Distribution of Day Fish in Ternate City Water Based on Chlorophyll-A

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ABSTRACT

Distribution of pelagic fish such as fish float can be predicted its existence through the analysis of oceanographic parameters and one of the simultaneous changes is chlorophyll-a. Chlorophyll-a is one of the most important photosynthetic pigment substances for plants in the waters, especially phytoplankton. Chlorophyll-a and its changes are often used as indicators of water and environmental conditions that directly affect fish distribution, especially flying fish, which are predicted to be locations for *fishing ground*. This research was carried out by extracting satellite images to get the value of chlorophyll-a concentration which was then analyzed using non-linear regression to study the distribution of oceanographic parameters especially the concentration of chlorophyll-a and its relationship with the distribution of flying fish . The results showed that the distribution of chlorophyll- a concentration parameters in the waters of Ternate Island in October 2018 to February 2019 was in the range of 0.2-0.5 mg / m^3 with an average value of 0.24 mg / m^3, where the value of chlorophyll-a concentration has a significant influence on catches of flying fish with a correlation coefficient of 0.86 in exponential regression.

Keywords: Coral reef; Reef Fish; Maitara Island

1. Introduction

Chlorophyll-a is an indicator of the abundance of phytoplankton in waters that plays a role in the process of photosynthesis Zhang & Han (2015), Moses *et al.* (2009), Izza M *et al* (2018). Phytoplankton contribute greatly to determine primary productivity in waters. Production of organic carbon during photosynthesis is defined as the primary productivity or net primary productivity *(Net Primary Productivity*) Lee *et al.* (2014). Clean primary productivity is a key measure of environmental health and management of marine resources (Behrenfald *et al.* 2005).

The development of management information technology through website-based remote sensing has provided benefits and made it easier to map the oceanographic conditions of waters especially in Indonesia. These developments can actually be utilized in various fields of life, especially in the field of capture fisheries. In addition, remote sensing information can be obtained easily and cheaply Bidawi et al, (2009), Nammalwar et al, (2013), S. Nurdin *et al*, (2013), (M. Zainuddin and M. Jamal, 2009).

The distribution of pelagic fish such as flying fish can be predicted by analyzing known oceanographic parameters and their changes over time simultaneously (daily and monthly) Laevastu and Hela, (1970), Yusmina *et al*. (2018), Jesaseja e*t al, (*2018), Prathibha and Shanbhogue, (2005). Likewise, chlorophyll-a concentrations and changes in changes are often used as indicators of water conditions and environmental changes that can affect fish distribution directly, especially flying fish, which can then be predicted as alocation *fishing ground* (Utamaningsih, 1995).

Water environmental information from satellite data that has been widely used for these purposes include sea surface temperature (SPL), chlorophyll-a concentration which is an important pigment in phytoplankton photosynthesis as an indicator of water fertility, total dissolved material (total suspended matter) that can reflect turbidity of the waters, and sea level height anomalies (TML) which can describe the direction of surface water currents Zainuddin, (2008), Venetia Stuart *et al*, (2011).

2. Matter and Method

This research was conducted in the waters of Ternate City (Figure 1) with samples from October 2018 to Februry 2019. Chlorophyll-a data was obtained through Aqua MODIS level 3 satellite imagery and carried out cutting and merging screens for the research location and subsequently field verification. Secondary data in the form of catches of flying fish (*Decapterus spp*) were obtained from the Nusantara Fisheries Port (PPN).

The catch data is analyzed using Microsoft Exel which is presented in tables and graphs. Satellite *Aqua MODIS* level-3 data in the form of data *compressed digital* in *Hierarchical Data format* (HDF) that has been corrected radiometrically and atmospherically and the relationship with flying fish is analyzed using the *Sea WIFS Data Analysis System (SeaDAS) software* 7.4 and chlorophyll-a spatial distribution data using Surfer software 13.

