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DISTRIBUTION OF CHLOROPHYL-A AND SEA SURFACE TEMPERATURE AND ITS INFLUENCE ON THE CATCH OF YELLOWFIN TUNA (*Thunnus albacares*) ON SERAYA BESAR ISLAND, EAST NUSA TENGGARA

Distribusi Klorofil-A dan Suhu Permukaan Laut Serta Pengaruhnya Terhadap Hasil Tangkapan Tuna Sirip Kuning (Thunnus albacares) di Pulau Seraya Besar, Nusa Tenggara Timur

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ABSTRACT

Determining fishing Ground (FG), fishermen on Seraya Besar Island still use traditional methods or only experience, so there is a need for a touch of technology and knowledge to predict fishing ground through the distribution of chlorophyll-a and the distribution of sea surface temperature (SST) so that fishing activities are more effective. and effective and efficient. Starting from this idea, the author wants to study the distribution of chlorophyll-a and sea surface temperature and their influence on the catch of yellowfin tuna (Thunnus Albacares) on Seraya Besar Island, East Nusa Tenggara. This research uses a descriptive method. Based on this research, the average distribution of chlorophyll-a from January to November 2023 in the fishing ground fishermen on Seraya Besar Island was 0.44 mg/m3. The average distribution of sea surface temperatures from January to November 2023 in the fishing ground for fishermen on Seraya Besar Island is 27.55°C. Linear regression with the equation Y = 2618.120 + 1715.958 X1 - 99.329 X2 with an adjusted R2 value of 79%. The T test results show that the chlorophyll-a distribution variable has a significant partial effect. Meanwhile, the variable distribution of sea surface temperature has no significant partial effect on Yellowfin Tuna catches on Seraya Besar Island, East Nusa Tenggara. The results of the F test show that the variables of chlorophyll-a distribution and sea surface temperature have a significant simultaneous effect on the catch of Yellowfin Tuna on Seraya Besar Island, East Nusa Tenggara.

Key words: Chlorophyll-a; Sea Surface Temperature ; Yellowfin Tuna

ABSTRAK

Penentuan daerah penangkapan ikan (DPI) nelayan di Pulau Seraya Besar masih menggunakan cara tradisional atau dengan pengalaman saja, sehingga perlu adanya sentuhan teknologi dan

pengetahuan untuk memprediksi DPI melalui distribusi klorofil -a dan distribusi suhu permukaan laut (SPL) sehingga kegiatan penangkapannya lebih efektif dan efektif dan efisien. Berangkat dari gagasan tersebut penulis ingin mengkaji terkait Distribusi Klorofil-A dan Suhu Permukaan Laut Serta Pengaruhnya Terhadap Hasil Tangkapan Tuna Sirip Kuning (*Thunnus albacares*) di Pulau Seraya Besar, Nusa Tenggara Timur. Penelitian ini menggunakan metode deskriptif. Berdasarkan penelitian ini diperoleh hasil rata-rata distribusi klorofil-a dari bulan Januari-November 2023 di DPI nelayan Pulau Seraya Besar ialah 0,44 mg/m^3. Rata-rata distribusi suhu permukaan laut pada bulan Januari-November 2023 di DPI nelayan Pulau Seraya Besar ialah 27,55 °C. Regresi linear dengan persamaan Y = 2618,120 + 1715,958 X_1 - 99,329 X_2 dengan nilai adjusted R^2 sebesar 79 %. Hasil Uji T menunjukkan variabel distribusi klorofil-a berpengaruh nyata secara parsial. Sementara, varibel distribusi suhu permukaan laut tidak berpengaruh nyata secara parsial terhadap hasil tangkapan Tuna Sirip Kuning di Pulau Seraya Besar, Nusa Tenggara Timur. Hasil Uji F menunjukkan bahwa variabel distribusi klorofil-a dan suhu permukaan laut berpengaruh nyata secara simultan terhadap hasil tangkapan Tuna Sirip Kuning di Pulau Seraya Besar, Nusa Tenggara Timur.

Kata kunci : Klorofil-a; Suhu Permukaan Laut; Tuna Sirip Kuning

INTRODUCTION

Yellowfin Tuna or Yellowfin Tuna (*Thunnus albacares*) is a type of tuna commodity that has the highest catch compared to other types of Tuna such as Big Eye Tuna and Bluefin Tuna in Indonesia. The stock condition of Yellowfin Tuna (*Thunnus albacares*) in the Indian Ocean is in good condition. However, high demand on the world market in recent years has resulted in increasingly intensive use (Wujdi *et al* ., 2015). The province of East Nusa Tenggara (NTT) is flanked by waters in the south and north. In the south, there is the Indian Ocean, Savu Sea and Timor Sea, while in the north there is the Flores Sea. These waters are waters that are known to be tuna fishing areas. Indonesian waters that are used as tuna fishing areas are the Indian Ocean, Flores Sea, Banda Sea, Aru Waters, Arafura Sea, Seram Sea, Maluku Sea, and Tomini Bay (Uktolseja *et al*., 1991). Fishermen in East Nusa Tenggara generally carry out tuna fishing activities using small fishing units (<5 GT) and large fishing units (>20 GT). GT). Yellowfin Tuna fishing activities on Seraya Besar Island generally use small fishing units (<5 GT). Seraya Besar Island is located in Komodo District, West Manggarai Regency, Nusa Tenggara Province, Island It borders the Komodo National Park. Seraya Besar Island has a population of less than 200 heads of families, most of whom (96%) work as fishermen. The dominant fishing fleet is outboard motor boats with the fishing gear used in the form of tuna fishing lines (hand lines) and their modifications. Seraya Besar Island fishermen carry out fishing operations starting in the afternoon until the morning or one *day fishing. The fishing ground* or fishing area for fishermen on the island is around 18-30 miles from *the fishing base*. The tuna caught by fishermen is sold to collectors or processed into tuna loins and then marketed to Bali.

