# ABUNDANCE AND DIVERSITY OF PHYTOPLANKTON IN RIVER FLOWS IN BANJAREJO VILLAGE IN SUPPORTING THE PRODUCTIVITY OF TRADITIONAL PONDS IN BANJAREJO VILLAGE, LAMONGAN

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**ABSTRACT**

Banjarejo Village River close by in a way direct with aquaculture areas so that the main water source used for irrigate pond originate from river water. Problems in the Banjarejo Village River is lack of management waste domestic nor waste activity agriculture can​ influence water quality and existence phytoplankton. Therefore​ that's the goal study this for know composition type, abundance, diversity, uniformity and dominance phytoplankton in rivers as material information management pond traditional and River. Taking sample done month December 2023 and January 2024 at time morning, afternoon and evening. Research sites found 3 stations. The main parameters observed covers abundance, diversity, uniformity and dominance phytoplankton. Meanwhile, the supporting parameters in the form of bulk data rain and water quality. Composition results type phytoplankton found in the Banjarejo Village River as many as 17 genera from 4 classes phytoplankton (Bacillariophyceae, Chlorophyceae, Cyanophyceae and Xanthophyceae). The value of abundance phytoplankton in the river flow in Banjarejo Village in the month December and January are included in type waters mesotrophic, index diversity medium, index even uniformity, and index dominance show that no there is a genus that dominates. Brightness, ammonia, nitrate and nitrite values in December and January overall exceeded the maximum limit. As for the test results of other parameters like temperature, DO, pH, salinity and phosphate still in optimal category for growth phytoplankton.

**Keywords :** Banjarejo, Phytoplankton, Abundance, Diversity, Uniformity, Domination

**1. INTRODUCTION**

Banjarejo is one of the areas located in the District Karangbinangun, Lamongan. This region surrounded by flowing rivers​ role important as source aquatic biota (Hasanah et al., 2022). Stability River ecosystem in Banjarejo Village can distracted by activity man like activity agriculture and activities anthropogenic like direct waste​ dumped by residents in the waters of the can River influence water quality, condition waters, and life existing organisms​ in it (Zanatia et al., 2019). One of organism the is phytoplankton. Phytoplankton is plant planktonic celled free single​ floating and drifting in water as well capable photosynthesize. Phytoplankton role as source food in chain food as well as stabilizer quality and fertility waters (Hossain et al., 2017). Fertility waters can indicated with abundance available phytoplankton.​ Along the River in Banjarejo Village there are aquaculture areas that cultivate fish and fish shrimp with use system cultivation traditional. Location of fish ponds and shrimp in Banjarejo Village this close by in a way direct with River, with distance around 1,5 meters so that the main water source used for irrigate pond originate from river water. Success cultivating fish/shrimp in ponds traditional one of them determined by river water quality. Poor river water quality has a significant impact on additional productivity (Rukminasari et al., 2020). Based on description that, then study This need done for know composition type phytoplankton present​ in the Banjarejo Village River, as well know​ abundance and diversity phytoplankton in the Banjarejo Village River as material information management pond traditional and river as well as indicator fertility River waters in Banjarejo Village.

**2. MATERIALS AND METHODS**

**2.1 Place and Time Study**

This research was carried out in December 2023 - January 2024 in Sungai Banjarejo Village, Lamongan. Identification phytoplankton carried out in the Laboratory Anatomy and Cultivation, Faculty Fisheries and Maritime Affairs, Airlangga University. Testing physical and chemical parameters in a way *in situ* carried out in the Banjarejo Village River and online *ex situ* carried out at the UPT Fish and Environmental Health Laboratory, Bangil, Pasuruan, East Java.

**2.2 Research** **Materials**

Equipment used​ in study is *haemocytometer*, cover glass, DO meter, refractometer, current ball, *stopwatch*, *cool box*, dropper pipette, microscope, bottle sample, 10 liter bucket, *Secchi Disk*, Plankton Net mesh size 10 micron, book plankton identification, tools write and *hand counter*. Meanwhile, the materials used is water samples obtained from the Banjarejo River, distilled water, tissue, label paper, *ice packs* and Lugol 1%.

