abundance between each observation is caused by differences in water conditions at different times at the time of sampling. According to Sachlan (1982) the abundance of phytoplankton is influenced by water conditions where the concentration of nutrients such as nitrate and phosphate affects the growth of phytoplankton. The intensity of the light that enters the waters also has a great influence in relation to the photothesis process carried out by phytoplankton. The large difference in abundance at each time of observation is caused by differences in water conditions at different times. At station 4 the second observation of the large abundance of phytoplankton is caused by rain on the night before sampling in the morning, causing an increase in the volume of the reservoir water resulting in dilution.

While the large differences in abundance in each species are caused by the ability of each species to utilize existing nutrients to carry out photosynthesis. The species with the highest abundance at each station is Peridinium sp. and Ceratium sp. Peridinium sp. and Ceratium sp. is a phytoplankton species from phylrophyta phylum belonging to the class of Dinophyceae. Dinophyceae in fresh water are generally non-toxic and harmless as Dinophyceae in seawater is toxic and has a negative effect on aquatic systems. But if the amount is excessive, a bloom can occur that can cause toxic properties for other planktonic organisms (allelophaty). *Peridinium sp.* and *Ceratium sp.* has the ability to prevent other phytoplankton from growing with high biomass, thereby reducing nutritional competition. This causes *Peridinium sp.* and *Ceratium sp.* in the community freshwater phytoplankton is a common type and can dominate abundance in lakes with tropical climates (Rengefors and Legrand 2001).

Strong correlation is caused by the condition of the waters that fluctuate significantly. At station 1 nutrient input occurs continuously from Cimanuk river and surrounding settlement. The number of phytoplankton species obtained was as many as 50 species, which were the most compared to other stations. Strong correlation at station 2 which is the focus of capture fisheries activities in Jatigede Reservoir where this indicates that phytoplankton as abundant natural food and fluctuate with the cycle of fish feeding in the station.

3. CONCLUSION

Based on the results, the highest concentration of dissolved oxygen Jatigede Reservoir was 7.3 mg/L. The most abundant phytoplankton species is *Peridinium* sp. and *Ceratium* sp. at each station. The abundance of phytoplankton is strongly related to the dissolved oxygen concentration, where the increase in phytoplankton abundance is also followed by an increase in dissolved oxygen concentration in the waters. Correlation values ranged from 0.867 to 0.967 which means the correlation is very strong.

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