In determining fishing areas, fishermen on Seraya Besar Island still use traditional methods or only experience, so there is a need for a touch of technology and knowledge to predict fishing areas through chlorophyll-a and SPL so that fishing activities are more effective and efficient. Starting from this idea, the author wants to study the distribution of k chlorophyll-a and sea surface temperature and its influence on the catch of Yellowfin Tuna (*Thunnus albacares)* in the fishermen's fishing areas of Seraya Besar Island, East Nusa Tenggara**.** The data obtained will be processed into a map of the distribution of chlorophyll-a and sea surface temperature which can be used as information and benefits for the main actors, in this case fishermen, as information, a basis for policy, and the development of scientific disciplines, especially in the field of capture fisheries. The aim of this research is to determine the

distribution of chlorophyll-a and sea surface temperature and their influence on the catch of yellowfin tuna in the fishing areas for fishermen on Seraya Besar Island.

METHODS

Research Location and Time

This research will be carried out on Seraya Besar Island, which is located in Seraya Marannu Village, Komodo District, West Manggarai Regency, East Nusa Tenggara Province, with coordinate points in decimal 8.14 South Latitude 119.21 East Longitude to 9.00 Latitude 120.20 East Longitude. The location of the island of Selamat Besar is at the coordinates 8°23'41" South Latitude, 119°51'12" East Longitude . This research was compiled over a period of 1 month or 30 days, starting from November 1 , 2023 to November 30, 2023.

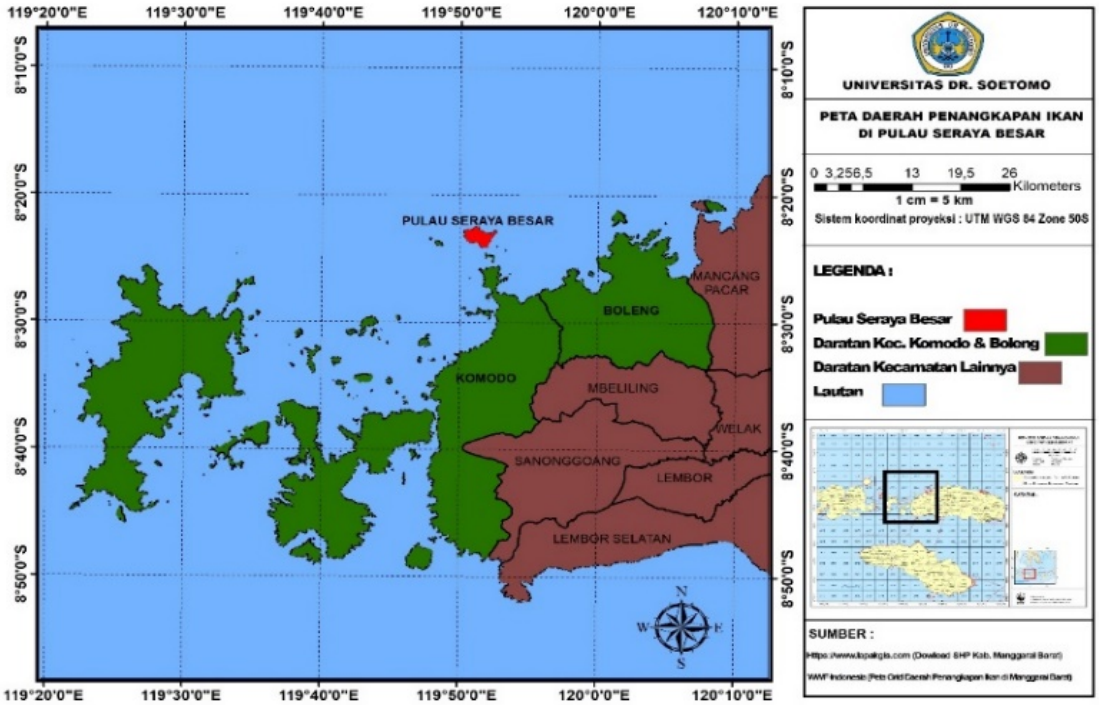

Figure 1. Research Location Map (Source: Research processed data, 2023)

Research methods

The method the author uses is descriptive statistics. Descriptive statistics provide an overview or description of data seen from the average value (*mean*), standard deviation, variance, maximum, minimum, *sum, range, kurtosis* and *skewness* (Ghozali , 2018). The authors describe the average, maximum and minimum values of chlorophyll-a distribution and sea surface temperature. The data collection method consists of secondary data. Some of the data taken includes data on the total catch of Yellowfin Tuna from January-November 2023, data obtained from interviews with collectors on Seraya Besar Island. The data for Sea Surface Temperature and Chlorophyll-a is taken from satellite imagery sourced from NASA *Ocean Color* (oceancolor.gsfv.nasa.gov) Level 3 & 4 *Sea Surface Temperature* 4µ *nighttime* for the distribution of SPL and *Chlorophyll concentration* for the distribution of chlorophyll-a for the period January-November 2023. The tool the author uses to compile the data in this research is a laptop.

