Original Research Article

Plankton Community Structure and Its Relationship with Minerals Profiles in Minapadi Area, Talagasari Village, Kadungora Garut Regency

ABSTRACT

Minapadi is an integration of rice cultivation with fish breeding in one location. This research was conducted in the village of Talagasari, District Garut Kadungora because this area is thought to have nutrient elements in the form of specific micro and macro minerals that are good for agriculture and fisheries. Planktons are microscopic organisms that are form an important link in the life of aquatic organisms. This research aimeds to analyze the quality of water, mineral composition and its effects on plankton community structure in minapadi. The research method used was purposive sampling. Plankton relationship with water quality and dissolved minerals were analyzed using a Canonical Correspondence Analysis (CCA). Sampling was done 6 times in the period May 20 - July 25, 2018. Research shows that there are 31 orders of plankton which is divided intoconsisting of 26 orders of phytoplankton and 5 order of zooplankton. Phytoplankton diversity index and dominance over their respective research ranged from 0,5149 to 0,8797 and 0,1203 to 0,4851, while for zooplankton from 0 to 0,8 and from 0,2 to 0,1. The water quality parameters measured primarily by temperature, DO, pH, nitrates, phosphates, ammonia qualify recommended PP 82 2001, third class. There is a concentration of dissolved minerals that exceeds the normal condition nitrates, phosphates, ammonia qualify recommended PP 82 2001, third class. There is a concentration of dissolved mineral exceeds the normal condition nitrates, phosphates, ammonia qualify recommended PP 82 2001, third class. There is a concentration of dissolved mineral exceeds the normal condition K, S, Si, Ca, Fe, Mn, Cu, and Cl, which led to the dominance of the phylum Euglenophyta, Bacillariophyta, and arthropods.

Comment [U1]: Is this a repeated sentence?

Keywords : Community structure, dissolved mineral, water quality, plankton, phytoplankton, zooplankton

1. INTRODUCTION

Minapadi is an integration of rice cultivation with fish farming in a location that can provide many benefits to society. Minapadi cultivation using nilem fish commodities (Osteochilus hasselti) ~~and~~ is located at the Village Talagasari, District Garut Kadungora precisely in Agri Insan Mandiri CV. Selection ~~commodity~~ of nilem fish commodity is because the fish nilem which is considered to remove weeds in rice fields interfere with the growth of rice by enhancing rice growth rate. Fish biocleaning nilem can act as an agent because it is like to eat detritus and periphyton. In addition, droppings can also be organic fertilizer for rice.

According to Sunardi (2014) Regions Talagasari is a form of a depression (hollow) which is controlled by fault structure, bounded by the volcanic high~~s~~lands, which is located in the highlands and is dominated by lacustrine. Depression is known as the sub-basin Leles, Garut, so the area Talagasari has enough fertile soil for agriculture (Sunardi 2015). The location Talagasari area surrounded by mountains makes this region as a catchment area. The location of this area which is in the volcanic regions also enables the region to contain the nutrient elements in the form of macro and micro minerals sufficient for farming activities. Background geology of this area can control the mineral composition of the soil and the surrounding waters. In addition to water quality, the dissolved mineral composition will certainly influence the plankton community structure

2. MATERIALS AND METHODS

2.1 Tools and Materials

The tools used for this research included a scoop, sample bottles, plankton net, digital thermometer, DO meter, pH meter, plankton identification books, microscopes, *Sedgewick* Rafter Cell, Paper labels, and a cool box. Materials used in this research included water samples, Lugol, ice cubes, phenol sulfonic acid, NH_4OH 10%, distilled, $SaCl_2$, NH_4 molybdate, Signette, and Nessler.

2.2 Methods

The research method used in this research is purposive sampling. The study was conducted by collecting data directly in a minapadi. Sampling was carried out at 4 stations, based on differences in flow conditions and water exchange. The observation stations include stations 1 which is an inlet, stations 2 and 3 which is central caren, and station 4 which is an outlet.

2.3 Sampling and Measurement

Physical-chemical parameters of waters analyzed consisted of 23 parameters that include temperature, pH, DO, nitrate, ammonia, phosphate and dissolved minerals. Physical-chemical parameters analyzed in-situ and ex-situ. Ex situ analysis conducted at the Laboratory of Water Resource Management FPIK UNPAD and ITB FTSL Water Quality Laboratory. Phytoplankton samples were taken by filtering water using a surface layer of plankton net size of 45 µm by 10 liters by using a bailer volume of 1 liter. The filtered sample water is put in a sample volume bottle of 300 ml and preserved using Lugol 1% preservative ~~for~~ of 10-15 drops or until colored tea. The plankton composition identified was calculated based on the number of genera for each type and list compilation according to the results of plankton identification up to the genera level.

2.4 Sample Analysis

Data were analyzed descriptively, by comparing the data processing results with the existing references and classification and water quality criteria for the designation of fisheries activities by the Indonesian Government Regulation No. 82 of 2001 on water quality management and water pollution control. Plankton sample data and its relationship with environmental factors were analyzed by using an index of abundance, diversity, dominance, and methods Canonical Correspondence Analysis (CCA).

