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The Strategy of Phytoplankton In Critical Conditions In Coastal Waters

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3 ABSTRACT

The objectives of this research is to analyze the life strategy of abundance phytoplankton on critical aquatic conditions in coastal waters. To achieve the desired results, multivariate analysis is used Correspondent analysis (CA) and Principal Components Analysis (PCA). The results showed that based on the analysis of Factorial Koresponde (CA), there were two grouping abundance of phytoplankton. Group I showed that the grouping of abundance of phytoplankton occurred at A depth of 10 m at the time of sampling A (10.00 hours: normal conditions). Group II occurs at a depth of 5 and 15 m at sampling time B (hours 14.00: critical condition). Furthermore, the shift in grouping phytoplankton occurs at the time of sampling A at a depth of 10 m into the sampling time B in 5 m depth, not at a depth of 0 m. This is due to the very strong sunlight intensity that can lead to death in the type of phytoplankton that exist. It turns out that the strategy and the abundance dynamics of phytoplankton at critical time is not doing the grouping at the surface depth (0 m), but at a deeper depth (5 m) in order to keep the activity well done.

Keywords: strategy, abundance, phytoplankton, critical conditions, coastal waters

1. Introduction

Coastal waters have high biological resources. It is supported by physical, chemical and biological conditions (Duarte et al., 2000). The waters are the most widely known and studied parts of the sea because the area is easily accomplished by humans. Although the area is limited, there are a variety of environmental parameters when compared to other marine regions. In this area there are also many interesting phenomena to be researched (Morovic, M. 2008; Cosgrove, et al., 2015).

In coastal areas, phytoplankton can perform the process of photosynthesis effectively (Mosharova et al., 2018). In conducting activities, these microorganisms are heavily influenced by light and nutrients as well as other physical-chemical parameters. The availability of these parameters is quite large in coastal waters. This causes the activity of phytoplankton to run well.

In many research results by experts get the conclusion that the process of photosynthesis goes perfectly on the corner of the sun is at the peak of illumination around 12.00. More specifically, the research carried out by Tambaru and Samawi in 2002 in the waters of Barrang Lompo Island resulted in one conclusion that the primary productivity of the highest phytoplankton was found in critical environmental conditions for the life of phytoplankton (incubation time 10.00-14.00).

Theoretically, the above is unlikely. There is a very high illumination of the sun at the incubation time, thus making phytoplankton activities do not go perfectly. But why does it get the highest primary productivity measurement results? The question was missed through research on the strategy and life dynamics of abundance of phytoplankton at the best incubation time interval (10:00-14:00) in the coastal waters of the island of town Barrang Lompo Makassar.

2. Method

This research was carried out in the waters of Barrang Lompo Island of Makassar. Research is conducted at four depths of 0 m, 5 m, 10 m, and 15 m. Incubation time interval used is 10:00-14:00. At that time interval, research was conducted in 10.00 and 14.00 hours. To see the abundance of phytoplankton, the water sampling time for identification is implemented at the time of sampling A (hours 10:00 = stable condition) and B (14:00 = critical condition). The water samples were subsequently analyzed at the Oceanographic Chemistry Laboratory at the Faculty of Marine Sciences and Fisheries Unhas. For nutrient measurements (orthophosphate, nitrate, and silicate), water samples were taken together with water sampling for phytoplankton specimens. At that time, a measurement of chemical parameters-Physics (temperature, salinity, and pH) was measured.

To describe the distribution of the spatio-temporal abundance of phytoplankton, a multivariate analysis of the Correspondent analysis (CA) followed the instructions of Legendre and Legendre (1993) and Bengen (2000). This analysis can give an overview of grouping phytoplankton in critical conditions on the water column. For testing linkage between physical-chemical variables of water with sampling time and depth by using Principal Components Analysis (PCA) (Bengen, 2000).

3. Results and Discussion

3.1. Environmental parameters

The results of environmental parameter measurements (nitrates, orthophosphate, silicate, temperature, degree of acidity (pH), and salinity) are still in the range corresponding to the growth of phytoplankton.

3.2. Composition of phytoplankton

The composition of phytoplankton found consists of 3 classes and 20 types which are the Bacillariophyceae of 11 types, the Chlorohyceae as much as 4 types, and the Cyanophyceae as much as 5 types. Diatoms and the Bacillariophyceae are the most dominant types and classes of phytoplankton at the time of sampling A and B.

3.3. The strategy and dynamics of abundance phytoplankton

3.3.1. Distribution of Spasio – temporal of phytoplankton abundance

Distribution of the Spasio-temporal of phytoplankton abundance at the time of sampling A and B in 4 depth of water was analyzed by a correspondent factorial

analysis (CA). From a graphical representation (Fig. 1), between the main factorial axes 1 and 2 (F1 and F2) shows the abundance grouping of phytoplankton.

In Figure 1 shows that there are two abundant groups of phytoplankton. Group I demonstrated the abundance of phytoplankton at the time of sampling A (A1, A2, and A3) in groups and had a close relationship with a depth of 10 m. Group II demonstrated the abundance of phytoplankton at sampling time B (B1 and B2) tend to group and have close relationship with depth 5 and 15 m.

Of the two groups above, grouping abundance of phytoplankton occurs during research. Grouping abundance of phytoplankton is very differently reviewed from the sampling time and depth of water.