Data analysis

The data is processed using image data processing. Analysis of chlorophyll -a distribution data and sea surface temperature using several mapping *software* including *SeaDas*

software 7.5.3, *Surfer* 11.0.624 and *ArcGis 10.8*. Data that can be presented after the analysis include a tabular description of the average monthly distribution of chlorophyll-a and sea surface temperature and an image of a map of the distribution of chlorophyll-a and sea surface temperature in the Seraya Besar Island fishing areas. To determine the effect of chlorophyll-a distribution and sea surface temperature on catch results, the research variable data was processed using the Statistical Product and Service Solution (SPSS) software program version 23. The analytical method used included the classic assumption test. , multiple linear regression analysis, partial test (t test) and simultaneous test (F test) . and the coefficient of determination ($R2^{)}$ to measure the extent of the model's ability to explain variations in the dependent variable.

RESULTS

Fishing Activities

Yellowfin Tuna fishing activities on Seraya Besar Island generally use small fishing vessels , namely 1-5 GT, Usually 1 boat with GT 1 contains 1-2 anglers. The fishing gear used by Seraya Besar Island fishermen to catch Yellowfin Tuna is handlines with hooks number 7 and 8. The fishing area for Seraya Besar Island fishermen is in the waters around Seraya Besar Island and the waters of West Manggarai Regency. These waters are located in WPP 713 and are included in the Flores Sea.

Yellowfin Tuna Catch Results

In this research, the author collected data on catches of Yellowfin Tuna by interviewing fish collectors on Seraya Besar Island. From the results of the interviews, the author obtained data on catches by fishermen on Seraya Besar Island every month starting from January to November 2023. The researchers were collectors. interviewed is the only Yellowfin Tuna collector on Seraya Besar Island. The collector sells yellowfin tuna in the form of tuna loin. The tuna loin fish is sold outside East Nusa Tenggara Province. The sales destination is Bali Province. From the results of the interview the researcher obtained the following data:

Table 1. Data on Yellowfin Tuna Catches by Fishermen on Seraya Besar Island

No.	Month	Catch (Kg)
1	January	354.00
2	February	547.50
3	March	219.20
4	April	270.00
5	May	905.00
6	June	870.00
7	July	670.00
8	August	605.00
9	September	467.00
10	October	935.00
11	November	1140.00
	Total	6892.70 Kg

Source: Research Data, 2023

The table above describes the total weight of the catch in a period of 11 months, namely from January 2023 to November 2023. From the data table above we can see the results of catches of Yellowfin Tuna by fishermen on Seraya Besar Island. From January to February there was a slight increase in results. Catches in March and April experienced a decline in catches, even the lowest catch was in March with a total catch 219,20 kg of Yellowfin Tuna. From May to September the catch decreased, until from October to November the catch

increased until the highest catch was in November with a total catch of 1140 Kg of Yellowfin Tuna. The total catch from January 2023 to November 2023 is 6892.70 kg of Yellowfin Tuna.

Chlorophyll-a Distribution

Chlorophyll-a distribution data and information in this study were taken from the website *NASA Ocean Color* (oceancolor.gsfc.nasa.gov) Levels 3 & 4 using *MODIS Aqua Chlorophyll Concentration* satellite image data. Chlorophyll-a data was taken covering fishing areas by fishermen on Seraya Besar Island with the coordinate points in decimal form being 8.14 LS, 119.21 BT to 9.00 LS, 120.20 BT. The data obtained was processed using *SeaDas software* 7.5.3, *Surfer* 11.0.624 and *ArcGis 10.8* to produce a map of the distribution of chlorophyll-a. The processed data produces monthly average chlorophyll-a numerical data in the yellowfin tuna fishing area of Seraya Besar Island fishermen. The following is the data obtained by researchers:

Table 2. Numerical Data on Average Monthly Chlorophyll-a B Distribution on Seraya Besar Island

No.	Month	Average Value of Chlor ofyl -a (mg/m ^{3})
1	January	0.31
2	February	0.36
3	March	0.28
4	April	0.30
5	May	0.51
6	June	0.50
7	July	0.42
8	August	0.40
9	September	0.33
10	October	0.52
11	November	0.90
Average Chlorophyll-a Distribution 0.44 mg/ ^{m3}		