2.4.1 Abundance

Plankton abundance is defined as the number of individuals or cells per unit volume (dm3 or liters). Phytoplankton and zooplankton are expressed in units ind/L. Plankton abundance calculated by using the Sachlan formula (1982):

$$N = N \times Vr/Vo \times 1/Vs$$

Information :
N = Plankton abundance (ind/L)
n = Number of individuals or cells number-i species identified
Vs = Volume of water filtered liters (10 liters = 10.000 ml)
Vr = Volume of water filtered (50 ml)
Vo = Volume the observed sample (1 ml)

2.4.2 Dominance Index

Dominance index is used to look at their certain species predominate in a particular type of population. Calculation of dominance index for phytoplankton and zooplankton using Simpson dominance index formula (Odum 1993) as follows:

$$D = \sum Pi^2$$

$$Pi = ni/N$$

Information :
D = Simpson dominance index
Ni = the number of individuals/cell number-i species which chopped up

D values ranging between 0 and 1, if the value of D close to 0 means that almost no one individual dominates, whereas when D is close to 1 means that there are individuals who dominate the population (Odum 1993).

2.4.3 Diversity Index

Plankton diversity index is calculated using Simpson diversity index (Krebs 1985 in Zahidah et al., 2009) were formulated as follows:

$$H' = 1 - D$$

Diversity index values ranging between 0-1, if the index is close to 0 then diversity is low and if the index is close to 1 then the high diversity. Otherwise good stability of aquatic ecosystems if Simpson diversity index has a value between 0,6 to 0,8 (Odum 1971).

2.4.3 Canonical correspondence analysis

Canonical correspondence analysis (CCA) is a multivariate method that may explain the relationship between the biology of the species and environmental parameters. This method for extracting a clone made environmental gradients of ecological data. The gradient is the basis for illustrating the difference in habitats of taxa on a diagram ordinated with clear and concise. The main result of the CCA is the ordination diagram is a graph with the coordinate system formed by the axis of ordination. CCA ordination diagram contains points of the species, location and qualitative classification of environment variables and quantitative arrows to environmental variables (Ter Braak 1995 in Ummami 2012). CCA in this study was made with the assistance of the Past 3 program.

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3. RESULTS AND DISCUSSION

3.1 Physical and Chemical Parameters

3.1.1 Dissolved minerals

Analysis of the dissolved mineral content in the water in village Talagasari ~~has~~ was done in order to ~~become~~ obtain the reference information as a determinant of plankton community structure. The type of mineral elements observed ~~is~~ was selected based on the data of the detected trace elements KKNM report Talagasari Village with CV Agri Insan Mandiri that analyze the mineral content of the soil village in Talagasari using XRF (X-Ray fluorescence) in Soil Laboratory, Faculty of Agriculture, University Padjadjaran. The dissolved mineral analysis method referreds to the standard APHA (American Public Health Association).

Mineral ions needed by phytoplankton in her lifecycle. Minerals or elements needed consists of two elements namely macro and microelements. Macro elements are the elements required by living organisms, especially plants in relatively large quantities, while the microelements are needed by plants in relatively small quantities. Macro-elements that were measured in this study ~~such as~~included N, P, K, Ca, Na, Si, and S. Micro elements that were measured ~~among~~ included Fe, Zn, Mn, Cu Mg, Cl, B, and. Mineral composition analysis is conducted to describe the characteristics of soil and water in the village Talagasari. According to Moss (1993) *in* Effendi (2003) nitrogen (N), phosphorus (F), potassium (F), magnesium (Mg), sulfur (S), calcium (Ca), and iron (Fe) ~~is a~~are nutrients majorly required by almost all living cells. Haslam (1995) in Effendi (2003) states that there is some kinds of heavy metals, which is one of the many elements needed by plants, especially algae, namely Co, Cu, Fe, Mn, Mo, and Zn.

Mineral	Dissolved minerals (mg/L)	Natural Concentration in Freshwater	Citation
K (Potassium)	15,8	10 mg/L	McNeely *et al.*(1979)
S (sulfide)	0,064	0,05 mg/L	Moore (1991)
Na (sodium)	18,2	<50 mg/L	McNeely *et al.*(1979)
Si (Silicate)	186	5-25 mg/L	Cole (1988)
Ca (Calcium)	52,8	15 mg/L	McNeely *et al.*(1979)
Fe (Iron)	6,35	1 mg/L	Moore (1991)
Zn (Zinc)	<0,001	0,05 mg/L	Moore (1991)
Mn (Manganese)	1,81	0,2 to 4 mg/L	Effendi (2003)
Cu (Copper)	0,035	<0,02 mg/L	Moore (1991)
Mg (Magnesium)	4,96	1-100 mg/L	McNeely *et al.*(1979)
Co (Cobalt)	<0,001	<0,001 mg/L	Moore (1991)
Ni (Nickel)	<0,001	0,001-0,003 mg/L	Moore (1991)
Cl (Chloride)	29,9	2-20 mg/L	Effendi (2003)
Al (Aluminum)	0,018	<1 mg/L	Effendi (2003)
Ba (Barium)	0,027	0,1 mg/L	Moore (1991)
B (Boron)	<0,003	<0,1 mg/L	Effendi (2003)
Se (selenium)	<0,001	<0,1-5 µg/L	Moore (1991)

