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Relationship between distribution of phytoplankton with Cimanuk river water quality

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Abstract. Plankton is the primary food source for aquatic animals so that these herbs have an important role for the aquatic ecosystem. Research conducted in April 2019 at Cimanuk River, Garut, West Java. Water quality is strongly influenced by the activity of sand mining, industrial waste, agricultural, and household waste so that quality is reduced. Water quality can be determined through the study of biological analysis with the use of bioindicators. Bio-indicators used is the aquatic biota phytoplankton. This research uses descriptive research with correlation method. The goal is to determine the relationship between the distribution of phytoplankton with the quality of its waters. From the results of the research produced distribution of phytoplankton that consist of: The abundance of phytoplankton (1,077–1,710 individuals/l), the index of diversity (2.6014–2.9184), the index of evenness (0.8651–0.8797), and index of dominance (0.8912–0.9255 level). Based on the person correlation showed that the relationship between water quality (light intensity, brightness, current speed, wind speed) with the distribution of phytoplankton.

1. Introduction
Cimanuk river is a river located in the Eastern part of the Province of West Java, which culminate in Mount Papandayan, Garut. Regional River Flow (DAS) Cimanuk, Garut, suffered damage due to sand mining activities which lasted for a long time so the impact on the decline in the quality of the waters of the river Cimanuk. The decline of water quality caused by the disruption of one of the biological component in a medium of water. Waters has 3 main components, namely: physics, chemistry, and biology. If one component is disturbed will result in an imbalance between the 3 components and also the imbalance between the BOD (Biological Oxygen Demand) with DO (Dissolved Oxygen) so that the quality of the waters in the region to be disrupted [1,2]. In this research, decline in the quality of waters seen from the presence of Phytoplankton as part of the Biological component in the waters.

Phytoplankton or plankton vegetable is a plant life floating in the waters. Its size is very small ranging between 2 – 200 µm (1 µm = 0.001 mm) and cannot be seen with the visual [3]. Phytoplankton is the largest contributor to oxygen in the waters of the sea and is the parameters of biology that can be used as indicators to evaluate the quality and the level of fertility of waters. As bio indicators waters, phytoplankton serve as a measure of whether the waters are in good condition or have been impaired because phytoplankton have short life cycles and very quick response to environmental changes [4,5].

From some previous research is produced that, “Phytoplankton can serve as indicators of water quality because of the short life cycle, and very quick response to environmental change” [6,7] Based
on these facts, the researchers conducted research with the aim to determine the relationship between the distribution of phytoplankton with the water quality in the Cimanuk river, Garut. The quality of the waters seen from: light intensity, brightness, current speed, and the speed of the wind while the distribution of phytoplankton seen from: The diversity, The Evenness and Index of Dominance. From the results of the research show that the relationship between the quality of the waters with the distribution of phytoplankton. This research materials as additional information for the community about the quality of the waters in the flow of the Cimanuk River, Garut.

2. Methods
This research is descriptive with quantitative approach. Because it contains calculations that produce numerical data (numbers). This research describes the existence or the distribution of phytoplankton as Biological components in waters and as the bio indicators used to determine the quality of the waters of a region. While the method of correlation used to see the relationship between distribution of phytoplankton with the water quality in the Cimanuk River, Garut. Population as object of research is a whole species of a group of phytoplankton that are along the flow of the Cimanuk River, Garut. The sample observed is the individual from the group of phytoplankton that is filtered by the plankton net at the time of sampling at the location of the observation is inserted into the bottle for further identification.

Research Data resulting from the calculation of the physical parameters (water temperature, brightness of the waters, wind speed, current speed, light intensity) and the Distribution of Phytoplankton (Index of diversity, Index of Evenness, Index of Dominance) [8].

Determining the location of sampling done by purposive sampling method, namely the determination of the location of research with the intent and purpose in accordance with the results to be achieved [9]. There are three locations of observation (figure 1), namely: river flow station A (Regional Cibunar), river flow station B (Regional Sukakarya), and the river flow station C (Regional Cimacan).

Figure 1. Location research each location (station).

Sampling techniques of phytoplankton using the technique of filtering horizontally. Sampling using bottles that have a volume of 5 L as much as 5 bottles for filtering water containing samples. So the total volume of the sample extracted from the 3 study locations a total of 20 L. Filtering using plankton net.
Samples are filtered put in a bottle size 25 mL of given solution of lugol's 4% as much as 1 mL [4]. Then taken to the laboratory for identification and processing of data. Final Data analysis is the correlation test. The test is to determine the relationship between the distribution of phytoplankton with the water quality in the Cimanuk river, Garut.

3. Results and discussion

The role of phytoplankton is the ability to perform photosynthesis, namely: a process that can absorb solar energy and form organic compounds from inorganic compounds. These organic compounds are a source of energy that is required by all living creatures for various activities including to move, grow, and reproduce. Hence, phytoplankton is an important component of all life in the waters, either directly or indirectly, or through the food chain [9-11].