Source: *Https:// oceancolor.gsfc.nasa.gov* , (2023) processed

Based on these data, it appears that the average value of chlorophyll-a distribution in the fishing areas fishermen of Seraya Besar Island from January 2023 to November 2023 ranges from 0.28 mg/m^3 to 0.90 mg/m^3. Where the highest average value of chlorophyll-a distribution p was in November with a value of 0.90 mg/m^3 and the lowest was in March with a value of 0.28 mg/m^3 **.** The average distribution of chlorophyll-a from January 2023 to November 2023 in the fishing areas for fishermen on Seraya Besar Island is 0.44 mg/m^3. The table above describes the average value of chlorophyll-a over a period of 11 months, namely from January 2023 to November 2023. From the table above we can see the average value of chlorophyll-a in the fishing areas fishermen of Seraya Besar Island from January to February experienced a slight increase in the average value of chlorophyll-a distribution until March and April experienced a decrease in the average value of chlorophyll-a distribution. In fact, the lowest average value of chlorophyll-a distribution was in March with the average value of chlorophyll-a distribution 0.28 mg/m^3. From May to June the average value of chlorophyll-a distribution looks constant. From July to September the average value of chlorophyll-a distribution experienced a decrease in the average value of chlorophyll-a distribution until October and November experienced an increase in the average value of chlorophyll-a distribution to the average value of chlorophyll-a distribution The highest was in November with an average chlorophyll-a value of 0.90 mg/m^3.

Distribution of Sea Surface Temperature (SST)

Data and information on sea surface temperature distribution in this research taken from the website *NASA Ocean Color* (oceancolor.gsfc.nasa.gov) Levels 3 & 4 using *MODIS Aqua Sea Surface Temperature* satellite image data were selected at night (4µ *nighttime*). Sea surface temperature data taken covering the fishing area by fishermen on Seraya Besar Island with the coordinate point boundaries in decimal form being 8.14 LS, 119.21 BT to 9.00 LS, 120.20 BT. The data obtained was processed using *SeaDas software* 7.5.3, *Surfer* 11.0.624 and *ArcGis 10.8* to produce a sea surface temperature distribution map. The processed data produces numerical data on the average monthly sea surface temperature distribution in the Yellowfin Tuna fishing area by Seraya Besar Island fishermen. The following is the data obtained by researchers:

Table 3. Distribution Average Data Sea Surface Temperature Monthly on Seraya Besar Island

No.	Month	Average Sea Surface Temperature (°C)
1	January	26.84
2	February	27.50
3	March	28.19
4	April	28.14
5	May	28.17
6	June	27.48
7	July	27.07
8	August	26.91
9	September	26.58
10	October	27.51
11	November	28.69
	Average SST Distribution	27.55 °C

Source: *Https:// oceancolor.gsfc.nasa.gov* , (2023) processed

Based on these data, it appears that the average value of sea surface temperature distribution in the fishing areas for fishermen on Seraya Besar Island from January 2023 to November 2023, it ranges from 26.58 °C to 28.69 °C. Where the highest average sea surface temperature distribution value is in November with a value of 28.69 °C and the lowest is in September with a value of 26.58 °C . The average sea surface temperature distribution from January 2023 to November 2023 is 27.55 °C. The table above depicts the average value of sea surface temperature distribution over a period of 11 months, namely from January 2023 to November 2023. From the data table above we can see the average value of the distribution of sea surface temperature in the fishing areas for fishermen on Seraya Besar Island from January to March there was an increase in the average value of the distribution of sea surface temperature until from March to May the average value of the surface temperature distribution was visible. constant sea. From May to September the average value of the sea surface temperature distribution experiences a drastic decrease in the average value of the sea surface temperature distribution until it appears that in September the temperature is very low, namely 26.58 °C . From September to November there was a drastic increase in the average value of the sea surface temperature distribution until the highest average value of the sea surface temperature distribution was in November with an average value of the sea surface temperature distribution of 28.69 °C .

Effect of Chlorophyll-a Distribution and SPL on Yellowfin Tuna Catch Results

After the researcher processed the research data using the *Statistical Product and Service Solution* (SPSS) software *version* 23 with the analytical methods used including descriptive statistical analysis, classical assumption tests, multiple linear regression analysis, partial and simultaneous tests, the researchers obtained the following results:

Table 4 . Kolmogorov-Smimov Normality Test Results

		Unstandardized Residuals
N		11
Normal Parameters [a, b]	*Mean*	0 .0000000
	Std. Deviation	122.69389497
Most Extreme Differences	*Absolute*	0 .164
	Positive	0 .164
	Negative	- 0.116
Statistical Tests		0 .164
Asymp. Sig. (2-tailed)		0 ,200 [c,d]

Source: Processed research data, 2023

Based on the Kolmogorov-Smimov Normality Test that the author carried out, *the Asymp value was obtained. Sig. (2-tailed)* of 0.20. Because 0.20 ≥ 0.05, it can be concluded that the data used in this study is normally distributed because the significant value obtained is ≥ 0.05.

Table 5. Multicollinearity Test Results

	Collinearity Statistics	
Model	*Tolerance*	VIF
(*Constant*)		
Average Chlorophyll-a (mg/m ^{3})	0 .731	1,367
Average Sea Surface Temperature (°C)	0 .731	1,367

Source: Processed research data, 2023

Based on the results of the multicollinearity test above, we can see that the tolerance value is 0.73, which means 0.73 ≥ 0.10 and the VIF value is 1.36, which means 1.36 ≤ 10, so it can be concluded that multicollinearity does not occur. So it can be said that the regression model that the author used is good because no correlation was found between the chlorophyll-a distribution data and the sea surface temperature distribution data.