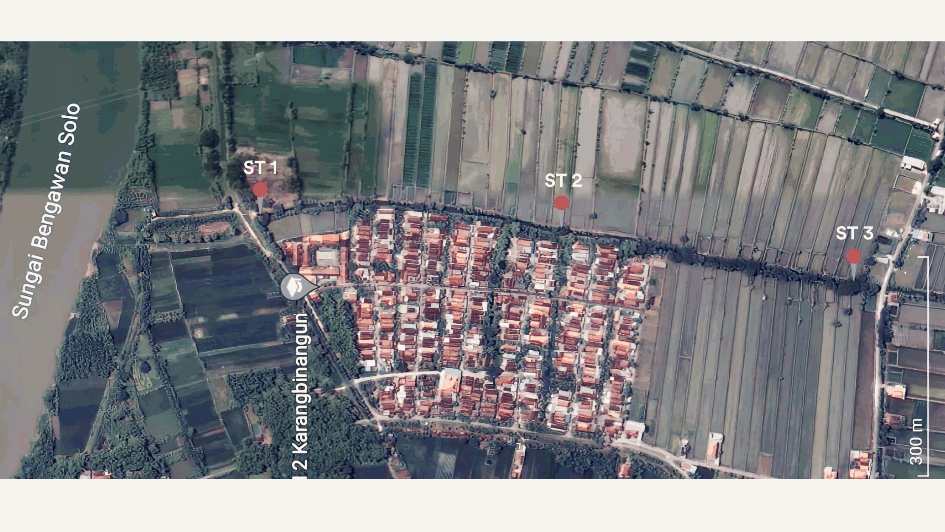
**2.3 Research Methods**

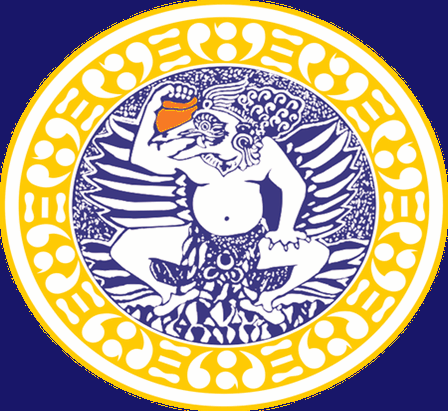
Research is an observational study that uses survey methods that is with search for data direct from location. Determining station points on the river for sampling using the *purposive sampling method* or in a way selected.

**2.4 Procedure Work Study**

**2.4.1 Water Sampling**

Research sites found 3 stations. Station 1 is located near the river with the Bengawan Solo River, station 2 borders direct with settlement residents and ponds traditional, as well bordering station 3 direct with ponds traditional.



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**Google Earth, 2024**

**Figure 1.** Location map study

Taking sample done in the morning day 06.00 WIB, noon day at 12.00 WIB, and in the afternoon at 16.00 WIB. Taking sample in the morning day due to time this phytoplankton not yet do activity photosynthesis (Hutabarat et al., 2013). On the other hand, during the day day phytoplankton tends to rise to surface for do photosynthesis. Taking sample for observation phytoplankton done with take 50 liters of river water will taken in 5x takes with use a bucket with a capacity of 10 liters. River water samples are filtered using a plankton net with *mesh size* 10 microns and inserted into the bottle sample with a volume of 100 ml. Existing water samples filtered with net plankton labeled. Sample later preserved use 5-6 drops of solution lugol 1% so that plankton conditions are not damaged. After preserved then saved put it in a cool box and take it with you to Laboratory for done identification. Determination rate ammonia use tool spectrophotometer whereas determination rate nitrates, nitrites and phosphates use HACH DR/890 colorimeter is suitable with Indonesian National Standard 06-6989-30-2005. Counting N/P ratio is obtained of the total nitrogen divided with total phosphate. Measurement bulk rain based on data from the Meteorology, Climatology and Geophysics Agency (BMKG) Karangploso, Malang.

**2.4.2 Identification and Calculation Phytoplankton**

Identification of phytoplankton is carried out based on the morphological characteristics or body shape of phyto plankton based on the references "*Illustrations of The Freshwater Plankton of Japan*" (Mizuno, 1979), and "*Illustrations of The Marine Plankton of Japan*" (Yamaji, 1979). Phytoplankton species that have been identified are then documented in the form of photographs. Calculation phytoplankton done with use *hemocytometer* and *hand tally counter* for make it easier calculation. Counting amount phytoplankton shared into 2 methods, namely *Small Blocks* and *Big Blocks* in accordance size observed phytoplankton.​ *Small block* method used if size cell phytoplankton more small of 6 μm, whereas method *big blocks* used if size cell phytoplankton more big of 6 μm. According to Satyantini et al., (2004) in Meritasari et al., (2012) calculations density phytoplankton (cells/ml) with use formula "*Small Block"* calculation :

Density phytoplankton (cells/ml) =

Note:

nA, nB, nC, nD, nE: Amount cell phytoplankton in blocks A, B, C, D and E

constant 5: Amount calculated blocks​

4x10-6: Area of the box small (A, B, C, D or E)

Calculation density phytoplankton (cells/ml) with use formula "*Big Block"* calculation (Satyantini and Masithah, (2007) in Tambunan et al., (2019):

Density phytoplankton (cells/ml) =

Note:

nA, nB, nC, nD: Amount cell phytoplankton in blocks A, B, C, D

constant 4: Amount calculated blocks​

Amount phytoplankton found Then entered in equality count for obtain results abundance, index diversity, index uniformity and index domination.