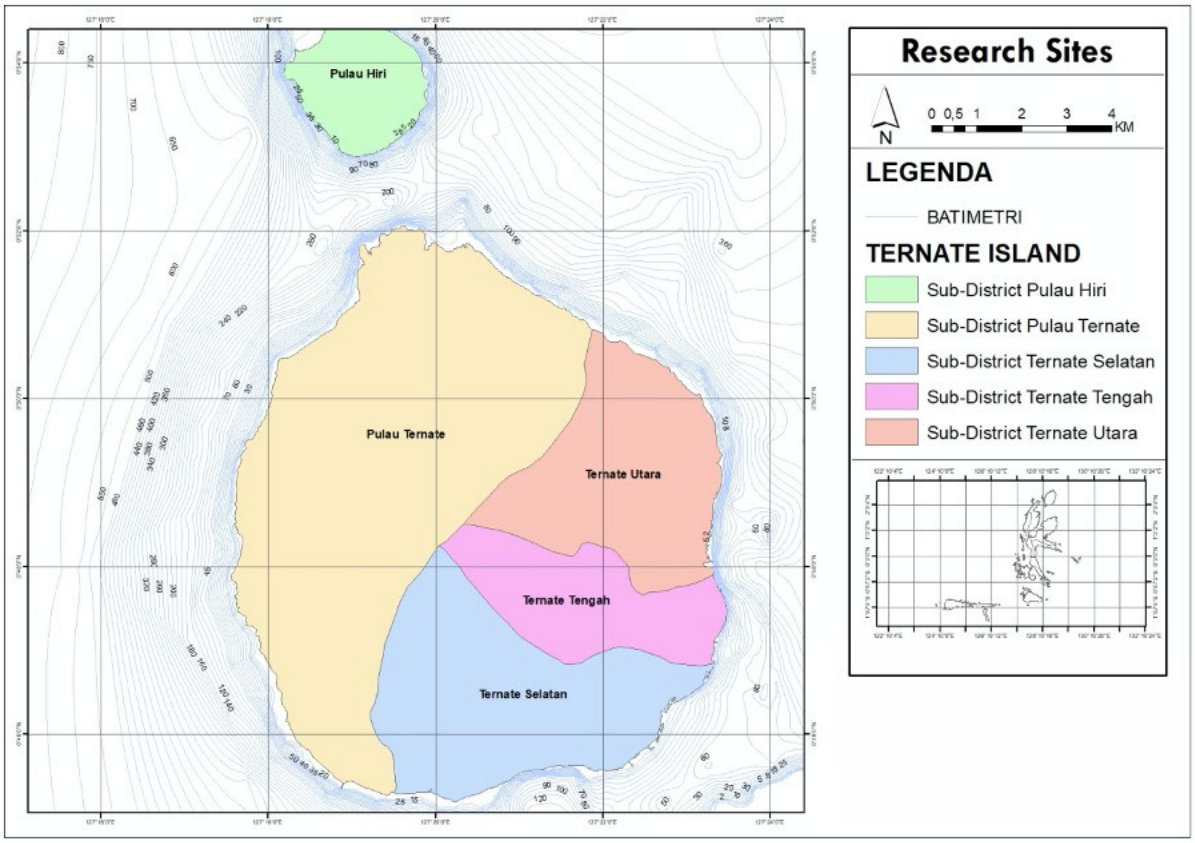

Figure 1: Research Sites

3. Result and Discussion

3.1. Catches of flying fish

Production of flying fish (*Catching of Decaoterus spp*) in the waters of Ternate City during the research tends to fluctuate every month during the study period. There are several factors that influence the fluctuation of catches of flying fish in the waters of Ternate City during the study, such as oceanography, capital, and the fishing boat it self.