Table 1. Measured concentration of soil minerals and dissolved minerals

Sodium (Na) is a metal ion that is very easy to dissolve because it has a one-handed electron, so the concentration in the water is very high and tend to form compounds that are soluble in water, such as halide, sulfate, nitrate, carboxylate, and carbonate (Lincoln et al. 2004). According to McNeely et al. (1979), the fresh waters ~~of~~ that contain Na element generally has a concentration below 50 mg/L. Elements of copper (Cu) concentrations exceed the needs of organisms. According to Moore (1991), the copper concentration in natural waters typically <0,02 mg/L. In plants, including algae, copper acts as constituent plastocyanin functioning in electron transport in photosynthesis (Boney 1989). The abundance of phytoplankton is also supported by elements such as calcium (Ca) and potassium (K). Both of these elements according to McNeely et al. (1979) had normal levels in freshwater each at 15 mg/L for Ca and 10 mg/L to K. Both elements have above normal levels which is 52,8 mg/L Ca and 15,8 mg/L K. Calcium is one of the elements forming the walls of phytoplankton cells, while potassium is an element that serves to carbohydrate metabolism of phytoplankton (Isnansetyo and Kurniastuti 1995). It is became of the basis that the higher the dissolved elements can support the abundance of phytoplankton in the waters in minapadi.

Sodium (Na) and iron (Fe) is an essential element forming the chlorophyll (Isnansetyo and Kurniastuti 1995). Silica (Si) is an element that is useful for the organism mainly diatoms (Umiatun et al., 2017). Elements Fe and Si dissolved in water ~~is~~ that was detected exceeds the needs of minapadi. Fe content in natural waters ranging from 0,02 to 0,5 mg/L (Boyd 1988 in Effendi 2003). Fe concentration> 1 mg/L are considered dangerous to the life of aquatic organisms (Moore 1991). Silica is an essential element ~~of~~ which is much-needed by phytoplankton. Phylum Bacillariophyta requires silica to form frustule (cell wall). According to Cole (1988) river and lake waters (freshwater) has a silica content of between 5-25 mg/L. The concentration of silica in this minapadi had~~ve~~ very high concentrations of the 182 mg/L. If the minapadi waters have high diatom abundance, high levels of dissolved silica can represent the abundance of diatoms themselves.

Mineral elements cobalt (Co), and zinc (Zn), including a micro-mineral that has an influence on algae, especially in the process of photosynthesis (Haslam 1995 at Effendi 2003). The results of the analysis of dissolved minerals during the research showed that the levels of Co and Zn are still below the threshold of water pollution. According to Moore (1991), natural fresh waters typically have high levels of cobalt and Zn each less than 0,001 and 0,05 mg/L. Cobalt is an element of microscopic needed in the growth and reproduction of plants. Cobalt found in vitamin B12 known as cobalamin and almost all blue-green algae require cobalamin (Effendi 2003). Zinc helps in the action of the enzyme in living organisms, and is also required in the process of photosynthesis as an agent for hydrogen transfer and plays a role in the formation of proteins (Effendi 2003).

Levels of manganese (Mn) in fresh waters varies greatly, between 0,2 to 4,0 mg/L (Effendi, 2003). Mn concentration at the site of research ~~by~~ was 1,81 mg/L, including in normal conditions and not excessive. Mn is an important component enzyme system. The concentration of chloride (Cl) in this minapadi including exceeding the needs, which amounted to 29,9 mg/L, while according to Effendi (2003) of chloride concentration in freshwater typically ranges from 2-20 mg/L. Moreover, chloride is not toxic to living things, even plays a role in cell osmotic pressure settings. The concentration of Magnesium (Mg) and sulfide (S) in minapadi are in a normal condition with respective concentrations of 4,96 and 0,064. Mg concentration in natural waters is in the range of 1-100 mg/L (McNeely et al. 1979), while according to Moore (1991) sulfide concentration in natural waters is usually 0,05 mg/L. Other elements such as Ni, Al, Ba, B, and Se concentrations were also low dissolved.

3.1.2 Water Quality Parameters

In general, water quality during the research ~~is~~ was still good for plankton life. Table 2 presents the range of results of measurements of water quality parameters during the research.

Table 2. Range of Water Quality Parameters During Research

Parameters		Observations					
		1	2	3	4	5	6
Temper-ature	Range	26,7-27,5	26,9-27,4	27,9-29,6	22,2-25,7	24,4-26	25,7-26,5
	Average	27	27,2	28,6	23,7	25	26,2
pH	Range	6,52-7,31	7,09-7,13	7,18-7,61	7,52-7,88	7,33-7,68	7,05-7,46
	Average	7,02	7,1	7,36	7,77	7,52	7,29
DO	Range	5-7,6	5,1-7	6,8-7,6	6,1-8,2	6,4-7,7	5,3-7
	Average	6,28	5,98	7,12	7,28	7,2	6,35
Nitrate	Range	0,432-0,621	0,462-0,631	0,444-0,689	0,893-1,413	0,773-1,320	1,214-1,371
	Average	0,513	0,546	0,556	1,173	0,980	1,286
Ammonia	Range	0,004-0,009	0,002-0,004	0,003-0,011	0,011-0,026	0,003-0,005	0,008-0,011
	Average	0,007	0,003	0,006	0,019	0,007	0,009
Phosphate	Range	0,165-0,225	0,178-0,223	0,184-0,227	0,258-0,332	0,222-0,262	0,233-0,256

Average	0,186	0,204	0,203	0,296	0,244	0,243

The results of temperature measurements in minapadi ~~for~~ duringr the research ranged from 22,2 to 29,6 ° C. Differences in temperature scale was caused by differences in the weather and sunlight every week at the time of measurement. The temperature of water is not constant, and always changes dynamically due to many factors that will affect. Factors affecting the change of temperature in the waters of which are solar radiation, air temperature, weather, climate (Boyd 2015), the presence of shade (for example, trees or water), and wastewater (sewage) that goes into the water body. An increase in water temperature will also affect chemical reactions and is associated with a decrease in water quality and the ecological status of freshwater (Whitehead *et al*. 2009).