**A. Abundance Value Phytoplankton (N)**

Abundance phytoplankton can calculated with formula APHA (1992) in Sukardi and Apri (2020):

N = nx

Note :

N = Abundance of plankton ( individuals/L)

n = number species individual

Vt = Volume of filtered water (100 ml)

Vcg = Volume of *hemocytometer water* under the cover glass (0,1 mm2)

Acg = Cover glass area (1 mm2)

Aa = Observed area (1 mm2)

Vd = Volume of filtered water (50 L)

**B. Index Diversity Phytoplankton (H')**

Index diversity type can be calculated with formula Afif et al (2014) :

H'= (*Pi*) ln (Pi)

Note:

H' = Index diversity type

pi = Proportion individual from species 1st to total individuals​ all species (pi = ni/N)

Ni = Total number of individuals from type to -I (ind/cm2)

N = Total individuals all type (ind /cm2)

S = Amount species discovered​

**C. Index Uniformity Phytoplankton (E)**

Index uniformity phytoplancon can calculated with formula Magurran (1992) in Hasanah et al. (2022):

E =

Information :

E = index uniformity

H' = index diversity

H´ max = Ln S (S = Sum individual)

**D. Index Domination Phytoplankton (D)**

Index domination can calculated use Hasanah et al. (2022) as formula :

D = ∑

Information :

D = Index domination Simpson

ni = Amount individual

N = Total number of individuals

s = Number of genera

**3. RESULTS AND DISCUSSION**

**3.1 Phytoplankton Types**

Composition type phytoplankton found on the moon December and January totaling 4 classes of the 17 genera it consists of from Bacillariophyceae (10 genera), Chlorophyceae (4 genera), Cyanophyceae (2 genera) and Xanthophyceae (1 genus) (Table 1). Chart composition phytoplankton based on class at each station can seen in **Table 1.**

**Table 1 .** Phytoplankton Found at the Research Location

|  |  |  |  |
| --- | --- | --- | --- |
| **Class** | **Order** | **Family** | **Genus** |
| Bacillariophyceae | Coscinodiscales | Coscinodiscaceae | *Coscinodiscus* sp. |
| Thalassiosirales | Stephanodiscaceae | *Cyclotella* sp. |
| Naviculate | Pleurosigmataceae | *Gyrosigma* sp. |
| Melosirales | Melosiraceae | *Melosira* sp. |
| Naviculate | Naviculaceae | *Navicula* sp. |
| Bacillariales | Bacillariaceae | *Nitzschia sp.* |
| Naviculate | Pinnularaceae | *Pinnularia* sp. |
| Naviculate | Pleurosigmataceae | *Pleurosigma* sp. |
| Thalassiosirales | Skeletonemaceae | *Skeletonema* sp. |
| Fragilariales | Fragilariaceae | *Synedra* sp. |
| Chlorophyceae | Chlorococcales | Radiococcaceae | *Actinastrum* sp. |
| Sphaeropleales | Scenedesmaceae | *Coelastrum* sp. |
| Hydrodictyaceae | *Pediastrum* sp. |
| Scenedesmaceae | *Scenedesmus* sp. |
| Cyanophyceae | Nostocales | Oscillatoryaceae | *Spirulina* sp. |
| Nostocaceae | *Oscillatoria* sp. |
| Xanthophyceae | Tribonematales | Tribonemataceae | *Tribonema* sp. |

**3.2 Abundance Relatively Class Phytoplankton**

Abundance data relatively class phytoplankton the months of December and January are shown in **Figure 1**.

**Figure 1.** Relative Abundance of Phytoplankton Classes in December and January

Class phytoplankton with abundance highest month December that is class Chlorophyceae with the genus *Pediastrum* sp. and class Xanthophyceae with the genus *Tribonema* sp. Whereas abundance Lowest class Bacillariophyceae with the genus *Pleurosigma* sp. His height Chlorophyceae abundance compared with another class on the month December This in accordance with statement from Ambarwati et al. (2014) that Chlorophyceae generally lots found in freshwater waters​ because its nature easy adaptable and fast multiply, so its population lots found in waters bid. Phytoplankton from class Chlorophyceae in general abundant in waters with intensity sufficient light​ like ponds, lakes, reservoirs and rivers (Pratiwi et al., 2018). Genus of quite class Chlorophyceae overflow that is *Pediastrum* sp. Harmoko et al. (2017) stated that *Pediastrum* sp. can used as bioindicators water pollution due to *Pediastrum* sp. capable lively and fast thrive on conditions polluted waters, both moderate​​ or highly polluted.

