The effect of distance of floating karamba on placement of phytoplankton abundance in coastal waters of Sathean Village, Langgur - Tual Regency

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Abstract. The condition of water will also affect the distribution pattern or distribution of phytoplankton both horizontally and vertically, so that it will affect the abundance of phytoplankton which in turn affects the primary productivity value. The waters of Sathean Village are some floating net cages (KJA) owned by both the community and the company. The existence of economic activities in the waters of Sathean Village, it results in disruption of the balance of the aquatic environment which ultimately affects the growth of phytoplankton in these waters. The study was conducted using an experimental method with a factorial completely randomized design. The first research factor was the distance of KJA placement with 3 sub-factors, namely 26 m distance; 38 m; and 52 m. The second research factor is the depth of sampling consisting of 4 depths namely 0 m; 2 m; 4 m; and 6 m. The test is done 3 times. Station B, a distance of 38 m from the beach 38 from the beach with a sampling depth of 0m, 2m, 4m and 6m, and 3 replications. The main parameters observed were phytoplankton abundance, diversity index, uniformity index, and dominance index. Meanwhile, the supporting factor is water quality.

1. Introduction
Coastal ecosystems are dynamic ecosystems and have a variety of diverse habitats, on land and at sea, and interact with each other. Besides having great potential the coastal area is also an ecosystem that is easily affected by human activities. Generally, development activities directly or indirectly have a detrimental impact on the ecosystem of the coastal water [1]. One ecosystem that plays an important role in the coastal waters environment is a group of biota both plants and animals, in biology plankton can be divided into two main categories, namely phytoplankton which includes all micro-plants and zooplankton which includes animals that are generally micro [2].

The waters of Sathean Village are some floating net cages (KJA) owned by the community, Mutiara Company, and the Tual State Fisheries Polytechnic. Floating Net Cages (KJA) are used to cultivate grouper fish, baronang and another marine water biota. The several types of Floating Cages (KJA) used are AquaTec Brand KJA Box and KJA manually assembled. With the dense economic
activity in the waters of the Sathean village, it disrupts the balance of the aquatic environment which ultimately affects the growth of the existing phytoplankton.

The development of fisheries in this village will sooner or later have a less favorable impact on the sustainability of natural resources. The determinants of the fertility level of water can be seen from the abundance of phytoplankton and the physical and chemical quality conditions of the waters. Excessive activity around the waters of Sathean Village will be able to change the condition of aquatic ecosystems such as an abundance of phytoplankton and water quality. In this regard, the authors feel interested in researching the abundance of phytoplankton in the waters of Sathean Village, Langgur - Tual Regency.

2. Material and methods

2.1. Place and time of research

When the research was carried out from January 21 to March 21 2019. Whereas the research was conducted at the floating net Karamba Tual State Polytechnic. Whereas phytoplankton analysis was conducted at the Tual State Fisheries Polytechnic Laboratory.

2.2. Tools and materials

The tools used are 25 μm Plankton net mesh, Thermometer, GPS (Global Positioning System), Secchi disc, Camera, Sedgwick rafter/cover glass Microscope, Object glass, Caver glass, Washing bottle, Prescot book, Counter (counter), Lugol 0.5%, Phytoplankton Sample Material

2.3. The procedure of research preparation

The method used in this research is the experimental method. Experimental method is a way of presenting lessons, where students conduct experiments by experiencing something themselves are learned [3]. In the teaching and learning process, with the experimental method, students are allowed to experience themselves or do it themselves, following a process, observing an object, state or process of something. Thus, researchers are required to experience themselves, look for the truth, or try to find a law or proposition, and draw conclusions from the process they went through.

The experimental method (experiment) is a demand of the development of science and technology to produce a product that can be enjoyed by the public safely and in learning involving students by experiencing and proving themselves the process and results of the experiment [4].

Based on the above opinion, it can be concluded that the experimental method is a way of presenting lessons with an experiment, experiencing and proving itself what is learned, and students can draw a conclusion from the process they experienced. This research was conducted by observing the floating net cages at 3 stations with 3 sampling depth and 3 replications of each treatment. The treatment is:

a. Station A, a distance of 26 m from the coast with a sampling depth of 0m, 2m, 4m, and 6m and 3 replications;
b. Station B, a distance of 38 m from the beach with a sampling depth of 0m, 2m, 4m and 6m, and 3 replications;
c. Station C, 52 m distance from the beach with sampling depths of 0m, 2m, 4m and 6m and 3 replications;

2.4. Data analysis

The data obtained is then tested using a simple linear correlation analysis [5], Correlation analysis is a statistical method used to determine the strength (degree) of a linear relationship between two or more variables. If an increase in a variable is followed by an increase in another variable, it can be said that both variables have a positive correlation, but if an increase in a variable is followed by a decrease in other variables, then the two variables have a negative correlation.
3. Result and discussion
3.1. Phytoplankton abundance

The abundance of phytoplankton found during the study varied in value at each depth in the waters of Sathean Village. The highest average abundance value is at a distance of 26 meters from the beach with a depth of sampling of 4 m (939 Cells / L). This is due to the penetration of light entering at a depth of 4-6 meters when sampling is at the optimal point that allows for phytoplankton to photosynthesize. Light penetration is the main factor that supports phytoplankton to photosynthesize in waters. The maximum growth rate of phytoplankton will decrease if the waters are in a condition of low light availability [6].

