Biomass Distribution and Phytoplankton Cell Size in Different Seasons at Cirata Reservoir, West Java, Indonesia

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ABSTRACT

The study aims to determine the dynamics of phytoplankton biomass and cell size in different season at Cirata Reservoir. Research is carried out for one year and includes two distinct season using survey method. Five locations for the study are selected based on the different values of BOD: Patokbeusi, Jatinengang, Gandasoli, Cicendo and Cihea. The results show that the biomass of phytoplankton in rainy season is higher than that in dry season, this pattern is similar with the pattern of the abundance of phytoplankton. Meanwhile variance in the size of phytoplankton cells between the rainy season and the dry season indicates no significant difference, except for certain genus. Genus with different cell size and not the dominant ones, as seen in Synedra with the cell size of 59.06 µm3 in dry season and 109.19 µm3 in rainy season and Peridinium with cell size of 469.82 µm3 in dry season and 579.00 µm3 in of rainy season.

Keyword : Cirata, Biomass, Cell Size, Phytoplankton

INTRODUCTION

Cirata Reservoir is one of serial reservoirs situated along the *Citarum River*. Based on the position of the upstream to downstream, *Cirata* lies in the second position after *Saguling Reservoir* in the upstream and before *Jatiluhur Reservoir* in the downstream. Increased fertility usually begins with physicaland chemical changes in the waters, often accompanied by a variety of changes which tend to be harmful. Phytoplankton community is the earliest biota to respond to changes in the physical and chemistry qualities of the water. To identify the characteristics of phytoplankton in the stagnant waters,it is important to understand three components: productivity expressed in net primary productivity (NPP), biomass and species composition. Variations in annual phytoplankton production in the reservoir is generally lower than that in natural lake (Thornton,et. al., 1990).

Different seasons also affect the changes in volume, temperature and dissolved nutrients in the water which carry direct impacts on the phytoplankton biomass in a body of water (Cai,et. al., 2012). The changes will also affect the dominance by one species of phytoplankton and trigger the blooming of certain types of waters. The phytoplankton domination or phytoplankton blooming may be used as determinants of the status of waters (Yilmaz, 2013).

The size of phytoplankton cells ranges in an extensive variations; some researchers, including Vollenweider (1974) and Wetzel (2001), have conducted observations on the volume size of several types of phytoplankton, for example the size of *Aphanocapsa delicatissima* is 4 mm3, while *Fragilaria crotonensis* in the form of a colony is 1 mm long and 200000 µm3.

MATERIALS AND METHODS

Research is conducted using survey method at 5 observation stations in Patokbeusi, Jatinengang, Gandasoli, Cisendo and Cihea (Figure 1). Samples are taken at the surface to a depth of 0.2 m using a plankton net and then preserved with Lugol 0.5%. The phytoplankton productivity is estimated by enumerating as the census method.

Phytoplankton biomass is calculated based on geometric biovolume method by the following equation:

$$B = Bj.V$$

B = biomass(µg/L)
Bj = weight (1.10 µ)
V = volume (µm³)

The equation for calculating dominance and diversity is based on that by Simpsons (1949, cited by Magurran, 1988) as follows:

$$D = \sum P_i^2$$

D = Simpson's dominance index

$P_i^2 = \frac{n_i}{N}$

N_i = Number of genus cells to i

N = total cells = $\sum n_i$

RESULTS AND DISCUSSION

Average diversity index and dominance of phytoplankton (Simpsons's) based on seasons and stations

Station	Diversity index		Dominance index	
	Dry	Rainy	Dry	Rainy
Patokbeusi	[illegible]	[illegible]	[illegible]	[illegible]
Jatinengang	[illegible]	[illegible]	[illegible]	[illegible]
Gandasoli	[illegible]	[illegible]	[illegible]	[illegible]
Cisendo	[illegible]	[illegible]	[illegible]	[illegible]
Cihea	[illegible]	[illegible]	[illegible]	[illegible]