DO measurement results in minapadi ~~for~~ research ranged~~ing~~ from 5 to 8.2 mg/l, and in general, these conditions are optimal for plankton life. According to Whangchai *et al. (*2004) in Noortsany (2017), phytoplankton and zooplankton can live optimally at DO concentrations above 3 mg/1. DO concentration is also quite good for aquaculture activities because its value is more than 3 in accordance with the water quality Standards Regulation PP No. 82 2001 Class III. In general, algae growth will be optimum at pH 7.8–8.3 (Makmur dkk. 2012). The concentration of dissolved oxygen is very dynamic and can change significantly either daily or seasonal, depending on their mixing, photosynthetic activity, respiration and waste (effluent) that enter the body of water. Water the fields in this research can be ascertained from oxidative, meaning it contains a lot of oxygen. This can be seen from several indicators, namely the quantitative measurement of dissolved oxygen content and also the behavior of the fish in the water. When Nilem fish ~~that~~ are not visible on the surface indicate oxygen requirements are met.

Results of pH measurement in minapadi for the research ranged from 6,52 to 7,88, and the condition ~~is~~ was quite stable and ideal for freshwater biota including plankton and still comply with the water quality criteria for the allotment of fishing activities Standards Regulation PP No. 82 2001 Class III. The factors that affect the stability of the pH of which is alkalinity acts as a buffer. ~~-~~ ~~v~~Very low pH will cause the solubility of the metals in the water to increase, which is toxic to aquatic organisms, whereas a high pH can increase the concentration of ammonia in the water which is also toxic to aquatic organisms (Tatangindatu et al., 2013). The measured pH was still ~~is~~ lower in value, especially in the afternoon or at night when there is no photosynthesis. According to Adiwilaga et al. (2009), pH during the day to evening is higher than night until morning, as a result of photosynthesis during the day.

The results of measurements of nitrate in minapadi for the research ranged from 0,432 to 1,413 mg/l., ~~and t~~These conditions, ~~including~~ are low and stands at less than optimal. Mackentum (1969) in Sanaky (2003) states that nitrate concentrations are optimal for the growth of phytoplankton ranged from 3,9 to 15,5 mg/l, while the nitrate concentration of less than 0,114 ppm will cause the nitrate becomes a limiting factor. Nitrogen contained in the nitrate compounds are substances main inorganic nutrient required by the growth of phytoplankton. Nitrate concentrations during this research are also affected by other water quality parameters. DO parameters expected to have a strong influence because of the level of DO in water will affect directly the reaction of nitrification and denitrification. The concentration of ammonia measured during this research is very low, presumably because the nitrification of ammonia to nitrite and nitrate were maximal in response to oxidative water with optimal DO. Nitrification is the oxidation of ammonia to nitrite and nitrate is carried out by aerobic bacteria. Massa stayed longer water provides an opportunity nitrate formation process is more optimal. Nitrates are highly soluble in water and are stably produced from the complete oxidation of nitrogen compounds in the water. Yuliana's (2012) study stated that DO at low invitation will affect the activity of microorganisms in the process of decomposition of organic matter, one of which is the denitrification process which is the process in which nitrate ions and nitrite are converted into nitrogen (N2) molecules, which are used to measure nutrient uncertainty that can be utilized will decrease.

The results of measurements of ammonia in minapadi for research, including low, ranging from 0,002 to 0,026 mg/l. Ammonia measured in this study were free ammonia (NH¬3-N) which cannot be ionized. Measured ammonia concentration is very low due to the occurrence of nitrification of ammonia to nitrite and nitrate were maximal in response to oxidative water with optimal DO. This low concentration of ammonia would not be toxic to organisms (zooplankton and fish) in minapadi. Other environmental factors such as temperature and pH are also in the normal range, so the condition is very safe waters of the toxicity of ammonia. Minapadi ammonia in water is derived from the effluent of zooplankton, the unconsumed feed eaten, and fish waste nilem. According to Alabama (2008) in Fathurrahman and Aunurohim (2014) states that the ammonia present in the waters largely is the result of metabolic processes in aquatic organisms and the decay process of organic matter or organic waste such as household garbage and others by bacteria carried by the current. Food that is not utilized by fish nilem whether it be is dirt or food that is not eaten will precipitate and form ammonia (NH3). The ammonia will then undergo nitrification into nitrate ion (NO3-). This oxidation process went smoothly because this minapadi water conditions from oxidative and DO are optimal. DO is low will cause anoxic conditions, and cause denitrification reaction ie reduction in ammonia or nitrates to molecular nitrogen by denitrifying bacteria.