Meanwhile, Xanthophyceae are usually found as phytoplankton in lakes and rivers especially rich in it material organic and humic (Agustina and M. Poke, 2016). One of the genera of class Xantophyceae capable​ endure live on the run humate that is *Tribonema* sp. On the moon December at stations 2 pm and 3 pm this algae lots found, then River conditions at the station this own warning danger content humate (Suhartini et al., 2021). According to Zila and Zainul (2019) existence substance humate in waters will cause problem health and environment. Presence substance humate can make waters colored yellow, brown or black.

Class phytoplankton with abundance the highest in January was obtained class Bacillariophyceae with the genus *Cyclotella* sp. as well as abundance lowest obtained class Bacillariophyceae with the genus *Gyrosigma* sp., *Melosira* sp. and *Skeletonema* sp. In January, the class Bacillariophyceae has the genus with amount most, this because Bacillariophyceae is type the most tolerant and capable phytoplankton adapt with good for the environment waters (Tian et al., 2021; Arofah et al., 2021). In addition, Bacillariophyceae are capable grow in a way fast despite the conditions relative nutrients and light​ low (Bone et al., 2023). Genus of quite class Bacillariophyceae overflow that is *Cyclotella* sp. *Cyclotella* sp. own mark good nutrition​ for lots species cultivation (Boyd, 2014). This species is one of types of plankton that can showing level water quality.​ Existence from *Cyclotella* sp. can showing exists pollution material organic intermediate until high, as well content high nutrition.​ Development *Cyclotella* sp. indicated exists eutrophication Because influence activity man. This matter because *Cyclotella* sp. is tolerant organisms​ to material organic (Yang et al., 2020).

**3.3 Abundance Phytoplankton**

Based on abundance data phytoplankton obtained , there is a genus of phytoplankton with abundance highest in the month December that is *Pediastrum* sp. and *Tribonema* sp. Meanwhile, the genus phytoplankton with abundance highest January that is *Cyclotella* sp. Characteristics every genus can seen in **Figure 2**. Meanwhile, abundance data phytoplankton on the moon December and January are presented in **Table 2** and **Table 3**.

|  |  |  |
| --- | --- | --- |
| A | B | C |

**Figure 2.** The most commonly found phytoplankton genus A. Pediastrum sp., B. Tribonema sp., C. Cyclotella sp.

**Table 2.** Abundance Value Phytoplankton December​

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Class** | **Genus Name** | **Abundance Phytoplankton ( individual /L)** | | | | | | | | |
| **Morning** | | | **Afternoon** | | | **Afternoon** | | |
| **1** | **2** | **3** | **1** | **2** | **3** | **1** | **2** | **3** |
| Bacillariophyceae | *Cyclotella* sp. | 0 | 0 | 500 | 500 | 0 | 0 | 500 | 1000 | 500 |
| *Navicula* sp. | 500 | 0 | 0 | 500 | 0 | 0 | 0 | 500 | 500 |
| *Nitzschia* sp. | 0 | 0 | 0 | 0 | 0 | 0 | 500 | 0 | 500 |
| *Pinnularia* sp. | 0 | 1000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Pleurosigma* sp. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 500 |
| Cyanophyceae | *Spirulina* sp. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 500 | 0 |
| Chlorophyceae | *Actinastrum* sp. | 0 | 0 | 0 | 500 | 0 | 0 | 0 | 0 | 500 |
| *Coelastrum* sp. | 0 | 0 | 0 | 500 | 0 | 0 | 0 | 0 | 0 |
| *Pediastrum* sp. | 1000 | 1000 | 500 | 500 | 500 | 0 | 500 | 500 | 1000 |
| *Scenedesmus* sp. | 0 | 0 | 500 | 500 | 0 | 500 | 500 | 500 | 500 |
| Xanthophyceae | *Tribonema* sp. | 500 | 500 | 500 | 1000 | 500 | 1000 | 500 | 1000 | 1000 |
| **Totsl** | | 2000 | 2500 | 2000 | 4000 | 1000 | 1500 | 2500 | 4000 | 5000 |