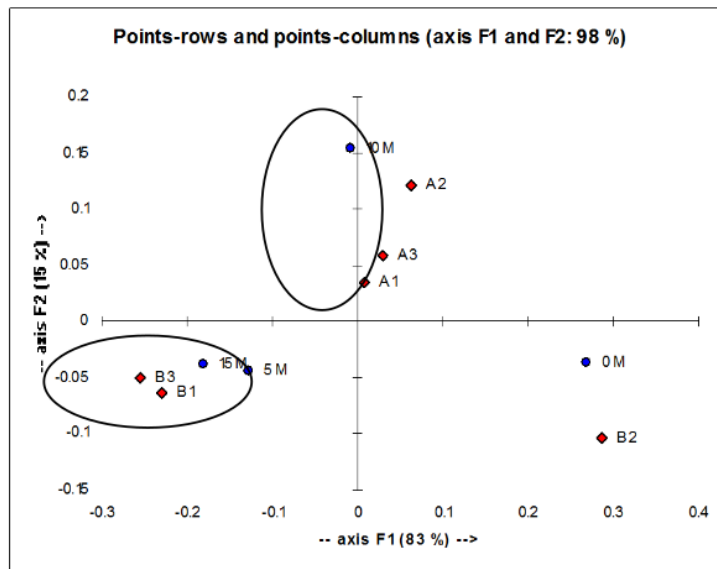


Figure 1. Graphical representation of factorial axes 1 and 2 (F1 and F2) group abundance of phytoplankton based on sampling time and water depth

The occurrence of grouping phytoplankton indicates the suitability and the relation of relationships occurring at the time of sampling and depth in which the group is formed. The suitability and relevance of this relationship can occur due to certain environmental parameters that affect the depth in which the grouping occurs.

3.3.2. Thickness between environment parameters based on measurement time and water depth

To emphasize that environmental parameters have an influence on grouping the abundance of phytoplankton, it is performed analysis of physical-chemical parameters at various sampling time and depth. The analysis used is Principal Component Analysis (PCA). It can explain about any parameter that characterizes/affects the various sampling times and the depth of water.

From the overlay result between the variable distribution plot and the observation on F1 and F2 (Fig 2) shows that each sampling time and depth is characterized by the presence of one or more different the Peniri variables. The most dominant characteristic variable at the time of sampling A is nitrate and silicate, while that at the time of sampling B is salinity.

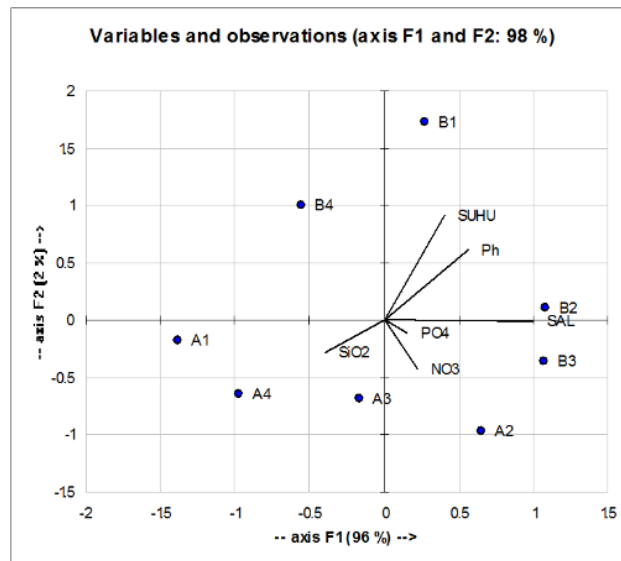


Figure 2. Combined Plot between station observation and variables on axes 1 and 2 (F1 and F2)

The presence of a variable characterizes at various times of sampling and the depth above emphasises that the grouping of abundance of phytoplankton (results of FCA analysis) is occurring at every sampling time and depth of water. The detailed explanation concerning both the CA and PCA analysis results in relation to the strategy and the abundance dynamics of phytoplankton can be explained as follows: Review of the sampling time and depth can be explained that grouping phytoplankton (Fig. 1) at the time of sampling A at A depth of 10 m shifted to the sampling time B at a depth of 5 m. This occurs because of the difference.

Generally speaking at A sampling time A, the value of the salinity range is found lower compared to the value of the range B. This causes the types of phytoplankton at the time of sampling B to be more active and in accordance with its development. Some types of phytoplankton that were previously not able to activity well because of low salinity value became optimal when the value of salinity became higher. Consequently, abundance at the sampling time B is found higher.

The occurrence of the shifting group of abundance phytoplankton also caused the conformity with sun intensity. At the time of sampling A, sunlight has not been absorbed much by phytoplankton because its exposure is still slightly entering the water. The occurrence of grouping phytoplankton at A depth of 10 m at the time of sampling A is not due to growth, but due to the treatment of phytoplankton at night. In times of low light intensity, most phytoplankton sink to near the base of the water. Therefore, at the time of sampling A was carried out, obtained grouping phytoplankton

is precisely found in the water column near the base of Waters (10 m). This condition is contrary to grouping phytoplankton at the time of sampling B. At the time of sampling B clearly the group shifts the abundance to a column near the surface. The occurrence of this shift caused greater light intensity into the water. This causes the phytoplankton to grow in depth with greater beam intensity (Duarte, et al., 2000). Surely the depth in question is the close depth of the surface (5 m), but not the depth of 0 m. No grouping at 0 m depth caused by the intensity of sunlight is precisely very strong. This can lead to death in the type of phytoplankton.

It turns out that the strategy and the abundance dynamics of phytoplankton at critical time is not doing the grouping at the surface depth (0 m), but at a deeper depth (5 m) in order to keep the activity well done.

4. Conclusion

In the end it can be concluded that the strategy and the abundance dynamics of phytoplankton at critical time (time 10.00-14.00) is doing the grouping at a deeper depth i.e. at 5 m, not the surface depth (0 m). This happens so that phytoplankton can keep doing well.

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