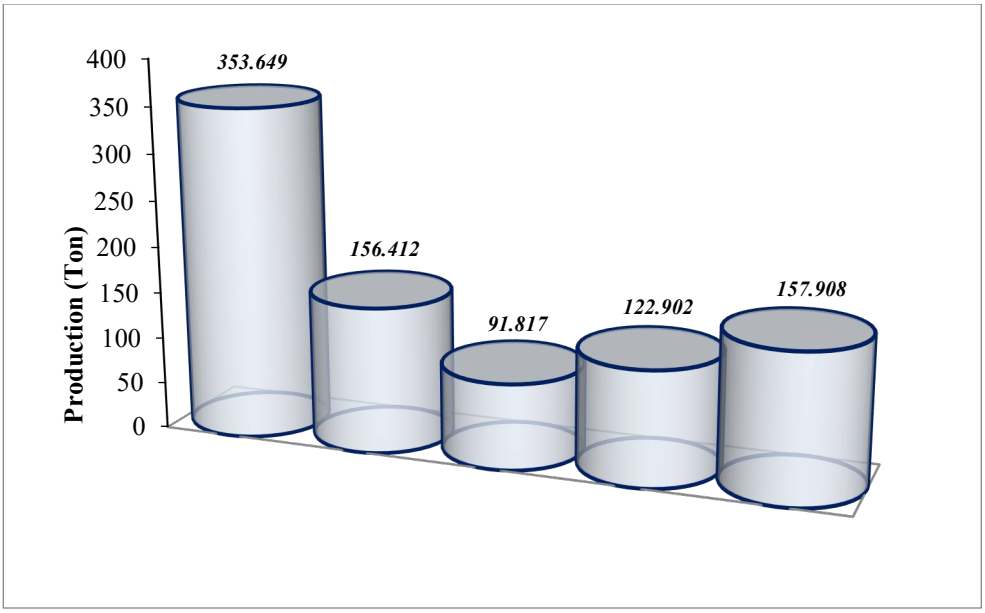

Figure 2: Fish Production Layang to October February

In this study, it was found the main factor that causes fluctuation results of this catch is Ocean waves All activities related to marine are very sensitive to any changes that occur at sea, these environmental parameters will affect fish dispersal, migration, aggregation, spawning and food supply as well as fish behavior Setyohadi, (2011), Ridha *et al*, (2013), Daniel *et al.* (2013), Natalia *et al.* (2017), Angraeni, *et al.*, (2014) The areas that have the highest wave height include waters around the Karimata strait and northern Maluku between 2-25 Meters in December Hadikusuma, (2009), (Roni *et al.*, 2011) In January, the catch has begun to increase along with changes in wind direction that began to move into the fig h south (Roni, *et al* 2011).

3.2. Distribution of Chlorophyll-A in Ternate City Water

Chlorophyll-a is one of the most important photosynthetic pigment substances for plants in the waters especially phytoplankton in the process of photosynthesis or organic formation of inorganic materials. Chlorophyll-a is an indicator of the abundance of phytoplankton in waters that plays a role in the process of photosynthesis Zhang & Han (2015), Moses *et al.* (2009), (Lee *et al.* 2014). The distribution of chlorophyll-a concentrations in October in Ternate Island waters was in the range of values of 0.2-0.3 mg / m^3, with an average value of chlorophyll-a concentration in October 2018 being 0.24 mg / m^3 and was the highest value during the study. In November (Fig 3a), the concentration of chlorophyll-a is seen in the western part of the Celebration of Ternate Island in the north to northeast direction, the value of chlorophyll-a concentration is in the range of 0.2 - 0.3 mg / m^3, while the western waters are south to southeast. and the east to northeastern part of Ternate Island, the value of chlorophyll a concentration is in the range of 0.3 - 0.4 mg / m^3. In the southeastern area to the eastern part of Ternate Island the value of chlorophyll-a concentration is in the range of 0.4 - 0.5 mg / m^3. Overall the value of chlorophyll-a concentration in the waters of Ternate Island in November 2018 is in the range of 0.2 - 0.5 mg / m^3, with an average value of chlorophyll-a concentration in November 2018 of 0.23 mg / m^3.