The measurement results from phosphate in minapadi for research, including low, ranging from 0,165 to 0,332 mg/l. Water quality Standards Regulation PP No. 82 2001 Class III states that the threshold values of phosphate in the water is equal to 1 mg/L. This indicates that the concentration of phosphate in the research area is below the threshold, and feasible for use of fishery activities. The concentration of phosphate in the water can be derived from nature or from domestic waste minapadi neighborhood or along the river. Sanaky (2003) states that the concentration of phosphates in the water can come from natural sources such as soil erosion process results, feces or carcasses of animals, industrial waste, domestic and weathering plants or water itself. Phosphate concentrations were too high in the water will cause the dominance of certain species that are not controlled, whereas if the concentration of phosphate is too low will cause the phosphate becomes a limiting factor in the waters. The concentration of phosphate that is optimal for the growth of phytoplankton in the range of 0,27 to 5,51 ppm, while the phosphate concentrations of less than 0,02 ppm would make a limiting factor (Rumanti et al., 2014). Evelyn et al. (2005) stated that the imbalance of the ratio of N and P elements in waters will have an impact on the biological conditions of ecosystems such as phytoplankton biomass, the composition of species that are likely to occur in certain types of dominance and also in food dynamics.

3.2 Plankton Community Structure

The results of identification of plankton to the level of the genus in minapadi during the research consisted ofcame up with 31 orders of plankton, consisting of 26 orders of phytoplankton and 5 orders of zooplankton. The total number of plankton genera identified was 53, which was divided into 41 genera of phytoplankton and 12 zooplankton genera. The plankton order and genera consisting of 7 phylum of phytoplankton is Chlorophyta, Bacillariophyta, Euglenophyta, Cyanophyceae, Ocrophyta, Rhodophyta, and Cryptophyta, and 3 phylum of zooplankton are Arthropods, Rotifera, and Ciliophora.

The identification results show that phylum Chlorophyta are often found and have relatively high abundance are ranging from the genera Spirogyra and Scenedesmus, while the phylum Bacillariophyta that is commonly found are genera Diatoma, Nitzschia, and Navicula. The most common genera of the phylum Euglenophyta is Euglena and Phacus, while class Cyanophyta most frequently encountered are the genera Oscillatoria. The genera of the phylum Ocrophyta, Rhodophyta, and Cryptophyta found only slightly. Zooplankton is always met and had a relatively high abundance is genera Diaphanosoma and Cyclops (Cyclops adults and nauplii Cyclops) of the phylum Arthropoda. As for the other genus found only slight and there are not always any observations.

Phylum Bacillariophyta and Euglenophyta ~~an abundance~~ of phytoplankton was found with the highest abundance compared to the others. This is indicated by the high content of silica minerals above requirements ~~is~~ at 182 mg/L and the concentration is above 100 mg/L is the concentration that is not common. Silica is a necessary element of diatoms, especially for the formation of the cell wall. Phytoplankton abundance of plankton due to the phylum Euglenophyta less favored or utilized by fish nilem. Bacillariophyta remains abundant plankton species because of the content of a very high dissolved silica derived from volcanic soil characteristics of the research area. The abundance of phytoplankton is influenced by water quality conditions and also grazing. Low phytoplankton abundance during the research was because the plankton in the waters is maximally utilized by nilem fish. Based on the research results of CV Agri Insan Mandiri's research team, it has been shown that the growth of nilem fish cultivated there during the research has experienced growth so that nilem fish are considered to utilize natural food available in Minapadi waters.

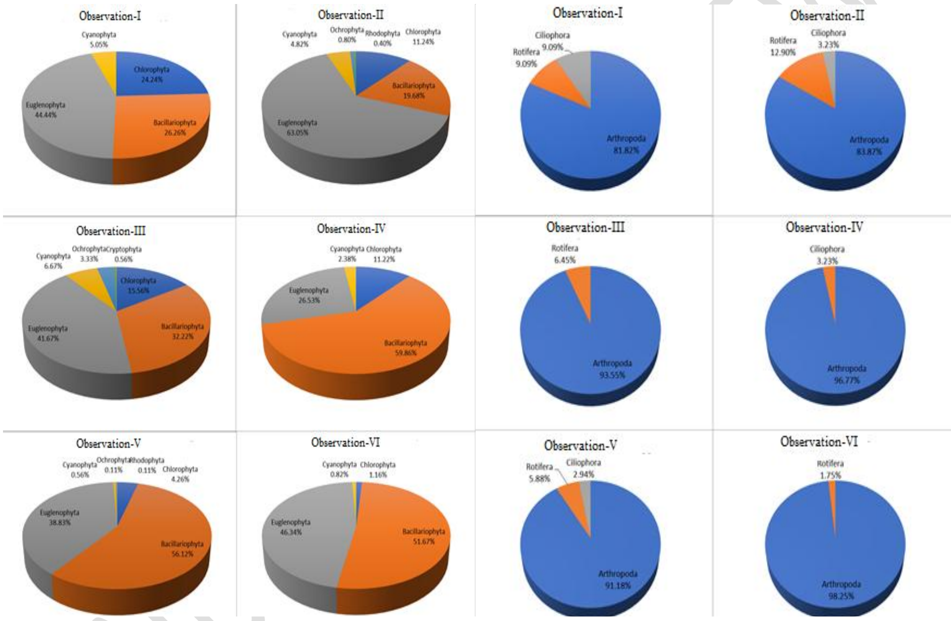


Figure 1. Percentage of phytoplankton (left) and zooplankton (right) abundance during the study