**Table 3.** Abundance Value Phytoplankton in January

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Class** | **Genus Name** | **Abundance Phytoplankton ( individual /L)** | | | | | | | | |
| **Morning** | | | **Afternoon** | | | **Afternoon** | | |
| **1** | **2** | **3** | **1** | **2** | **3** | **1** | **2** | **3** |
| Bacillariophyceae | *Coscinodiscus* sp. | 0 | 0 | 125 | 0 | 125 | 500 | 125 | 0 | 0 |
| *Cyclotella* sp. | 125 | 375 | 500 | 375 | 0 | 375 | 0 | 750 | 375 |
| *Gyrosigma* sp. | 0 | 0 | 0 | 0 | 125 | 0 | 0 | 0 | 0 |
| *Melosira* sp. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 125 |
| *Navicula* sp. | 125 | 375 | 0 | 125 | 500 | 1000 | 250 | 0 | 375 |
| *Nitzschia* sp. | 0 | 250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Pinnularia* sp. | 250 | 125 | 0 | 0 | 125 | 500 | 0 | 0 | 1000 |
| *Skeletonema* sp. | 0 | 0 | 0 | 0 | 125 | 0 | 0 | 0 | 0 |
| *Synedra* sp. | 0 | 0 | 0 | 0 | 0 | 0 | 125 | 0 | 0 |
| Cyanophyceae | *Spirulina* sp. | 0 | 0 | 0 | 125 | 0 | 0 | 0 | 0 | 0 |
| *Oscillatoria* sp. | 0 | 250 | 250 | 500 | 500 | 500 | 0 | 250 | 0 |
| Chlorophyceae | *Actinastrum* sp. | 0 | 0 | 125 | 0 | 0 | 125 | 0 | 0 | 125 |
| *Pediastrum* sp. | 0 | 250 | 0 | 0 | 375 | 250 | 125 | 250 | 0 |
| *Scenedesmus* sp. | 0 | 0 | 0 | 0 | 0 | 0 | 250 | 0 | 0 |
| Xanthophyceae | *Tribonema* sp. | 250 | 0 | 125 | 0 | 125 | 375 | 125 | 0 | 0 |
| **Total** | | 750 | 1625 | 1125 | 1125 | 2000 | 3625 | 1000 | 1250 | 2000 |

Based on abundance data that, is obtained results calculation of the average value total abundance of phytoplankton at the location study both in pond A and pond B shows that mark abundance on the moon December more tall than January. Average value total abundance can seen in **Table 4**.

**Table4.** Average Total Phytoplankton Abundance Value

|  |  |  |
| --- | --- | --- |
| **Mean Total Phytoplankton Abundance (individuals /L) ± SD** | | |
| **Time** | **December** | **January** |
| Morning | 2166.67 ± 26.24 | 1166.67 ± 29.27 |
| Afternoon | 2166.67 ± 146.12 | 2250.00 ± 84.57 |
| Afternoon | 3833.33 ± 114.39 | 1416.67 ± 34.69 |

Average total abundance of phytoplankton highest on the moon December available in the afternoon that is amounting to 3833.33 individuals/L included in category mesotrophic and in January it is during the day day that is amounting to 2250.00 individuals /L included in category mesotrophic. Meanwhile, the average total abundance of phytoplankton lowest in the month December there in the morning day and afternoon day that is amounted to 2166.67 individuals/L and in January it was found in the morning day namely 1166.67 individuals/L included in category oligotrophic.

By general abundance phytoplankton in the waters during the day day more tall if compared to with abundance that occurs in the afternoon. At noon day phytoplankton tends to rise to surface for do photosynthesis (Pavaux et al., 2021; Trimurti and Lariman, 2021). According to Siregar et al. (2014) at noon day there is light the sun is used by phytoplankton for carry out the process of photosynthesis. That matter means phytoplankton do it photosynthesis only is on the surface nor column still waters​ influenced by light sun. This matter compare backwards with amount phytoplankton found at the time study month December that abundance phytoplankton in the afternoon more tall compared to abundance phytoplankton during the day day. This matter supported with brightness Banjarejo Village River waters in the afternoon more tall compared to during the day day. Amount intensity incoming light​ to in bodies of water compare straight with amount phytoplankton in waters that, in other words increasingly a little amount intensity incoming light​ to in a body of water, then the more the number also decreases phytoplankton contained in it​ where intensity light is one of factor important supporter growth phytoplankton (Siregar et al., 2014; Nurfadillah et al ., 2019).

**3.4 Index Biology Phytoplankton**

The calculation results index diversity (H'), index uniformity (E), index dominance (D) phytoplankton month December and January are presented in **Table 5**.

