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Levels of water fertility in coastal waters of Kuri based on phytoplankton chlorophyll-a concentration

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Abstract. This research aims at analyzing the level of water fertility based on the concentration of chlorophyll-a phytoplankton in coastal waters of Kuri, Maros regency, South Sulawesi, Indonesia. Sampling chlorophyll-a phytoplankton was carried out on three stations. These three stations have different environmental characteristics. Station I is the Mambue estuarine, the station II is an estuarine Kuri Lompo, and the station III is Marusu estuarine. The concentration of chlorophyll-a phytoplankton was analyzed using a trichromatic method. Analysis of one way ANOVA is done to see the difference in the concentration of chlorophyll-a between stations. The level of water fertility based on the content of chlorophyll-a phytoplankton was analyzed using the category of fertility levels described by Hakanson and Bryann (2008). The results showed that the concentration of chlorophyll-a based on the station was showing no difference in the 95% confidence hose (α = 0.05). The level of water fertility based on chlorophyll-a phytoplankton is relatively high or hypertrophic.

1. Introduction

Coastal waters are many waters that accept loads of organic and inorganic material inputs [1.2]. This material comes from various sources such as aquaculture and farming activities, next entering the waters through the river flow and run-off from the mainland. It is one of the sources of nutrients in coastal waters [3, 4, 5], such as Indonesia's coastal waters. Distribution of these materials will differ in spatial and temporal.

The organic material that enters the coastal waters is further undergoing the process of decomposition, ultimately providing the supply of inorganic materials in this case nutrients such as nitrogen (N), phosphorus (P), and Silica (Si). The availability of nutrients caused by the process causes the waters to become fertile, which can spur the growth of phytoplankton [6.7]. Ultimately, the primary productivity of coastal waters becomes high.

High coastal fertility can be indicated based on the high concentrations of chlorophyll-a phytoplankton [8]. Chlorophyll-a itself is the main device owned by phytoplankton, and this plays an important role in the process of photosynthesis in the water [9]. The Organel can be used as an indicator of water fertility because it is identical to the presence of phytoplankton. It is the main food source for organisms at the tropical level in coastal waters.

In many literature, chlorophyll-a phytoplankton is one of the parameters which determines the primary productivity in coastal waters [10]. The change in the concentration of chlorophyll-a

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phytoplankton relies heavily on the physical-chemical parameters such as light and nutrient intensity (especially nitrates and phosphate). If the light intensity and nutrients are sufficient, then the concentration of chlorophyll-a will be found high, and vice versa.

Comprehensive assessment through research on the level of water fertility and the content of chlorophyll-a phytoplankton can be performed on water that receives continuous nutrient input. One of the waters that experienced such conditions is the coastal waters of the Maros regency. The waters were widely received by receiving nutrient loads due to community activities on land. This nutrient burden is produced from agricultural activities and fisheries that take place quite high on land. This research aims at analyzing the level of water fertility based on the concentration of chlorophyll-a phytoplankton in coastal waters.

2. Method

The research was conducted in September to December 2018. The sampling of water for chlorophyll-a phytoplankton was carried out in the coastal waters of Kuri, Maros Regency, Indonesia on three stations. Station I is the Mambue estuarine, the station II is an estuarine Kuri Lompo, and the station III is Marusu estuarine. Water sampling is done during the day at 10.00-14.00 WITA [11]. The samples of water taken in the sample are stored in 2 L volume samples, inserted into the cool box and brought to the Chemical Oceanography Laboratory, Department of Marine Sciences, Faculty of Marine Sciences and Fisheries, Hasanuddin University, Makassar to be analyzed.

Determination of the concentration of chlorophyll-a is conducted using trichromatic method [12], with the following procedure:

a) A total of 500 ml of water samples were filtered with a milipore filter paper using a vacuum pump that has been connected with a feller bunchers funnel and an Erlenmeyer section.
b) Once filtered, the filter paper is taken using a tweezers and inserted into the reaction tube containing the Aceton 90% volume of 10 ml.
c) The reaction tube of the filter paper, closed using aluminium foil.
d) The reaction tube is inserted into the cooler for 1 x 24 hours.
e) Centrifugal with a rotation force of 3500 rpm was performed on a filter paper in the reaction tube at room temperature for 15 minutes.
f) A total of 10 ml of the soniced samples were taken then inserted into the other reaction tubes.
g) The reaction tube, which contains the Blanko, is inserted in the Spectrophotometer DREL 2800.
h) The reading of the results in the DREL 2800 spectrophotometer performed at each wavelength of 630, 645, 665, and 675 nm.
i) The value of each wavelength indicated on the spectrophotometer screen is further recorded.

