PLANKTON COMMUNITIES IN BENING RESERVOIR MADIUN

by Marheny Lukitasari, Nurul Kusuma Dewi, Joko Widiyanto

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Marheny Lukitasari, Nurul Kusuma Dewi, Joko Widiyanto
Department of Biology Education, Faculty of Mathematic and Natural Science IKIP PGRI Madiun

ABSTRACT

Plankton often used as an indicator of water quality. The aim of this study was to investigate the plankton communities in relation to the physical and chemical characteristics of Bening reservoir Madiun during the dry season (March-July 2013). Plankton and surface water samples were collected from the six stations monthly during dry season (March-July 2013). Field sampling procedures were done at the reservoir, followed with identification and data analysis at laboratory using standard metod. There are 16 genus of phytoplankton and 14 genus zooplankton which were distributed unevenly. Synedra was the most abundant of the overall phytoplankton samples. The most abundant zooplankton found during this investigation were Cyclops in March samples and Nauplius in April, May, June and July samples. The low abundance found in this study for the plankton communities might explained by the presence of planktivorous fishes and most probably low light penetration (low transparency).
Keywords: dry season, transparency, Synedra, Cyclop, Nauplius

INTRODUCTION

The productivity of any aquatic water body depends on the amount of plankton present in the water body. Adesalu and Nwankwo (2010) identified phytoplankton as one of the useful indicators of aquatic environmental quality because they act as early warning signals thereby provoking appropriate remediation. Growth and distribution of plankton (phytoplankton) depend on the carrying capacity of the environment and on the nutrients concentration both intracellular and extracellular (Davies et al. 2009). According to Suthers and Rissik (2009), the major limiting nutrients for phytoplankton are nitrogen in form of ammonium (NH_4^+), nitrite (NO_2^-) and phosphate (PO_4^-). Nitrogen tends to be the limiting nutrients in marine systems, while phosphate in the limiting nutrient in the freshwater systems (Suthers and Rissik 2009). These two nutrients are needed for cell membranes and for proteins such as enzymes. Ezra and Nwankwo (2001) observed that changes in plankton population in Gubi Reservoir were influenced by physico-chemical parameters. Physico-chemical parameters also affect plankton distribution and species diversity (Astirin 2000; Sugianti 2006; Pirzan and Pong-Masak 2008; Qingyu 2008; Adesalu 2012).

Plankton distribution and abundance are affected by season (Ezra

and Nwankwo 2001; Davies 2009). Davies (2009) reported that in Minichinda Stream, Niger Delta, Nigeria, the wet season phytoplankton (6180 counts/ml) and zooplankton (1924 counts/ml) were higher than the dry season phytoplankton (4480counts/ml) and zooplankton (1426 counts/ml). Diversity and composition of algae in the Niger Delta water bodies varies seasonally with pe in dry season (Yakubu et al. 2000). Seasonal variations affect the physico-chemical variables thus causing variation in abundance a diversity of plankton. Variation in some of the physical and chemical parameters such as rainfall, temperature, salinity, nitrate-nitrogen, phosphate-phosphorus, sulphate, biological oxygen demand and chemical oxygen demand have been reported to influence phytoplankton abundance (Adesalu et al. 2010). There is no information on the seasonal abundance and distribution of phytoplankton and zooplankton as well the water quality of this reservoir. The present study attempts to provide such vital information for future references. Bening reservoir is one of reservoir in the Brantas River that was built in 1978 and completed in 1982. This reservoir is located at Petung, Pajaran Village, Saradan district, Madiun, East Java. Purposes of built this reservoir is to provide irrigation water for 9,120 ha (Nganjuk District, Gondang District and Rejoso District), flood control, tourism and aquaculture (Jasa Tirta 2012).

The aim of this study was to investigate the plankton communities in relation to the physical and chemical characteristics of Bening reservoir Madiun during the dry season (Maret-Juli 2013). The study was carried out in March-July 2013. Study site is located at Bening Reservoir, Petung, Pajaran village, Saradan district, Madiun, East Java. This reservoir has a vast pool 5,7 km with an effective volume 23,9 million m^3 in 2007. Type of reservoir is homogeneous pile with a volume of pile 800.000 m^3. Jasa Tirta (2012) reported that the low water level at elevation 96,40 m, with a high water elevation 108,60 m and 109,40 m flood water level.

MATERIAL AND METHODS

Plankton and surface water samples were collected from the six stations monthly during dry season (Maret-Juli 2013). Plankton samples were collected with 20 and 62-µm plankton nets for phytoplankton and zooplankton, respectivel Edmondson and Winburg 1971). Phytoplankton samples were preserved in Lugol's solution while zooplankton samples were preserved in 4% formalin. The species were identified using *Fresh Water Biology* (Edmonson 1959), *The Plankton of South Vietnam* (Shirota 1966), dan *The Marine and Freshwater Plankton* (Davis et al. 1955). Enumeration was done by using binocular micro ope.

Surface water temperature was measured in-situ using mercury in glass thermometer while pH was determined using pH meter. Water transparency (vertical visibility) was estimated using a standard secchi disc of 20 cm diameter while concentration of dissolved oxygen (DO) was determined using DO meter. Water samples were collected with a bottle and placed in a cooler box before being brought to the laboratory for analysis NH4+, NO3−, and PO4 3− according to the standard methods.

RESULT AND DISCUSSION

The results of the physico-chemical parameter analyzed in this study are presented in **Table 1**.