**Table 5.** Index Diversity (H'), Uniformity (E) and Dominance (D)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Index** | **Time** | **December** | | | **January** | | |
| **ST. 1** | **ST. 2** | **ST. 3** | **ST. 1** | **ST. 2** | **ST. 3** |
| H' | Morning | 1.04 | 1.05 | 1.39 | 1.33 | 1.74 | 1.43 |
| Afternoon | 1.91 | 0.69 | 0.64 | 1.21 | 1.87 | 1.94 |
| Afternoon | 1.61 | 1.73 | 2.03 | 1.73 | 0.95 | 1.32 |
| E | Morning | 0.95 | 0.96 | 1.00 | 0.96 | 0.97 | 0.89 |
| Afternoon | 0.98 | 1.00 | 0.92 | 0.88 | 0.90 | 0.94 |
| Afternoon | 1.00 | 0.97 | 0.97 | 0.97 | 0.86 | 0.82 |
| D | Morning | 0.38 | 0.36 | 0.25 | 0.28 | 0.18 | 0.28 |
| Afternoon | 0.16 | 0.50 | 0.56 | 0.33 | 0.18 | 0.16 |
| Afternoon | 0.20 | 0.19 | 0.14 | 0.19 | 0.44 | 0.33 |

Index diversity (H') is highest on the moon December found at station 3 pm amounting to 2.03 which is included in level diversity type medium and January are at station 3 pm​ of 1.94 included in level diversity type currently. Whereas diversity lowest month December located at station 3 pm of 0.64 included in category diversity type low and in January it is found at station 2 pm at 0.95 which is included in category diversity type low. According to Marman et al. (2014) value index diversity influenced by quantity species and abundance phytoplankton found.​ The more lots species discovered​ in something sample, then the more big mark index diversity, though mark this also really depends from total number of individuals of each species.

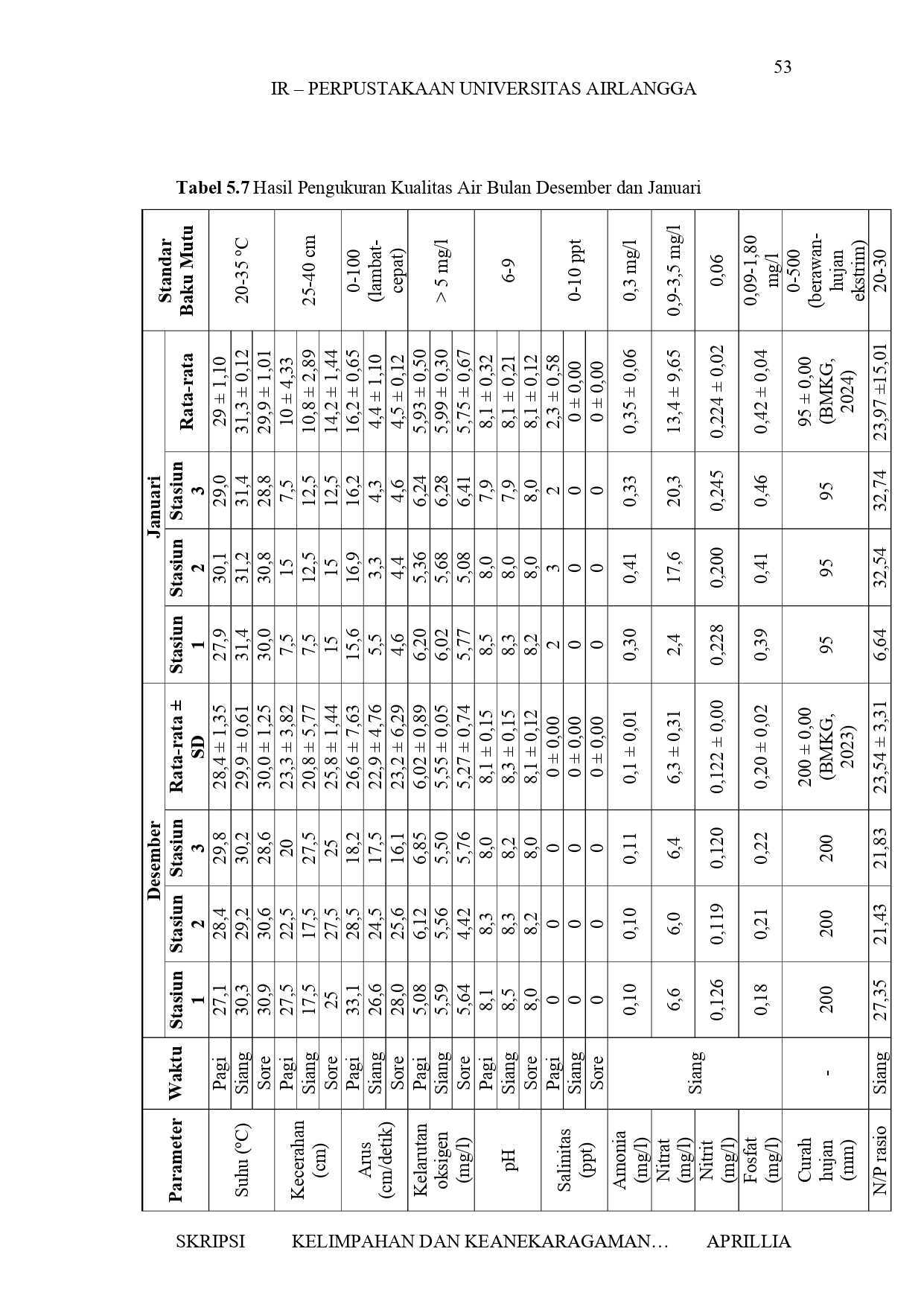
Index value uniformity (E) on the month December range between 0.92-1.00 and January ranges between 0.82-0.97. Index value uniformity on the moon December as well as January whole including in category uniformity the even kind or the same. This matter in accordance with statement Arofah et al. (2021) that index uniformity approach mark one 1 means uniformity of plankton between species relatively equally or amount individual of each species relatively the same so that no happen competition good to place nor to food. Whereas mark index uniformity close to 0, then can said spread individual between type no equally or there is group type certain dominant ones.