Nilem fish during the research included phytoplankton eaters with an average frequency of IBT 61.73% of phytoplankton feed from 6 weeks of fish samples. The Largest Section Index (IBT) shows that this nilem minapadi fish utilizes phytoplankton as the main feed because it has a frequency of ≥ 50% so that the nilem fish at the location of this research are herbivores. The types of plankton used as main feed were from the Bacillariophyceae, Cyanophyceae, and Chlorophyceae groups with an average preponderant index of 43.91%, 8.89%, and 8.34% respectively. Comparison between abundance and utilization of plankton by fish, Bacillariophyceae type plankton has abundance and high utilization of feed by nilem fish. Based on Ekawati et al. (2011) Bacillariophyceae plankton is a type of plankton that is most favored by nilem fish. On the other hand, Euglenophyceae has the most abundance after Bacillariophyceae but is the type of feed that is least preferred by nilem fish. Nutrient enrichment in the aquatic environment has a positive impact, but to some extent, it can also have a negative impact. The positive impact is an increase in phytoplankton production and total fish production (Gypens et al. 2009).

There ~~are~~ was one dominant zooplankton genera found in the study site, Diaphanosoma with a relative abundance of 42,77%. Diaphanosoma which belong to the order Cladocera is zooplankton that has a very broad tolerance to salinity ~~is very broad~~. Another zooplankton abundance at most after Diaphanosoma is of the genera Cyclops. Cyclops has a longer life cycle than Diaphanosoma because their larvae need some time before the resulting adult ~~molting~~emerges. This is what causes Diaphanosoma to be more prevalent than ~~in~~ the Cyclops. Here is an abundance of plankton during the research.

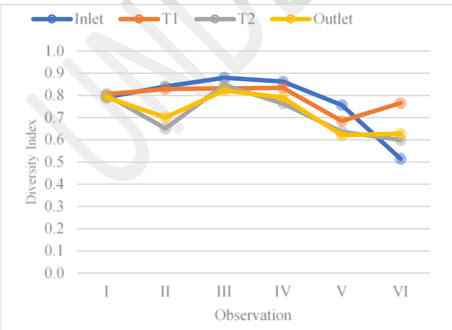
Table 3. The abundance of phytoplankton and zooplankton (individuals/liter) at each station

Phytoplankton					Zooplankton				
Observation time	Abundance				Observation time	Abundance			
	Inlet	T1	T2	outlet		Inlet	T1	T2	outlet
Observation-1	60	60	150	220	Observation-1	55	15	45	50
Observation-2	210	275	440	320	Observation-2	40	85	120	65
Observation-3	195	230	465	310	Observation-3	25	25	20	35
Observation-4	275	290	545	370	Observation-4	25	30	45	55
Observation-5	570	1265	1300	1330	Observation-5	25	30	70	45
Observation-6	1380	1695	2735	1545	Observation-6	5	25	340	480

The abundance of phytoplankton during the study ranged from 60-2.735 individuals/liter, while the abundance of zooplankton during the study ranged from 5-480 individuals/liter. Variations may occur natural phytoplankton production terms or density. A number of parameters that influence this variation are the intensity of sunlight, availability of nutrients, growth rate of predation, competition, and parasites (Zahidah 2017).

Figure 2. Phytoplankton diversity and dominance index

Phytoplankton diversity index for this research was in the range of 0,5149 to 0,8797, with an average value of diversity at 0,7521, and in general have a relatively



high propensity, In observation of all 6 ~~parts~~ sites, outlets diversity index declined quite dramatically, due to a significant increase in the abundance of phytoplankton of the genera Euglena and Navicula. During the research, the first station (inlet) gained as much as 29 genera of phytoplankton, the second station 34 genera of phytoplankton, the third station 30 genera of phytoplankton, and the fourth station (outlet) of 32 genera of phytoplankton. While the phytoplankton dominance index during the study was in the range of 0,1203 to 0,4851, with an average value of 0,2479 dominance, and generally have the tendency is relatively low. As for some of the type often found, any observations which are Navicula, Nitzchia, Euglena, Diatoma, Phacus, and Scenedesmus. In general, the type of phytoplankton that dominateds during this study includeds Navicula, Nitzchia, and Euglena were more numerous than other phytoplankton species are found. The existence of the dominant species is caused by several environmental factors, one of the most influential is the ratio of N and P. The imbalance of the ratio of N and P in waters will affect the biological condition of the ecosystem such as phytoplankton biomass, species composition is likely to occur dominance species certain types and also on the dynamics of food.