In November 2018, (Fig 3b) the distribution of chlorophyll-a concentrations was seen in the western part of the Celebration of Ternate Island in the north to northeastern value of the chlorophyll-a concentration in the range of 0.2 - 0.3 mg / m^3, while the territorial waters of the western part to the south to southeast and east to northeast of Ternate Island, the value of chlorophyll-a concentration is in the range of 0.3 - 0.4 mg / m^3. In the southeastern area to the eastern part of Ternate Island the value of chlorophyll-a concentration is in the range of 0.4 - 0.5 mg / m^3. Overall the value of chlorophyll-a concentration in the waters of Ternate Island in November 2018 is in the range of 0.2 - 0.5 mg / m^3, with an average value of chlorophyll-a concentration in November 2018 of 0.23 mg / m^3.

In December 2018, (Fig 3c) and in January 2019, (Fig 3d) the distribution of chlorophyll-a concentrations in Ternate Island waters was in the range of 0.2 - 0.3 mg / m^3, with an average chlorophyll-a concentration value in the month December 2018 and January 2019 were 0.21 mg / m^3. In February 2019, (Fig 3e) the distribution of chlorophyll-a concentrations was seen in the southwest and west of Ternate Island Waters north to northeast of the chlorophyll-a concentration values in the range of 0.3 - 0.4 mg / m^3, while the territorial waters of the section east to

south to southwest of Ternate Island, the value of chlorophyll a concentration is in the range of 0.4 - 0.5 mg / m^3. Overall the value of chlorophyll-a concentration in the waters of Ternate Island in February 2019 was in the range of 0.3 - 0.5 mg / m^3, with an average value of chlorophyll-a concentration in February 2019 of 0.34 mg / m^3.