![Figure 1. Results Graph Average Abundance Value of Phytoplankton Each - Every Treatment During the Study](image)

While the lowest abundance value is at a distance of 52 m from the beach with a depth of 0-meter sampling (709,333 Cells / L). The low abundance value at a depth of 0 m meters is due to the high penetration of light entering the surface when sampling so that phytoplankton tends to decrease to depth. The abundance of phytoplankton is influenced by light intensity, but the intensity of light that is too high or strong will damage the phytoplankton enzymes as a result of which phytoplankton that cannot stand will die [7].

The existence of differences in the abundance of phytoplankton at each distance and depth, then Landner (1976) [8] divides waters based on phytoplankton abundance, namely:

a. Oligotrophic waters are low fertility waters with phytoplankton abundance ranging from 0 - 2000 cells / L.

b. Mesotrophic waters are waters of moderate fertility with an abundance of phytoplankton ranging from 2000 - 15000 cells / L.

c. Eutrophic waters are high fertility waters with phytoplankton abundance ranging from > 15,000 cells / L.

Based on the classification, the coastal waters of Sathean Village which have an average abundance ranging from 1,833.08 - 2,053.58 cells / L are mesotrophic waters, which are waters that can be said to water that has moderate fertility.
3.2. Diversity index

The phytoplankton diversity index found during the study varied in value at each distance of the KJA placement and the depth of sampling in the waters of Sathean Village. The highest diversity index value at a distance of 38 m KJA with a depth of sampling is 4 m (3.38). This shows that the location of the study measured vertically stratified classified as mesotrophic waters (Fertility of moderate waters) because the phytoplankton spread is still quite evenly distributed at each distance of the KJA placement and sampling depth (Surface or 0m, 2m, 4m, 6m). The waters of Sathean Village include (H > 3) high diversity and moderate community conditions, this is because there has not been significant ecological pressure on the waters in Sathean Village.

![Graph of the average yield index of phytoplankton diversity per treatment during the study](image)

**Figure 2.** Graph of the average yield index of phytoplankton diversity per treatment during the study

Reiterates that the range of diversity index values from 0-1 indicates that the area has high ecological pressure and a low species diversity index [9]. Ranges 1-3 indicate a moderate diversity index, for diversity values greater than 3 indicate the state of an area that is experiencing low ecological pressure and a high species diversity index. The diversity index shows the number of species that can adapt to the environment in which the organism lives. The higher the diversity index value, the more species can survive in this environment [10].

3.3. Uniformity Index

The phytoplankton uniformity index found during the study varied in value at each depth in the coastal waters of the Sathean Village. The uniformity index value in the coastal waters of Sathean Village at each sample depth is close to one, which ranges between (0.697 - 0.957). This shows that the spread of individuals between types is relatively evenly distributed and there is no tendency for domination by a type. The even distribution of individuals at each depth during observation is caused by sufficient light intensity, and wind. [11], the wind blows affect the uniformity of phytoplankton which causes buildup in a place.
From these observations the uniformity index shows the uniformity of phytoplankton in the coastal waters of Sathean Village approaching 1, then the coastal waters can be said to be a moderate population uniformity index namely, \((0.4 < E < 0.6)\), which means that the coastal waters of Sathean Village have not occurred significant pollution resulting in pressure in these waters so that these waters still support the survival of phytoplankton [12].

Medium uniformity, it can be said that the ecosystem is in a fairly good condition, where the distribution of individuals of each type is relatively uniform [13]. if uniformity is close to zero, it means that uniformity among species in the community is classified as low and conversely uniformity that is close to one can be said to be uniform or evenly uniform [14].

3.4. Dominance Index
The dominance index of phytoplankton found during the study varied in value at each depth in the coastal waters of Sathean Village. The range of average dominance index values obtained during the observation is 0.077 - 0.144. This illustrates that the penetration of light entering the waters still supports the growth of phytoplankton at every depth so that there are no species that dominate other species.
Environmental factors that influence the dominance of one species are light, temperature, the chemical form of other nutrients [15]. The range of dominant values is 0 - 0.50 indicates that the area has low dominance [9]. The range 0.50 - 0.75 indicates that the area is dominance while the value of dominance 0.75 - 1 indicates the state of an area with high dominance. If it is concluded that the Sathean Village waters dominance index shows that the area has a low dominance. This shows that the condition of the community structure is stable (Odum, 1971).

3.5. Water quality
The average temperature of the waters of Sathean Village in each distance of the same KJA is 27 °C. This value is still in a good range for the life of marine life. Temperature can affect photosynthesis in the sea both directly and indirectly[16]. The direct effect of temperature has a role in controlling enzymatic reactions in photosynthesis. High temperatures can increase the maximum rate of photosynthesis, while the indirect effect is in changing the hydrological structure of the water column which in turn will affect the distribution of phytoplankton.