Table 6. Autocorrelation Test Results Durbin-Watson

Model	R	R ^{2}	*Adjusted* R ^{2}	*Std. Error of the Estimate*	*Durbin-Watson*
1	0 .912 [a]	0 .832	0 .790	137.17594	2,052

Source: Processed research data, 2023

The autocorrelation test using Durbin-Watson in this study produces values 2,052 . The du value is looked for in the Durbin Watson table value distribution based on k (2) and N (11) with sig. 5% or 0.05. The du value obtained from the Durbin Watson table value distribution is 1.604. So the following equation is obtained du (1.604) < DW (2.052) < 4-du (4- 1.604 =2.3956 **)**. So it can be concluded that there are no symptoms of data autocorrelation in this

study because the DW value is between the du and 4-du values. So it can be said that in the linear regression model of this research there is no correlation between confounding errors in period t and confounding errors in period t-1 (previously).

The results of the heteroscedasticity test that the author obtained after processing the research data are as follows:

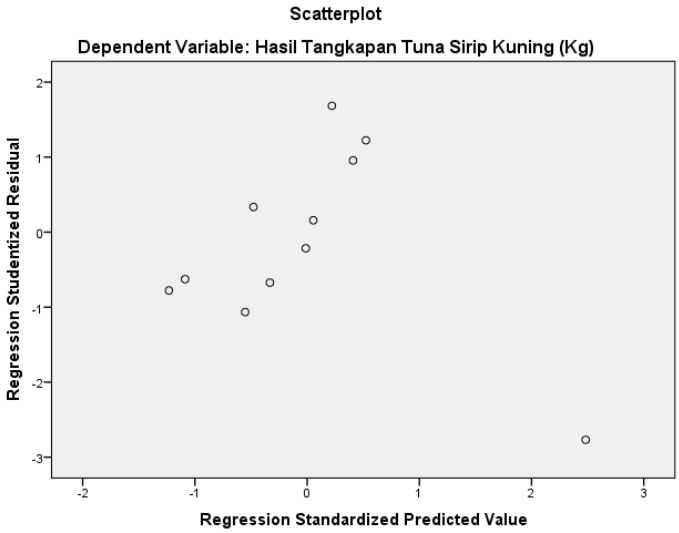

Figure 2. Heteroscedasticity Test Results Using *Scatterplot*
Source: Processed research data, 2023

Based on Heteroscedasticity Test Results Image above, we can see that it is not collected and there is no clear pattern (waves, widening and narrowing) in the image and the points/data are spread above the number 0 on the Y axis, so it can be concluded that this research is free from heteroscedasticity or homoscedasticity. So it can be said that the regression model in this research is good because there is a constant variance inequality from the residuals of one observation to another observation.

Table 7. Multiple Linear Regression Results

Model	*Unstandardized Coefficients*	
	B	*Std. Error*
(*Constant*)	2618,120	2012,811
Average Chlorophyll-a (mg/m ^{3})	1715,958	288,505
Average Sea Surface Temperature (°C)	-99,329	75,315

Source: Processed research data, 2023

linear regression results table With multiples we can obtain the following linear regression equation:

$Y = \alpha + \beta 1\ X_1 + \beta 2\ .\ X_2$

$Y = 2618.120 + 1715.958\ X_1 - 99,329\ X_2$

What can be explained is that:

1. The constant value is positive, meaning that if the independent variable value is constant, then the catch of yellowfin tuna is still worth 2618.120 Kg
2. The variable average distribution of chloro phyll-a has a positive value of 1715.958 , which means that for every increase in the average distribution of chloro phyll-a by one

mg/m^3, it will increase the catch of yellowfin tuna by 1715.958 Kg assuming other independent variables are constant.

3. The average sea surface temperature distribution variable has a negative value of -99.329 which means that every increase in the average distribution of sea surface temperature by one degree Celsius , it will reduce the catch of yellowfin tuna by -99,329 kg assuming the independent variable others are constant values.

Table 8 . T Test Results (Partial Test)

Model	*Unstandardized Coefficients*		*Standardized Coefficients*	t	*Sig .*
	B	*Std. Error*	*Beta*		
(*Constant*)	2618,120	2012,811		1,301	0 .230
Average Chlorophyll-a Distribution (mg/m ^{3})	1715,958	288,505	1,008	5,948	0 ,000
Average Sea Surface Temperature Distribution (°C)	-99,329	75,315	- 0.223	-1,319	0 .224

Source: Processed research data, 2023

Based on the T test results table, the average significant value of chlorophyll-a is 0.000, which means the significant value of chlorophyll-a distribution is <0.05, so it can be concluded that the value of chlorophyll-a distribution has a significant effect on Yellowfin Tuna catches. Meanwhile, the significant value of sea surface temperature distribution is 0.224, which means that the significant value of sea surface temperature distribution is > 0.05, so it can be concluded that sea surface temperature has no significant effect on Yellowfin Tuna catches. The T test can also be done by looking for the Tcount and Ttable values and then making a comparison if the Tcount > Ttable value means the independent variable (X) partially influences the dependent (Y).