Table 1. Variation in physico-chemical parameters in Bening reservoir Madiun

Parameter	March 2013	April 2013	May 2013	June 2013	July 2013	Average	SD
Transparency (cm)	68	56.7	67.3	61	63	63.20	4.66
Suhu Udara (^{0}C)	30	32.4	30.67	29.6	30.67	30.67	1.07
Surface water temperature (^{0}C)	31.3	32.6	31.47	31.2	30.9	31.49	0.65
DO	8	10.33	9.37	9	11.27	9.59	1.25
pH	8.4	7.86	8.47	8.41	8.36	8.30	0.25
NO3 (mg/L)	0.603	0.5725	0.633	0.512	0.542	0.57	0.05
PO4 (mg/L)	0.1045	0.109	0.10	0.009	0.059	0.08	0.04
NH3 (mg/L)	0.245	0.35	0.14	0.21	0.28	0.25	0.08

The few water quality parameters that were analysed in the studied reservoir indicate a general level that is acceptable in comparison to the natural levels in freshwater (Sinkala et al. 2002). Transparency of water was low in the study area, pH was more or less alkaline, ranging from 7.86 to 8.4. These values are in agreement with the pH of most natural waters that ranges between 6.0 and 8.5 (Chapman, 1992). Phospate and nitrate are in the normal and acceptable ranges and did not show any significant differences during the study period. NO_3 concentrations were generally high. This agrees with other studies in reservoirs (Pirzan and Pong-Masak 2008).

Table 2. Composition and abundance of the plankton in Bening Reservoir Madiun during the dry season

N0.	Genus	March	April	May	June	July	Average
	PHYTOPLANKTON	**2013**	**2013**	**2013**	**2013**	**2013**	
1	Ceratium	140	85	80	50	30	77
2	Closterium	170	85	85	45	0	77
3	Cocconeis	0	45	25	45	90	41
4	Cymbela	30	20	20	15	10	19
5	Denticula	40	45	35	35	50	41
6	Euglena	40	50	35	40	60	45
7	Fragilaria	150	135	105	100	120	122
8	Gyrosigma	80	90	65	70	100	81
9	Melosira	70	50	45	35	30	46
10	Navicula	370	400	295	310	430	361
11	Nitzschia	250	210	170	150	170	190
12	Peridinium	0	25	15	25	50	23
13	Rhopalodia	60	40	35	25	20	36
14	Staurastrum	130	115	90	85	100	104
15	Surirela	20	35	25	30	50	32
16	Synedra	1040	1395	960	1135	1750	1256
	ZOOPLANKTON						
1	Asplachna	10	20	15	20	30	19
2	Cyclop	1300	1175	915	850	1050	1058
3	Diaptomus	890	775	610	555	660	698

4	Difflugia	30	15	15	10	0	14
5	Eubranchipus	60	85	60	70	110	77
6	Euclanis	0	20	10	20	40	18
7	Filinia	20	40	25	35	60	36
8	Kellicottia	30	60	40	55	90	55
9	Keratella	20	90	50	85	160	81
10	Lecane	150	140	110	105	130	127
11	Nauplius	1120	1155	860	875	1190	1040
12	Notholca	60	75	55	60	90	68
13	Polyarthra	50	40	35	30	30	37
14	Sida	20	40	25	35	60	36

The reservoir plankton identified and counted in March-July 2013 is presented in **Table 2**. This study found that the diversity and abundance of plankton species varied monthly. Synedra was the most abundant of the overall phytoplankton samples. Synedra are described as having narrow frustules, free-floating or sometimes in colonies. They also can be benthic, meaning they grow on different surfaces. The valves are linear and on some, slightly curved. Synedras live in a variety of habitats, so can be found throughout the world. As a species within the algal community, Synedras have specific ecological requirements and tolerances. Nitrates, phosphates, and hydrogen ions are three of the major chemicals present in water, and all three have effects on the health of aquatic organisms. Nitrate is the most oxidized form of nitrogen found in the natural world. It is one of the most water-soluble anions known. Plants need nitrogen as a nutrient, and most plants prefer nitrate to ammonia. Synedras are forms of algae, so they also need a supply of nitrate. NO_3 concentrations in Bening reservoir were generally high.

The most abundant zooplankton found during this investigation were Cyclops in March samples and Nauplius in April, May, June and July samples. Cyclops is one of the most common genus of freshwater copepods while nauplius is the earliest free-living stage in the development of most crustaceans, except in the majority of the Malacostraca.

The lower abundance found in this study for the plankton communities might explained by the presence of planktivorous fishes and most probably low light penetration (low transparency). Though fish abundance was not part of this study, it was noted that fishes were present in the reservoirs. Humans were observed actively fishing on the reservoirs. Planktivorous organisms have preferences for specific food items (Wetzel 1983). Arcifa et al. (1986) concluded that plankton proliferation is greatly affected by the predator–prey relationships in reservoirs.

Based on the present observation, Bening reservoir is not rich in plankton and the nutrient status is high enough to support this plankton population during dry season. It will support fisheries production. According to Townsend et al (2000) and Miller (2005), plankton communities serve as a base for the food chain that supports the commercial fisheries.

CONCLUSION

This paper investigated the plankton communities in relation to the physical and chemical characteristics of Bening reservoir Madiun during the

dry season (March-July 2013). Water quality throughout the study area was at acceptable levels, and did not significantly differ between time. The diversity and abundance of plankton communities in the study area were influenced by NO_3 concentrations, transparency and predator–prey relationships. Zooplankton species abundance was at a low level, possibly due to the presence of planktivorous fish in the reservoirs.

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