Index value dominance (D) is highest in the month December located at station 3 pm of 0.56 which shows that there is a genus that dominates, whereas mark index domination lowest found at station 3 pm of 0.14 which shows that no there is a genus that dominates. Index value the highest dominance (D) in January was at station 2 pm at 0.44 which shows that no there is a genus that dominates, whereas mark index domination lowest located at station 3 pm of 0.16 which shows that No there is a genus that dominates. That matter in accordance with statement Cahyonugroho et al. (2022) that index dominance close to 0 indicates no exists dominance of a particular genus, conversely if mark index close to 1 then there is a genus that dominates. This matter means the more tall uniformity something population, then there is tendency something species dominate population (Fajrina​ et al., 2013). Index dominance also shows correlation very significant negative with index diversity. If index dominance high, then indicated that index diversity is at in category low (Radiarta, 2013).

**3.5 Water Quality Parameters**

Result of measurement of water quality parameters at each location taking samples on the moon December and January based study field and laboratory tests​ can seen in **Table 6** .

**Table 6.** Measurement Results Water Quality in December and January



By general range temperature obtained​ during study is still range​ can support life phytoplankton . According to Diana et al. (2021) ideal temperature for growth phytoplankton is 20-35°C. The overall brightness value in December shows that the brightness of the river waters in Banjarejo Village is optimal for phytoplankton growth. Meanwhile, the overall brightness value in January shows that the brightness of the river waters in Banjarejo Village is not optimal for phytoplankton growth. According to Efendi et al. (2022) range brightness waters for fresh water in growth phytoplankton is 25-40 cm. The low mark brightness in the waters can caused because exists activity anthropogenic, like waste thrown away straight away to the body of the River, this cause turbidity become height and brightness also increases low (Trimurti *and* Lariman, 2021). When brightness low then the process of photosynthesis will obstruction and abundance phytoplankton become low (Azis et al., 2020).

The flow speed of the Banjarejo Village River in December is higher than in January. The more fast current so the more low or there are also few plankton found matter this because the movement of plankton is greatly influenced by speed current. With thereby abundance phytoplankton will experience increase in sufficient current​ weak, because phytoplankton will carried away spread body waters when current waters too strong (Idiawati et al., 2021). This matter supported statement by Azis et al., (2020) that if current too torrential will result turbidity high waters that influence​ level brightness. Content oxygen dissolved lowest found at station 2 pm. The low the DO value at station 2 in the afternoon is caused by its height input waste results activity anthropogenic from environment around. Activity man like disposal waste and agriculture generally cause happen decline content oxygen dissolved in water (Blume et al., 2010). Meanwhile, the DO content in January is whole Still in normal condition. Water DO content > 5 mg/l is good for phytoplankton (Dewanti et al., 2018).

Measured pH value of the Banjarejo Village River in a way whole still in category good for growth phytoplankton. According to Burhanuddin (2019) pH for life organism phytoplankton range between 6.5-8. Overall salinity in December in the Banjarejo Village River is 0 ppt, while in January it ranges from 0-3 ppt. Phytoplankton that live in fresh water can grow with salinity ranging from 0-10 ppt (Trimurti and Lariman, 2021). Ammonia levels in December ranged from 0.10-0.11 mg/L and in January ranged from 0.30-0.41 mg/L. According to Suherla (2022) optimal levels of ammonia for continuity life phytoplankton is 0.3 mg/l. Ammonia levels throughout​ station taking sample on month December and rates ammonia in January at station 1 no exceeds the maximum limit, whereas rate ammonia January at stations 2 and 3 exceeded the maximum limit. As is known that ammonia is one of the pollution parameters organics in waters and can nature toxic for biota if his concentration exceed maximum threshold (Hamuna​ et al., 2018).