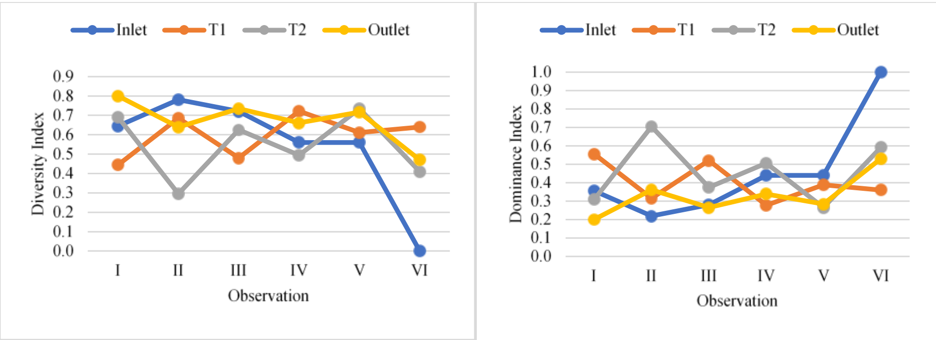


Figure 3. Zooplankton diversity and dominance index

The zooplankton diversity index during the study had an average value of 0,5883. In general, the diversity of zooplankton hads a relatively high propensity. There are special conditions on the observation of the 6th site when the rice has been harvested and the water venting portion so that zooplankton was identified only one species that is Diaphanosoma, which since the previous observations also have a high abundance. During the research, the first station (inlet) gained as much as 7 species of zooplankton, the second station 5 types of zooplankton, the third station 6 species of zooplankton, and the fourth station (outlet) as much as 9 types of zooplankton. While the dominance index of zooplankton during the study had an average value of 0,4117. Zooplankton dominance value has a relatively low inclination. As for some of the type often found any observations which are Diaphanosoma and Cyclops. Zooplankton is often found and more numerous than genera indicate that zooplankton is very tolerant of changes in physical and chemical properties of minapadi water. Sanders et al. (1987) explained that environmental factors that influence the dominance of a species and succession are light, temperature, concentration, ratio, and the form of nutrient chemistry.

3.2 Plankton Community Structure

Community structure of plankton communities analyzed in this research do just phytoplankton because phytoplankton takes advantage of environmental parameters measured directly in its life cycle, whereas zooplankton was more influenced by the presence of phytoplankton according to the principles of predation. The plankton type variable included in the CCA diagram is the order level identified during the study with a percentage of the total amount of more than 0.05%, so that the output on the graph is not too coherent. The number of orders of plankton that is inserted into the diagram as much as 20 orders.

Parameters that were analyzed its for relationships with phytoplankton included temperature, pH, DO, nitrate, phosphate, ammonia, and dissolved minerals consisting of potassium (K), sodium (Na), sulfide (S), calcium (Ca) and magnesium (Mg), which is a nutrient macro, as well as iron (Fe), copper (Cu), chloride (Cl), manganese (Mn), zinc (Zn), silicate (Si) and boron (B) which is a micronutrient. Value Se, Ba, Al, Ni and Co are not included in the chart because these elements are not essential elements that are directly utilized by phytoplankton. Each nutrient has special functions, N, P and S are important for protein formation, K functions in the metabolism of carbohydrates, Fe and Na play a role for the formation of chlorophyll, while Si and Ca are ingredients for the formation of cell walls or shells. The supply of nutrients into the water, especially Nitrogen (N), Phosphate (P) and Silicate (Si) is often said to be a limiting factor that can affect the spread and growth of phytoplankton populations and communities (Marlian 2016). Result analysis is presented in graphical form. The following figure shows the relationship between the order of phytoplankton with physical-chemical parameters of water by 2 (two) axis that axis 1 (one) and axis 2 (two).