Formula: Ttable = t (a/2; nk-1)
Ttable = t(0.05/2;11-2-1)
Ttable = (0.25;8)
Ttable = 2.306

The calculated chlorophyll-a distribution value is 5.948, which means > Ttable, so it can be concluded that the chlorophyll-a distribution value partially has a significant effect on the catch of Yellowfin Tuna. Waters with high primary plankton productivity will also have large aquatic biological resources. In the food chain, phytoplankton will be eaten by herbivores which are then preyed upon by carnivores and then at higher trophic levels (Nontji , 2002). Thus, phytoplankton, as primary producers, are fundamental in the food chain that supports the life of other marine biota. so that an increase in chlorophyll-a, which is the pigment content of phytoplankton, results in increased catches. Meanwhile, the calculated value of sea surface temperature distribution is 1.319, which means < Ttable, so it can be concluded that the partial average value of sea surface temperature has no significant effect on the catch of Yellowfin Tuna. Insignificant relationship between SST and *yellowfin* fish catch tuna is also thought to be caused by *yellowfin* tuna in general being a predator that is always on the surface during the day to hunt its prey (Gradieff, 2003).

Table 9. F Test Results (Simultaneous Test)

Model	*Sum of Squares*	df	*Mean Square*	F	*Sig.*
Regression	745692,490	2	372846,245	19,814	0 .001 [b]
Residual	150537,919	8	18817,240		
Total	896230,409	10			

Source: Processed research data, 2023

Based on the F test results table, a significant value of 0.001 is obtained, which means <0.005, which shows that each independent variable simultaneously has a significant effect on the dependent value, so it can be concluded that the distribution of chlorophyll-a and the distribution of sea surface temperature have a significant effect on the catch of Yellowfin Tuna. The F test can also be done by looking for the Fcount and Ftable values and then making a comparison. If the Fcount>Ftable value means the independent variable (X) simultaneously influences the dependent (Y)
Formula: Ftable = k; nk
Ftable = 2 ; 11-2
Ftable = 2 ; 9
Ftable = 4.26

The calculated F value obtained from the F Test table is 19.814, which means > F table, namely 4.26. So it can be concluded that the distribution value of chlorophyll-a and the distribution value of sea surface temperature simultaneously influence the catch of Yellowfin Tuna. The distribution of pelagic fish tends to be determined by habitat, the position where chlorophyll-a meets and temperature optimal , compared to other oceanographic parameters (Indrayani, et al., 2012). The distribution of oceanographic parameters (sea surface temperature and chlorophyll-a) in the Halmahera Sea appears to be fluctuating and this condition also appears to influence *yellowfin tuna* catches . This is known by looking at the results of the analysis of oceanographic parameters (sea surface temperature and chlorophyll-a) which together (F test) and individually (t test) have an effect on *yellowfin* tuna catches (Tangke *et al*., 2015).

Coefficient of determination (R^2)

(R^2) value obtained from this research (Table 6) is 0.832 and the *Adjusted* R^2 value is 0.790. The R^2 value obtained by researchers is almost close to one, meaning that the distribution of chlorophyll-a and sea surface temperature provide almost all the information needed to predict yellowfin tuna catches. The Determination Coefficient functions to determine what percentage of influence the independent variables (average chlorophyll-a and average sea surface temperature) simultaneously have on the dependent variable (Yellowfin Tuna Catch Results). The percentage can be found using the formula:
KD = *Adjusted* R^2 x 100%, KD = 0.790 x 100% = 79 %.

DISCUSSION

From the research results, the author can state that the distribution of chlorophyll a and the distribution of sea surface temperature have a significant simultaneous effect on the catch of Yellowfin Tuna at the Seraya Besar Island Fishermen's fishing areas, East Nusa Tenggara. The distribution of pelagic fish tends to be determined by habitat, position of chlorophyll-a and temperature optimal , compared to other oceanographic parameters (Indrayani, *et al* ., 2012). The high concentration of chlorophyll-a in November has an impact on the high catch of Yellowfin Tuna in November. The optimal sea surface temperature for tuna catches is in November so that Yellowfin Tuna catches in November are also high. The influence of chlorophyll-a distribution and sea surface temperature on yellowfin tuna catches is 79%.

Meanwhile, the remaining 21% is thought to be influenced by other factors or variables such as the influence of monsoon winds which cause water mass circulation patterns that are different and vary between seasons, where the influence of monsoon winds is also thought to result in an increase in water mass (*upwelling*) in the sea (Rasyid, 2016). Apart from that, the influence of the Pacific Ocean water mass that passes through Indonesian waters to the Indian Ocean through the Indonesian cross-flow system also influences the fluctuations in the distribution of chlorophyll-a concentrations, where when the water mass passes through Indonesian waters, the Arlindo water mass will mix with other water masses, resulting in mixing of water masses from two different oceans. The water mass includes temperature, salinity, oxygen, chlorophyll and other tracers which can be used as indicators of water fertility (Tomascik *et al*., 1997). There are other variables that are suspected influencing catches include weather (Picaulima *et al*., 2021), fishing areas (Picaulima *et al*., 2021), capacity of the fishing fleet (Yulianto *et al*., 2021) , number of trips, number of fishing gear (Retnowati *et al.,* 2017), and capital (Sinaga *et al.,* 2014).