The average pH of the waters is 7.71 - 7.77. The lowest pH is at a distance of 52 meters KJA and the highest at a distance of 26 meters KJA. pH ranging from 8.0 - 9.0 can still support the development of phytoplankton [17].

The dissolved oxygen content of the waters of Sathean Village averaged around 7.37 - 8.27 mg / L. The lowest oxygen content is at a distance of 52 m KJA and the highest at a distance of 26 m KJA. This is thought to be caused by the photosynthesis process carried out by phytoplankton. The high abundance of phytoplankton at this station contributes to the high levels of dissolved oxygen which are the result of photosynthesis. When compared with PEM NO.51 / MENLH / 2004, the allowable dissolved oxygen is > 5. The dissolved oxygen data in these waters indicate that dissolved oxygen at each KJA distance is high.

The average salinity value of the waters of Sathean Village is around 34 - 35 %o. In general, the salinity range in these waters is relatively high for aquatic biota life. Phytoplankton can develop well at salinity 15 – 32 %o[18].

The average water brightness of Sathean Village is around 6.60 - 6.85 m. The highest brightness is at KJA Distance 32 m and the lowest is at KJA Distance 52 m. In general, the brightness of the waters is classified as natural, which is by seawater quality standards intended for marine biota. The natural brightness at each KJA Distance is caused by the low activity around the waters of Sathean Village.

4. Conclusion
Research on the Effect of Distance of Floating Karamba on Placement of Phytoplankton Abundance in the Sathean Village Waters, Langgur Regency, Tual can be concluded that the distance of floating net cage placement has a very significant effect on the abundance of phytoplankton. This can be seen from the research parameters, namely:

The highest abundance of phytoplankton abundance at a karamba distance of 38 m by taking a sample of 4 m (2,906.33 cells / L) was then followed by a karamba distance of 26 m with a sampling depth of 4 m (2,848.67 cells / L); karamba distance of 52 m with a sampling depth of 4 m (2,740.33 cells / L); karamba distance 38 m with a sampling depth of 6 m (2,689.33 cells / L); karamba distance of 26 m with a sampling depth of 6 m (2,612.33 cells / L); karamba distance of 52 m with a sampling depth of 6 m (2,030.67 cells / L); karamba distance of 26 m with a depth of 0 m (1,424.67 cells / L); karamba distance 38 m with a sampling depth of 0 m (1,406 cells / L); karamba distance of 52 m with a depth of 0 m (1,160.67 cells / L); and the karamba distance is 26 m with a depth of 0 m (1,160.33 cells / L).
The highest index value of phytoplankton diversity at a distance of 38 m karamba with 4 m (3,523) sampling was followed by successive 38 m karamba distances with 2 m (3,400) sampling depth; karamba distance of 52 m with a sampling depth of 0 m (3,397); karamba distance 38 m with a sampling depth of 6 m (3,280); karamba distance 38 m with a sampling depth of 6 m (3,275); karamba distance of 52 m with a depth of sampling 4 m (3,258); karamba distance of 52 m with a sampling depth of 2 m (3,248); karamba distance of 26 m with a sampling depth of 4 m (3,218); karamba distance 26 m with a sampling depth of 0 m (2,807); karamba distance of 26 m with a sampling depth of 6 m (2,742); and the karamba distance is 26 m with a depth of 2 m (2,616).

The highest index value of phytoplankton uniformity at 38 m karamba distance with 4 m (0.940) sampling was followed by 26 m karamba distance respectively with 4 m (0.934) sampling depth; karamba distance of 26 m with a sampling depth of 0 m (0.930); karamba distance of 52 m with a sampling depth of 2 m (0.927); karamba distance of 52 m with a depth of sampling 4 m (0.922); karamba distance of 38 m with a sampling depth of 0 m (0.921); karamba distance of 26 m with a sampling depth of 2 m (0.914); karamba distance of 26 m with a sampling depth of 0 m (0.909); karamba distance 38 m with a sampling depth of 6 m (0.893); karamba distance of 26 m with a sampling depth of 6 m (0.891); karamba distance of 52 m with a depth of 6 (0.889); and the distance of the karamba is 52 m with a depth of 0 m (0.829).

The highest value of phytoplankton dominance index at 52 m karamba distance with 4 m (0.141) sampling then followed by 52 m karamba distance with 4 m (0.134) sampling depth; karamba distance 38 m with a depth of sampling 4 m (0.126); karamba distance 38 m and karamba distance 52 m with the same sampling depth of 2 m (0.117); karamba distance of 26 m with a sampling depth of 6 m (0.116); karamba distance of 26 m with a depth of sampling 6 m and 0 m (0.115); karamba distance of 52 m with a sampling depth of 0 m (0.113); karamba distance of 26 m with a sampling depth of 4 m (0.107); karamba distance of 26 m with a sampling depth of 2 m (0.102); and the karamba distance is 26 m with a sampling depth of 0 m (0.092). Water quality values are still in the normal range for phytoplankton growth, except salinity values that are higher than water quality standards for marine biota.

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