3.1. Distribution of phytoplankton

Distribution and abundance of phytoplankton is strongly influenced by the condition of the aquatic environment. It is likely to be influenced by the amount of light received by the phytoplankton for photosynthesis activity will do. Therefore, phytoplankton abundance and ecological index is often used as bio-indicators of the condition of the marine environment [12]. To see the stability level of the aquatic environment, some phytoplankton ecology index has been calculated that consists of: diversity index (Table 1), evenness index (Table 2), and the dominance index (Table 3).

| Locations | Diversity (H') | Criteria based on the value Diversity (H') |
|-----------|----------------|------------------------------------------|
| Station A | 2,9184         | diversity Medium                         |
| Station B | 2,6141         | diversity Medium                         |
| Station C | 2,6014         | diversity Medium                         |

| Locations | Evenness (E) | Criteria based on the value Evenness |
|-----------|--------------|-------------------------------------|
| Station A | 0,8789       | Being evenness in Stable Condition   |
| Station B | 0,8797       | Being evenness in Stable Condition   |
| Station C | 0,8651       | Being evenness in Stable Condition   |

| Locations | Dominance (D) | Criteria based on the value Dominance |
|-----------|---------------|---------------------------------------|
| Station A | 0,9255        | High Dominance Index                  |
| Station B | 0,9034        | High Dominance Index                  |
| Station C | 0,8912        | High Dominance Index                  |

3.2. Physical parameters

Physical parameters measured as supportive data in this study consisted of: temperature, light intensity, brightness, flow speed, and wind speed. Based on the physical parameters, the results of temperature measurements in the waters of the River Cimanuk shows the range of 23-23.5 °C with an average temperature 23,2oC, water temperature is an important factor affecting the life processes and the spread of the organism and affect the rate of photosynthesis and algae growth naturally , This value is still relatively good for the growth of phytoplankton, it indicates that the temperature of the river water is relatively normal, thus supporting the growth of phytoplankton. In addition, from the phylum Chlorophyta algae and diatoms grow well in the temperature range 20 to 30 °C and 30 to 35 °C [6].

Brightness waters at the study site ranged between 20-35 cm with an average value of 28.3 cm, a high brightness level is very useful for phytoplankton to perform photosynthesis process so that growth
can flourish. Low brightness level greatly affects the distribution and abundance of phytoplankton. In this study, it appears that the abundance of phytoplankton in the waters of the River Cimanuk quite low. This factor caused by the brightness level in the river waters Cimanuk low due to high suspended material.

Light intensity is an important parameter that needs by phytoplankton. The sunlight is absolutely necessary for photosynthesis reaction. The relationship between the intensity of sunlight by photosynthesis rate or productivity of phytoplankton have a linear relationship. Results of measurement of light intensity at the study site ranged: 1470 Lux - Lux 4018 with an average value: 3157 Lux.

Current velocity is an important parameter in relation to the distribution of phytoplankton. The flow velocity at the study site ranged from: 0.535 to 1.052 with an average value: 0.734. This is relatively low flow velocity. Strong current could affect the distribution of phytoplankton in the waters. Phytoplankton dynamics of the flow velocity has showed a succession of types of phytoplankton that is in accordance with current conditions [6].

Wind speed is an important parameter with respect to the distribution of phytoplankton. The wind speed at the study site ranged from: 1.6 to 3.4 with an average rating: 2.7.

3.3. Correlation
Correlation test used to look at the correlation (correlation) between the distribution of phytoplankton in the waters of the River quality Cimanuk, Garut. This correlation test done by Pearson correlation test [12] and SPSS 16. The results of the data analysis are shown in Table 4.

| Correlation       | Diversity | Evenness | Dominance | Abundance |
|-------------------|-----------|----------|-----------|-----------|
| Temperature       | 0,00      | 0,00     | 0,00      | 0,00      |
| Light intensity   | 0,155     | 0,00     | 0,00      | 0,143     |
| Brightness        | -0,299    | 0,00     | 0,00      | -0,408    |
| Flow velocity     | 0,316     | 0,00     | 0,00      | 0,409     |
| Wind velocity     | 0,158     | 0,00     | 0,00      | 0,262     |

From table 4 shows that the correlation coefficient is greatest correlation with the current speed of abundance, with correlation coefficient 0.409. From the table it was found that the correlation between: 1). variable light intensity with diversity, 2). Variable brightness with diversity, 3). Variable flow velocity of diversity, 4). Variable wind speed with diversity. While the temperature variables have no correlation with the distribution of phytoplankton.

4. Conclusion
The relationship between the distribution of phytoplankton in the water quality is tested using Pearson correlation formula. And showed that the correlation between: 1). Variable light intensity with diversity, 2). Variable brightness with diversity, 3). Variable flow velocity of diversity, 4). Variable wind speed with diversity. While the temperature variables have no correlation (relationship) with the distribution of phytoplankton.

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