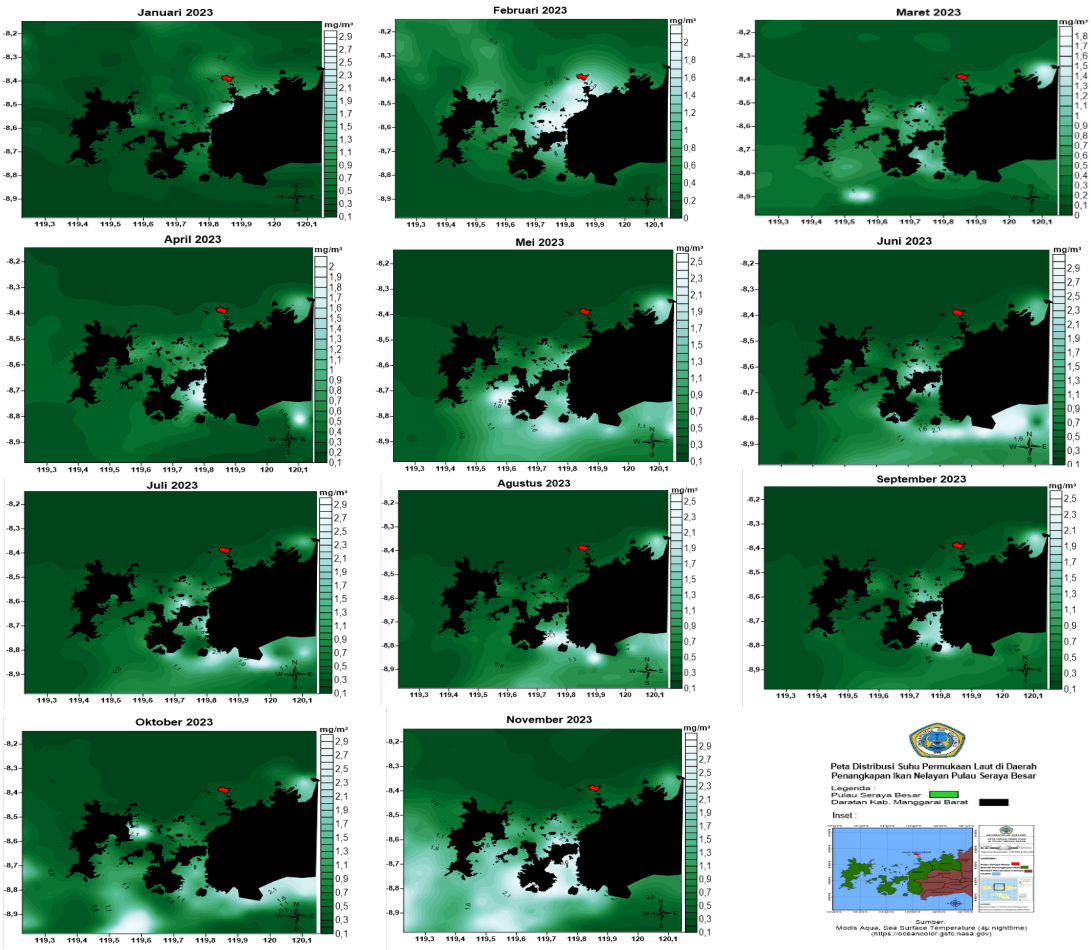

Figure 3. Chlorophyll-a distribution map for January-November 2023
(Source: Research processed data, 2023)

The concentration of chlorophyll in the waters affects the number of fish in the area. There is a lag or time during which the chlorophyll concentration found in aquatic areas is first consumed by herbivorous organism structures, for example zooplankton, or small crustaceans (*juveniles*), and then consumed by the trophic level above (Mujib *et al.*, 2013). The real influence between chlorophyll-a concentration and *yellowfin tuna* catches is thought to be because the average value of chlorophyll-a concentration in the surface layer of Seraya Besar Island's sea waters is quite high, approaching 0.44 mg/m^3. Phytoplankton is not a natural food

for tuna but is the basic food chain for tuna. Tertiary and secondary production makes tuna food (*forage*) dependent on the primary productivity of phytoplankton (Loukos *et al.,* 2003). Waters with high primary plankton productivity will also have large aquatic biological resources. In the food chain, phytoplankton will be eaten by herbivores which are then preyed on by carnivores and then at a higher tropic level. Thus, phytoplankton, as primary producers, are fundamental in the food chain that supports the life of other marine biota (Nontji, 2002). So an increase in chlorophyll-a, which is the pigment content of phytoplankton, results in increased catches.

From the pictures above, it can be concluded that the distribution of chlorophyll-a in fishermen's fishing areas Seraya Besar Island experiences changes every month. The lowest decrease in the average value of chlorophyll-a distribution in the fishing areas fishermen of Seraya Besar Island occurred in March with a value of 0.28 mg/m^3, it is possible that the chlorophyll-a value in March decreased drastically due to the transition from the west to the east monsoon. The highest increase in the average value of chlorophyll-a distribution in fishermen's fishing areas Seraya Besar Island occurred in November with a value of 0.90 mg/m^3, it is possible that the average value of chlorophyll-a distribution in November increased drastically due to the transition from the east to the west season. Chlorophyll-a concentration tends to be low during the west season and transition I (December - May), then tends to increase during the east season and transition II (June-November) (Clinton *et al.,* 2022). The presence of high concentrations of chlorophyll-a, especially in coastal areas, indicates the presence of sufficient plankton to maintain the survival of fish (Safruddin and Zainuddin, 2007).