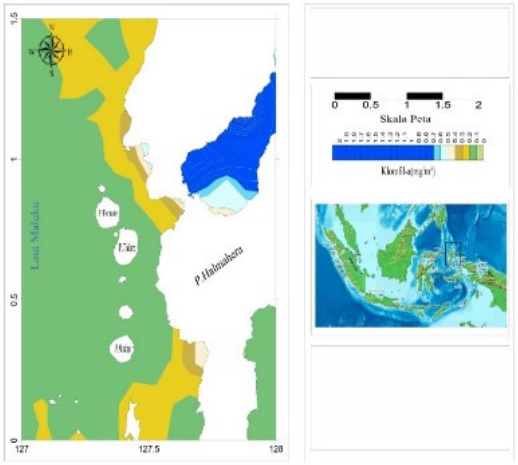

Fig 3a: Chlorophyll-a distribution in Ternate in October 2018

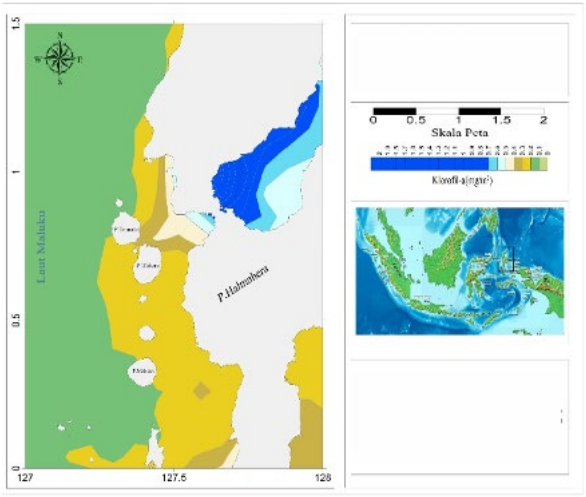

Fig 3b : Chlorophyll-a distribution in Ternate in September 2018

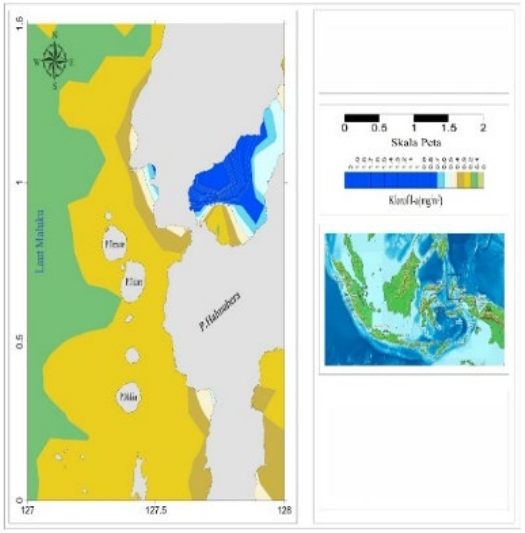

Fig 3c: Chlorophyll-a distribution in Ternate in Desember 2018

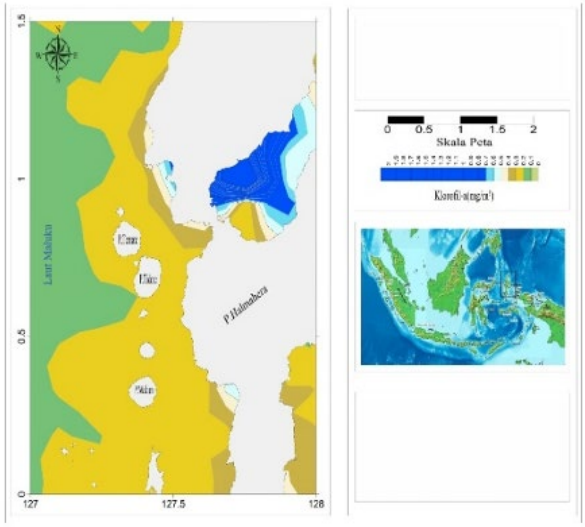

Fig 3d: Chlorophyll-a distribution in Ternate in January 2019

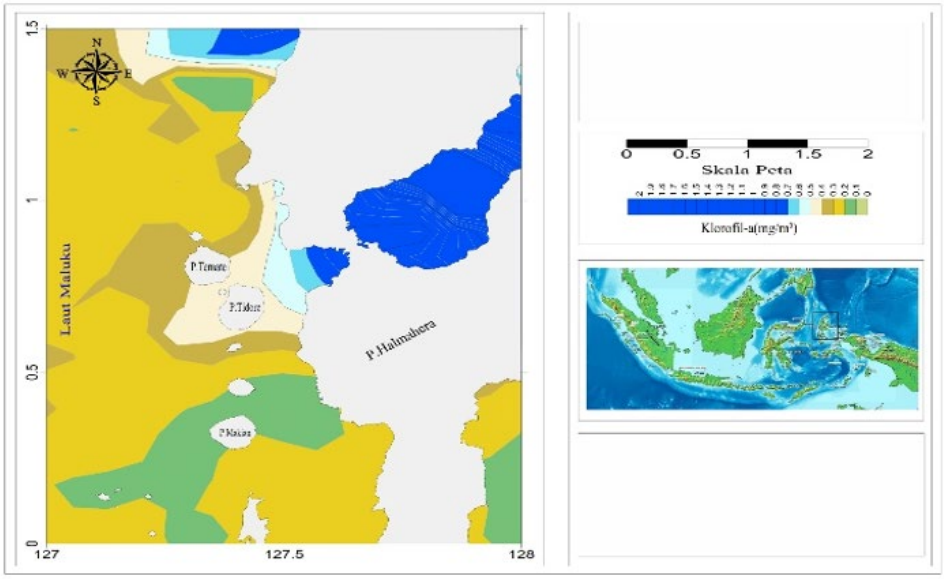

Fig 3e: Chlorophyll-a distribution in Ternate in February 2019

Figure 3: Chlorophyll-a distribution in Ternate

Fluctuations in the value of chlorophyll-a concentrations in the waters of Ternate City are closely related to the abundance of phytoplanton, where chlorophyll-a is a pigment contained in phytoplankton cells (mainly diatoms) which causes the distribution of chlorophyll-a to follow the pattern of phytoplanton abundance, where chlorophyll-a is a pigment contained in phytoplankton cells (mainly diatoms) which causes the distribution of chlorophyll-a horizontal distribution of the abundance of phytoplankton itself (Perason et al 1984).