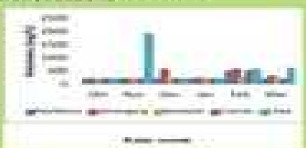
Fluctuation of dominant genus, abundance and biomass as well as the percent of dominance on the surface (0.2 m)

Season/station	Dominant genus	Abundance (cells/ml L⁻¹)	Percent (%)	Biomass (µg L⁻¹)	Total abundance (cells L⁻¹)	% dominance
Dry						
Patokbeusi	Nodularia	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Jatinengang	Microcystis	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Gandasoli	Microcystis	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cisendo	Nodularia	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cihea	Microcystis	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Rainy						
Patokbeusi	Microcystis	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Jatinengang	Microcystis	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Gandasoli	Microcystis	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cisendo	Microcystis	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cihea	Microcystis	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Average phytoplankton biomass (µg.L-1) on the surface (0.2 m) by season

Station	Dry	Rainy	Dry/rainy ratio (%)
Patokbeusi	94.679	598.658	15.56
Jatinengang	64.395	334.027	19.28
Gandasoli	40.715	171.088	23.79
Cisendo	43.709	222.241	19.71
Cihea	77.437	607.165	12.76

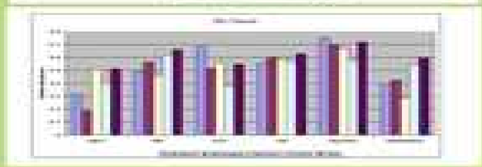
Distribution of phytoplankton biomass in surface (0.2 m) in different seasons



The size of phytoplankton cells in different seasons (µm3)

No.	Phytoplankton	Dry	Rainy
	Cyanophyceae		
1	Microcystis	34.73	34.03
2	Merismopedia	8.36	50.12
3	Nodularia	23.96	23.96
	Chlorophyceae		
1	Ankistrodesmus	41.79	43.78
2	Scenedesmus	278.66	387.23
3	Closterium	942.83	942.83
4	Staurastrum	250.79	271.68
	Bacillariophyceae		
1	Synedra	648.88	712.50
2	Diatoma	160.17	146.46
3	Navicula	644.75	360.15
	Dinophyceae		
1	Peridinium	469.82	579.00
2	Ceratium	2141.66	1150.42
	Euglenophyceae		
1	Euglena	200.00	200.00
2	Phacus	271.16	271.32

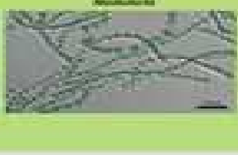
Distribution of diversity index of phytoplankton in the surface (0.2 m) in different seasons



Dominant genus of Cyanophyta phylum

Microcystis

Nodularia



CONCLUSIONS

It can be concluded from the study that the abundance and biomass of phytoplankton are higher in rainy season than that in dry season. Dominance occurs in certain species, namely *Microcystis* and *Nodularia* in dry season with percent dominance exceeds 85%, while in the rainy season *Microcystis* dominates more than 99%. Meanwhile the size of phytoplankton cells in the dry and rainy season in dominant species shows no significant difference.

REFERENCES

Cai L, G. Zhu, M. Zhu, H. Xu and B. Qin. 2012. Effects of Temperature and Nutrients on Phytoplankton Biomass During Bloom Seasons in Taihu Lake. Water Science and Engineering. 5(4): 361-374

Magurran, A.E. 1988. Ecological Diversity and Its Measurement. Princeton University Press. Princeton.

Vollenweider, R. A. 1974. Primary Production in Aquatic Environments. 2nd ed. Blackwell Sci Publ. Oxford

Wetzel, R.G. 2001. Limnology : Lake and River Ecosystem. 3rd edition. Academic Press. California.

__________ and G.E. Likens. 1991. Limnological Analyses. 2nd ed. Springer-Verlag. New York.

Yilmaz, N. 2013. Phytoplankton composition of Sazlıdere Dam Lake, Istanbul, Turky. Maejo International Journal of Science and Technology. 7(02), 203-211.