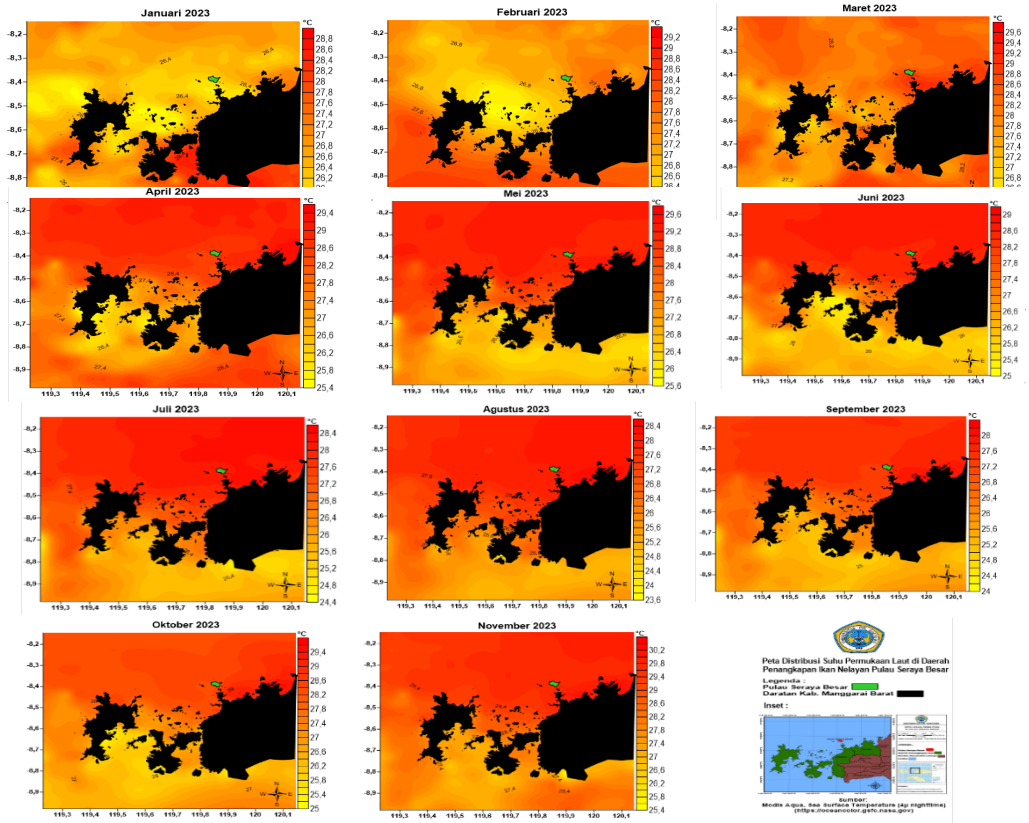

Figure 4. Sea Surface Temperature Distribution Map for January-November 2023
(Source: Research processed data, 2023)

From the pictures above, it can be concluded that the distribution of sea surface temperatures in the fishermen's fishing areas Seraya Besar Island experiences changes every month. The lowest decrease in the average value of sea surface temperature distribution in the fishing areas for fishermen on Seraya Besar Island occurred in September with a value of 26.58

°C. The highest increase in the average value of sea surface temperature distribution in the fishing areas for fishermen on Seraya Besar Island occurred in November with a value of 28.69 °C. This sea surface temperature value is still within the range preferred by yellowfin tuna, namely 18 - 31 ° C (FAO, 2003). *Y ellowfin Tuna* is a type of pelagic fish which in its marine group will appear slightly above the thermocline layer during the day and will migrate to the surface layer in the afternoon (Laevastu and Hela , 1970). Water temperature also influences directly on the physiological condition of fish and indirectly affects the abundance of food for fish (Zorica *et al.,* 2012).

CONCLUSION

Distribution of chlorophyll-a in fishermen's fishing areas Seraya Besar Island ranges between 0.28 - 0.90 mg/m ^{3} with the highest chlorophyll-a distribution in November and the lowest in March. Distribution of sea surface temperature in the fishermen's fishing areas Seraya Besar Island ranges between 26.58 - 28.69 °C with the highest sea surface temperature distribution in November and the lowest in September . Based on this research , linear regression results were obtained with the equation $Y = 2618.120 + 1715.958 X_1 - 99,329 X_2$ with an adjusted R^2 value of 79 %. The results of the Simultaneous Test showed that the variable distribution of chlorophyll-a and sea surface temperature had a significant simultaneous effect on the catch of Yellowfin Tuna on Seraya Besar Island, East Nusa Tenggara. The results of the Partial Test show that the chlorophyll-a distribution variable has a significant partial effect. Meanwhile, the variable distribution of sea surface temperature has no significant partial effect on the catch of Yellowfin Tuna on Seraya Besar Island, East Nusa Tenggara. The distribution of chlorophyll-a and the distribution of sea surface temperature simultaneously influence the catch of yellowfin tuna in the fishing areas for fishermen on Seraya Besar Island.

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