4. RELATIONSHIP OF CHLOROPHYL-A AND CAPTURE RESULTS

Chlorophyll-a which is the basis of the food chain which has an important role in the presence of fish in an aquatic, so that changes in the condition of chlorophyll-a concentration contribute to the distribution of fish, especially small pelagic fish that need food in the form of phytoplankton. Distribution of the number of catches of flying fish and the value of the concentration of chlorophyll-a in the waters of Ternate Island in October 2018 to February 2019.

If seen in Figure 4, the catch can be seen that in October is higher than the concentration value of chlorophyll-a. The number of catches in October was 353,649 tons with a chlorophyll-a concentration of 0.24 mg / m^3. The data on the catches of the floating fish were obtained from the Port of the Fisheries of the Archipelago (PPN) of Ternate City which is the largest fishing port in North Maluku Province, so that all activities around the terate waters are landed on the PPN, which causes the accumulated value of the activity of catching fly fishing on October.

Catching activity in the following month has begun to decline compared to the value of the concentration of chlorophyll-a in the waters of Ternate City. This is due to the condition of waters such as waves, where the wind speed in the fourth quarter has changed with a speed that has begun to rise. This factor then drives the movement of waves of water that are increasingly high and affect the safety of the capture and the ship. The average wind speed and direction of the wind that blows above the sea level of Indonesian territory, this December more winds blow from the north and south with speeds between 5-10 knots Roni *et al*, (2011) and Hadikusuma, (2009). The high wind speed that is blowing encourages the activities of fishermen in those months to be reduced and more activities are directed at improving fishing gear such as nets and ships. High waves occur in November to January, in that month fishermen tend not to go to sea and catches will increase along with the end of the famine season (Jonathan Sharples, *et al 2013;* Wikha Khalfianur *et al*, 2017; Muhamad Ali Rahman *et al,* 2019; Lena Bergstrom *et*al, 2019).

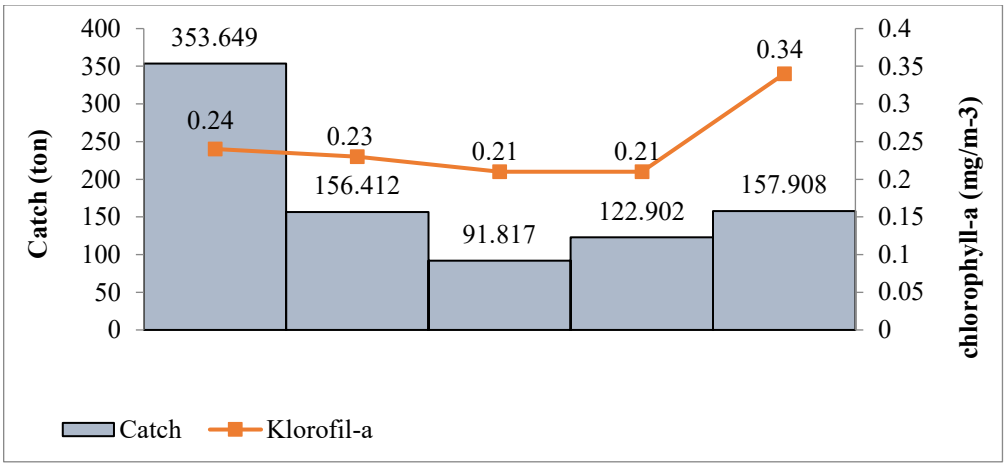

Figure 4 : Distribution of Amount Fish and Chlorophyll-a Concentration Value in Ternate Island Waters.

4.1. Non-linear

Regression analysis Non-Linear regression analysis was used to see the relationship between the distribution of chlorophyll-a with catches of flying fish in the waters of Ternate City. The results of the polynomial regression analysis showed that there was a close relationship between the catches of flying fish with the concentration distribution chlorophyll-a with a mathematical model y = -60846x2 + 33954x - 4351.3, where y is the catch and x is the concentration value of chlorophyll-a. From the mathematical model, the correlation coefficient (r) of 0.53 and the value of the adjusted r square of 0.7315 means 73.15% of the presence of flying fish in Ternate Island waters is influenced by the chlorophyll-a concentration value by assuming that the value of other oceanographic parameters is constant. The graph of the relationship between the catches of flying fish with the value of the concentration of chlorophylla can be seen in Figure 5.