Chlorophyll-a phytoplankton calculated with equations:

$$\text{Chlorophyll-a (mg/L)} = \frac{[(\mathbf{11{,}85} \times \boldsymbol{\lambda}\,\mathbf{664}) - (\mathbf{1{,}54} \times \boldsymbol{\lambda}\,\mathbf{647}) - (\mathbf{0{,}08} \times \boldsymbol{\lambda}\,\mathbf{630})] \times \boldsymbol{Ve}}{\boldsymbol{Vs} \times \boldsymbol{d}} \quad (1)$$

Information :

$\boldsymbol{\lambda}$ 664	= Abs 664 nm – Abs 750 nm
$\boldsymbol{\lambda}$ 647	= Abs 647 nm – Abs 750 nm
$\boldsymbol{\lambda}$ 630	= Abs 630 nm – Abs 750 nm
Ve	= Volume of Acetone Extract (mL)
Vs	= Volume of filtered water samples (L)
d	= Width of cuvette diameter (10)

The value of the concentration of chlorophyll-a phytoplankton between stations analyzed by using the One Way ANOVA. To analyze the level of water fertility based on the content of chlorophyll-a phytoplankton used category of fertility given by [13].

3. Results and Discussion

3.1. Research Site Overview

Marusu District is one of the areas in Maros Regency located on the west coast of South Sulawesi. The total area of Maros Regency is 1619.11 km^2 with a sea level of approximately 100 m. Geographically located between 119º 27' – 119º 30' E and 4º45' – 5º50' LS. Research and sampling location is divided into 3 stations. Geographically for Station I is located in 199º28' 27.3" BT and 5º02' 04.7" LS, Station II is located in 199º28' 15.3" BT and 5º00'37.0" LS and station III is located in 199º28'35.0" BT and 4º59'21.6" LS.

The research area is a coastal region that is generally a pond and mangrove area so it can be found along the coast and river. The burden of waste entering the coastal waters of Maros is much produced through the flow of rivers that fall into coastal areas. There are 9 rivers that are located in the waters of Maros, but the river that receives the most environmental pressure is Marusu River because it is a river that receives many burdens from various community activities. As for some rivers that exist is only a river that serves as a water intake for the cultivation activities, which are electrical in the rainy season and in the dry season.

3.2. Concentrations of chlorophyll-a phytoplankton

Chlorophyll-a fitoplantkon is one of the parameters that determines the primary productivity of the sea. High low concentrations of chlorophyll-a phytoplantkon depend on the condition of oceanographic of a water. The distribution of chlorophyll-a in coastal waters of the Maros regency is showing variations on each observation station.

Station I (Mambue River) has chlorophyll-a concentration of 0.068 mg/L. Furthermore, the station II (the River Kuri Lompo) has a concentration of chlorophyll-a of 0.063 mg/L, and on the III station (Marusu River) has an average concentration of chlorophyll-a of 0.070 mg/L. The value of chlorophyll-A on station III has the highest concentration. This fact is thought to be caused by phosphate concentrations are quite large fluctuations. This gives a stronger influence on the change in the concentration of chlorophyll-a phytoplankton. In general, the range of concentrations of chlorophyll-a phytoplankton during research is ranged between 0.063-0.070 mg/L.

Based on the measurement of the concentration of chlorophyll-a phytoplankton shows the difference between stations. However, after the test one way Anova apparently obtained the results that the concentration of chlorophyll-a phytoplankton is not shown noticeable differences between stations on the hose of Confidence 95% ($\alpha = 0.05$). This means that the distribution of chlorophyll-a phytoplankton on each station is considered the same.

When compared to research ever conducted by some researchers near the research site can be explained that the concentration of chlorophyll-A on this research is classified as low. For example, the concentration of chlorophyll-a obtained in research conducted by [14] in the area of Kuri's estuarine ranged from 16,27 mg/L 22,23. Similarly, the results of research conducted by [15] in the eastern season in the Spermonde waters are at the range of 0.15-1.15 mg/L. Research conducted by [16] in the coastal waters of Pangkep also demonstrates the same thing that the concentration of chlorophyll-a in research it is found to be higher. The range of chlorophyll-a concentrations obtained from the results of its research is 0,224-1,088 mg/L.

3.3. Coastal fertility levels of Kuri

Based on the measurement of the concentration of chlorophyll-a phytoplankton on the station I (Mambue Estuari), II station (Estuari Kuri Lompo), and Station 3 (Estuari Marusu), the fertility rate of the waters of Kuri belong to hypertrophic conditions (high) with a range of concentrations of chlorophyll-a between 0.063-0.070 mg/L. According to [13], if the value of the concentration of chlorophyll-a phytoplankton > 0.02 mg/L then the water has high fertility.

4. Conclusion
It can be concluded that chlorophyll-a phytoplankton have the concentration and distribution that is considered the same at each station in the Kuri. Furthermore, the fertility index of the coastal waters of Kuri based on the concentration of chlorophyll-a phytoplankton is categorized as high or hypertrophic.

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