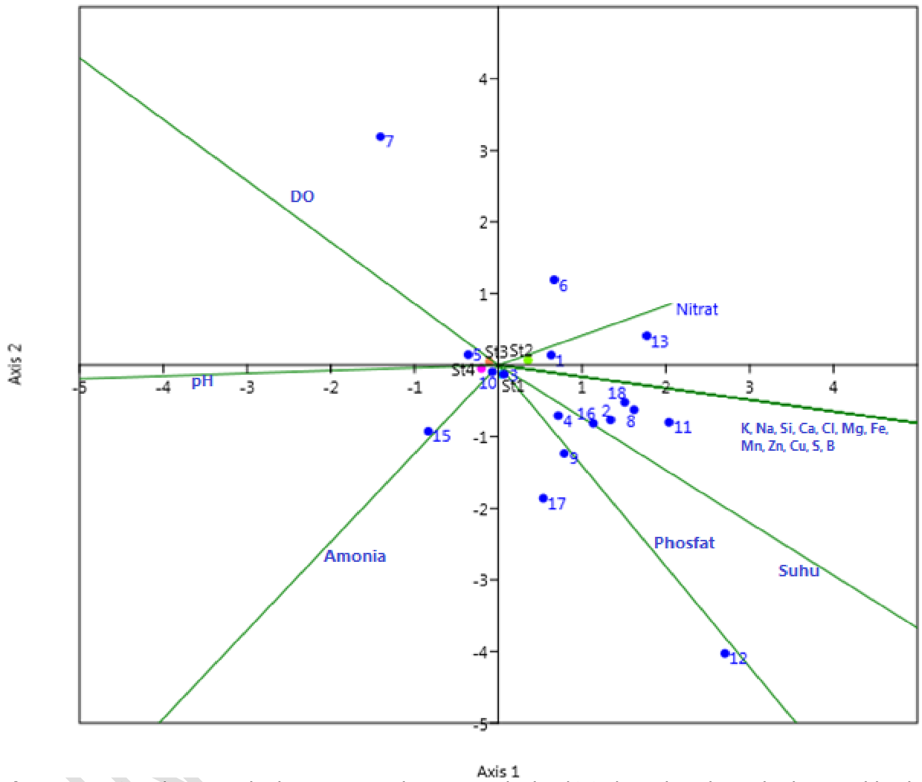


Figure 4. Graph canonical correspondence analysis (CCA) ordo phytoplankton with the parameters of water quality and dissolved minerals. Description order: 1 = Chlamydomonadales,
2 = Sphaeropleales, 3 = Ulvales, 4 = Ulotrichales, 5 = Zygnematales, 6 = Desmidiales,
7 = Chlorellales, 8 = Naviculales, 9 = Tabellariales, 10 = Bacillariales, 11 = Fragilariales,
12 = Surirellales, 13 = Melosirales, 14 = Rhizosoleniales, 15 = Euglenales, 16 = Oscillatoriales,
17 = Chroococcales, 18 = Nostocales, 19 = Spirulinales, 20 = Tribonematales

Diagram triplot CCA ordination showed the influence of environmental parameters that varies depending on individual orders. Results of correlation analysis of orders of phytoplankton in minapadi shows a different relationship with 18 environmental parameters. In general, the line of dissolved minerals triplot in the graph is very close together, which indicates that each of the measured dissolved minerals in this minapadi gives the same effect on the phytoplankton community. Determination of phytoplankton based by groups by station ~~is~~ iwas not done, because the point of station 1 to 4 on the charts is located close to the center/center axis of ordination. This suggests that each station has characteristics similar to the water quality, as each station is in the same location that is 1 field.

Parameter phosphate, dissolved minerals and temperature have a strong correlation with 9 orders, especially phytoplankton of the order Tabellariales and Naviculales. Both of these orders have the total percentage of each is equal to 5,16% and 15,91% of the total abundance of phytoplankton during the research. The variation of the temperature difference and phosphate becomes limiting in the life and growth of phytoplankton and Naviculales Tabellariales particular order. Both orders of phytoplankton are also strongly affected by dissolved minerals, especially mineral concentration is quite high in the mineral waters namely K, S, Si, Ca, Fe, Mn, Cu, and Cl.

Nitrates contributed greatly to the growth of phytoplankton of the order Chlamydomonadales, Melosirales, and Desmidiales. Phytoplankton of the order is few in number, each having the overall percentage of the total number of 0,5%, 0,34%, 0,28%. Nitrate concentrations during the study were at ~~a rate~~levels less than optimal as has been noted in previous discussions. This has led to the order Chlamydomonadales, Melosirales, and Desmidiales small amounts for research in this minapadi. Parameters DO contribute greatly to the growth of phytoplankton of the order Zygnematales and Chlorellales. Phytoplankton of the order is few in number, each has a percentage of the total amount 1,52% and 0,09%. DO concentration during the study in minapadi generally be in the range that is optimal for the life of the phytoplankton in the range of 5 to 8,2 mg/L.

Parameter ammonia and pH contributed greatly to the growth of phytoplankton of the order Euglenales. Euglenales Order of phytoplankton is always found in every observation and have the highest percentage of the total number, amounting to 42,81%. The concentration of ammonia in the research area minapadi measured during the study ranged from 0,002 to 0,026 mg/L. Ammonia measured in this study were free ammonia (NH_3-N) which cannot be ionized. Free ammonia is not used directly by the phytoplankton. However, as the temperature and pH during this study were within the normal range as the previous discussion, as well as the normal pressure due to the water surface, then the possibility of ammonia is in the form of gas and establish equilibrium with the gas ammonium (Effendi 2003) that are utilized by the order Euglenales this direct is ammonium (NH_4). These conditions make the explosive growth of phytoplankton of the order Euglenales especially on observation to 4-6.

Phytoplankton of the order Bacillariales and ulvales has a strong correlation with all the variables, because the location is very close to the center axis of ordination. Each parameter of the 18 environmental variables ~~pas~~ that was put into triplot CCA provides the same effect greatly to this growth, ~~O~~order of Bacillariales an order that is often found in every observation and the ~~amount~~ abundance is relatively more than other types of orders with the percentage of the total amount of 27,62%. While the order ~~u~~Ulvales was quite a few in number which is equal to 0,59%. Phytoplankton of the Order Rhizosoleniales, Spirulinales, and Tribonematales ~~no~~ are not in the CCA chart above, since the point which is far above the DO and nitrate ordinate axis, thus indicated that these orders are hardly correlated with environmental parameters. This suggests that the factors affecting the existence of the order of phytoplankton are other parameters besides the 18 environmental parameters that were included in this analysis.

4. CONCLUSION

The parameters of temperature, DO, pH, nitrates, phosphates, ammonia ~~including~~ are within recommended quantities qualify to PP 82 2001-III ~~to~~ class. There are some dissolved minerals that the measurement results exceeded the normal ~~condition~~ levels namely K, S, Si, Ca, Fe, Mn, Cu, and Cl. During the research, 31 orders of plankton were identified which were divided into 26 orders of phytoplankton and 5 order of zooplankton. The plankton orders consists of 7 phylum phytoplankton and 3 phylum zooplankton. The results of correlation analysis orders of phytoplankton in minapadi shows ~~a~~ different relationships with 18 environmental parameters. Every Dissolved mineral ~~are~~ that was measured in this minapadi g~~i~~ave the same effect on the phytoplankton community.

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