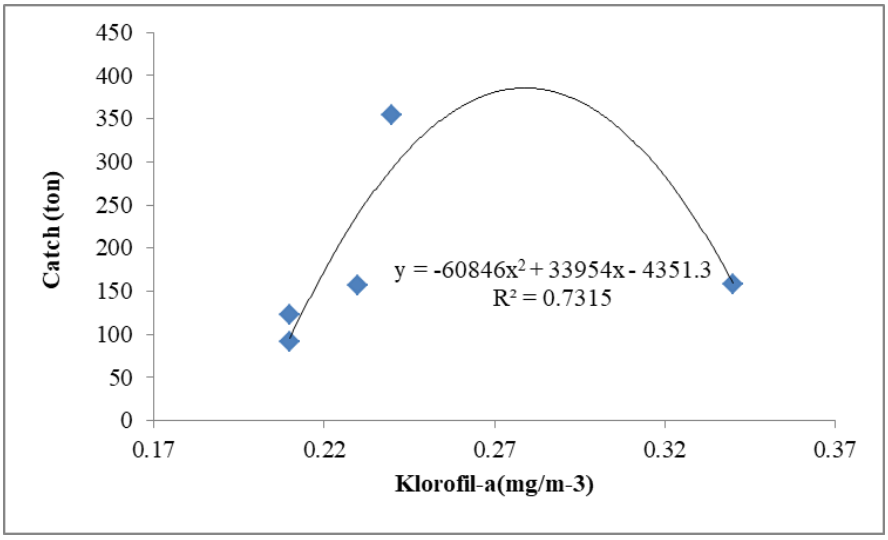

Figure 5: Relationship between Fly Catches and Chlorophyll-a Concentration Value

Regression analysis can be used as a knife analysis in various types of marine data analysis, both to see the functional relationships of several marine variables (Indra Hotman Harahap, 1989). The adjusted r square value in Figure 5 shows that the presence of 73.15% flying fish is influenced by the concentration of chlorophyll-a individually. The same resultsby Aisyah *et al* (2018), found that in the same waters the concentration of chlorophyll-a significantly affected the catch of small pelagic fish with an adjusted r square value of 0.729.

5. Conclusion

Production of flying fish (Catching of Decaoterus spp) in the waters of Ternate City during the research tends to fluctuate every month during the study period. In this study, it was found the main factor that causes fluctuation results of this catch is Ocean waves All activities related to marine are very sensitive to any changes that occur at sea, these environmental parameters will affect fish dispersal, migration, aggregation, spawning and food supply as well as fish behavior.

Fluctuations in the value of chlorophyll-a concentrations in the waters of Ternate City are closely related to the abundance of phytoplanton, where chlorophyll-a is a pigment contained in phytoplankton cells (mainly diatoms) which causes the distribution of chlorophyll-a to follow the pattern of phytoplanton abundance, where chlorophyll-a is a pigment contained in phytoplankton cells (mainly diatoms) which causes the distribution of chlorophyll-a horizontal distribution of the abundance of phytoplankton itself.

The results of the polynomial regression analysis showed that there was a close relationship between the catches of flying fish with the concentration distribution chlorophyll-a with the catch and the concentration value of chlorophyll-a. It means 73.15% of the presence of flying fish in Ternate Island waters is influenced by the chlorophyll-a concentration value by assuming that the value of other oceanographic parameters is constant.

So, The distribution of chlorophyll-a concentration parameters in the waters of Ternate Island in October 2018 to February 2019 is in the range of 0.2-0.5 mg / m^3 with an average value of 0.24 mg / m3, where the value of this concentration has a significant effect on fish catches elevated with a correlation coefficient of 0.86 in exponential regression.

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