Nitrate levels in December ranged from 6.0-6.6 mg/L and in January ranged from 2.4-20.3 mg/L. According to Permatasari et al. (2016) Optimal growth of phytoplankton need content nitrate in the range of 0.9-3.5 mg/l. In this case, the nitrate value in the Banjarejo Village River in December and January is above the optimum limit. Nitrate levels more than 5 mg/l describes happen pollution anthropogenic origin​ from humans and animals. Temporary that's it, rate nitrate < 0.44 mg/L to factor barrier growth phytoplankton (Cahyonugroho et al., 2022). Concentration high nitrate​ allegedly consequence exists activity agriculture in the environment around. Impact from activity agriculture is produce sediment nitrates and phosphates consequence use available fertilizer​ increase concentration nitrate (Casali et al., 2010). Temporary it was in January, at station 1 value rate nitrate show low yield.​ The low nutrients nitrate in waters caused by distance location taking distant samples​ from settlement residents (Nurhasanah et al., 2018).

Nitrite levels in December ranged from 0.119-0.126 mg/L and in January ranged from 0.200-0.245 mg/L. Nitrite value obtained​ from every station has exceeds the limit value maximum as stated by Sinaga et al. (2021) that rate maximum nitrites in waters for growth phytoplankton is 0.06 mg/l. Content excess nitrite​ mark maximum can nature toxic for organism waters and potential bother existence organism waters. The phosphate content in the Banjarejo Village River in January is higher than the phosphate content in December. Content phosphate throughout station on the moon December and January don't exceeds optimal limits, this in accordance with statement by Diana et al. (2021) that content optimal phosphate for growth phytoplankton range between 0.09-1.80 mg/L, whereas content phosphate < 0.02 mg/L to factor barrier.

N/P ratio in waters can used for know domination type phytoplankton that grows in these waters. At N/P ratio < 10:1 type phytoplankton in general grow originate from class Cyanophyceae alau *Blue Green Algae*, while the N/P ratio > 10:1 is dominated from class Chlorophyceae or Bacillariophyceae (Widigdo and Wardiatno, 2013). N/P ratio by month December and January respectively whole own mark N/P ratio >10:1. This matter show that phytoplankton that dominates the waters of the Banjarejo Village River on the moon December and January respectively whole originate from classes Chlorophyceae and Bacillariophyceae. However, in January at station 1 it has mark N/P ratio < 10: 1. This show that the phytoplankton that dominates the Banjarejo Village River in January at station 1 originates from class Cyanophyceae.

Apart from that, there are other factors can influence abundance phytoplankton in the waters of the Banjarejo Village River like bulk Rain. Rainfall in the month December more tall than bulk rain in January. High rainfall​​ causes nutrients concentration will more low so that abundance phytoplankton in the waters is also low, this is because at the moment season rain water volume increases so the river water experience dilution more big result​ existence phytoplankton will reduced (Kim et al., 2014). However, the compare backwards with amount abundance phytoplankton found at the time study that on the moon December abundance phytoplankton tend more tall. The value of abundance high phytoplankton​ because mark brightness on the moon December is optimal for growth phytoplankton. Phytoplankton is microorganisms chlorophyll so that need energy sun and intensity incoming light​ to in waters for do photosynthesis (Tarmizi et al., 2021). Whereas January has​ bulk rain more low compared to month December however own level low brightness,​ this is one factors that make abundance phytoplankton decreased in January. Brightness value low signify that level turbidity tall so that happen decline penetration light sun into the next waters​ will lower photosynthesis and productivity phytoplankton (Ginting et al., 2021).

**4. CONCLUSIONS**

Composition type the most abundant phytoplankton found in the river flow in Banjarejo Village in the month December that is class Chlorophyceae with the genus *Pediastrum* sp. and class Xanthophyceae with the genus *Tribonema* sp. Meanwhile, composition type the most abundant phytoplankton discovered in January ie​ class Bacillariophyceae with the genus *Cyclotella* sp. Abundance value (N) of phytoplankton in the river flow in Banjarejo Village during the month December and January respectively whole classified in type waters mesotrophic. Index value diversity (H') of phytoplankton on the moon December and January respectively whole own mark currently. Index uniformity (E) of phytoplankton on the moon December and January respectively whole own mark even uniformity.​ Index dominance (D) of phytoplankton on the moon December and January respectively whole show that no there is a genus that dominates.

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