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POTENTIAL CATCHING AREA OF TUNA (*EUTHYNNUS AFFINIS*) BASED ON SEA SURFACE TEMPERATURE AND CHLOROPHYLL-A IN BELITUNG WATERS INDONESIA

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ABSTRACT

One of the fishing areas can be identified by detecting oceanographic parameters in a waters. Parameters that can be used to determine fishing areas include SST and Chlorophyll-a. This study aims to analyze the relationship between SST and Chlorophyll-a on the catch of komo tuna (*Euthynnus affinis*) in Belitung waters. This research was conducted in two stages, namely field data collection in August and downloading and processing of satellite image data in October 2018 to February 2019. The method used was the survey method with spatial analysis. Primary spatial data is in the form of sea surface temperature distribution and chlorophyll-a distribution in Belitung waters and data on the production of tuna fishing. The results showed that the highest weight of tuna catch in 2017 occurred in January at 20,002 kg and the *CPUE* highestoccurred in January at 121 kg / trip. The results of multiple regression tests show that 34.7% of the sea surface temperature and chlorophyll-a factors affect the tuna catch. Based on the assessment of fishing area indicators, there are 20 coordinate points for tuna fishing in Belitung waters that can be categorized as potential fishing areas.

***Keywords*:** Fishing area, tuna, sea surface temperature, chlorophyll-a, Belitung

1. INTRODUCTION

Belitung Regency is one of the regions that has the potential of capture fisheries and is located in WPP-RI 711. Various important types of marine fish are found in Belitung Regency. Belitung Regency has a center for fishing activities, namely at the Port of Nusantara Fisheries Tanjungpandan. The position of the port is very strategic, because it is close to fishing ground and marketing center, both domestically and abroad. Besides being rich in pelagic fish such as mackerel (*Scomberomorini*), tuna (*Euthynnus affinis*) and mackerel (*Rastrelliger*), Tanjung Pandan waters of Belitung Regency also have demersal species including snapper (*Lutjanus*), stingrays (*Batoidea*) and grouper *(Serrenidae*)[1]. Belitung capture fisheries resources are consistently an economic contributor to Belitung Regency, one of the main catches of Belitung capture fisheries is tuna (*Euthynnus affinis*)[1] . Mackerel (Euthynnus affinis) is a fish that is obtained by many fishermen in the waters of Belitung, the price is quite

economical, making tuna is quite attractive to the community.

There is no permanent fishing area, it always changes and moves following the movement of environmental conditions, which naturally fish will choose habitat that is more suitable. The habitat is strongly influenced by conditions or oceanographic parameters including sea surface temperature, salinity, chlorophyll-a, speed and current[2]. Other conditions in capture fisheries are fluctuating production, inefficient utilization of fish resources, and the absence of a sustainable fisheries resource management system strategy. The existence of small pelagic fish is more determined by habitat with the meeting position of chlorophyll-a and optimal temperature, compared to other oceanographic parameters, so the factor determining success in fishing is the accuracy in determining an appropriate fishing area for capture operations fish[2].

Estimation of Fishing Area can be seen based on the distribution of optimum and non-optimum sea surface temperatures beginning with an analysis of the relationship between sea surface temperature and catches. If the sea surface temperature has an influence on the catch, then the temperature can be used as a fishing area indicator and determined the optimum temperature range for capture. However, if the temperature does not have a significant relationship with the catch, then the temperature indicator alone is not enough to be used in determining the fishing area. Another parameter that can be used as an indicator of determining the fishing area is the distribution of chlorophyll-a. Chlorophyll-a is a green pigment in plants that utilize sunlight and is needed by phytoplankton to carry out photosynthesis. The high chlorophyll-a content shows the number of phytoplankton as a natural food source for fish, one of which is tuna. So tuna tends to occupy a lot of this area because it is rich in nutrients[3].

Fishing operations in Belitung waters rely more on experience and visual observation, while advances in remote sensing technology have been able to identify potential fishing areas by analyzing parameters related to the gathering place of fish. remote sensing methods for fishing activities can improve fuel efficiency, reduce fishing trips and reduce ship maintenance costs [4]. Observing the above problems, it is necessary to do a research to map potential fishing areas of tuna fish resources, so that there is no decline in production and can maximize resources in capture fisheries, through surveys of various oceanographic parameters ex-situ and combined with the use of technology to obtain data and information about oceanographic characteristics in the waters of Belitung. Observation of distribution patterns can be done using satellite image data and catch data position. One image that can be used to detect the spread of chlorophyll-a is satellite imagery with sensor MODerate resolution Imaging Spectroradiometer (MODIS).

2. MATERIALS AND METHODS

This research was conducted from August-October 2018 with two stages. The first stage is the collection of field data at the Nusantara Fisheries Tanjungpandan, Belitung Regency, which was held in August 2018, the second stage is the downloading and processing of satellite image data carried out from October 2018 to February 2019. Maps of research locations are presented in Figure 1.

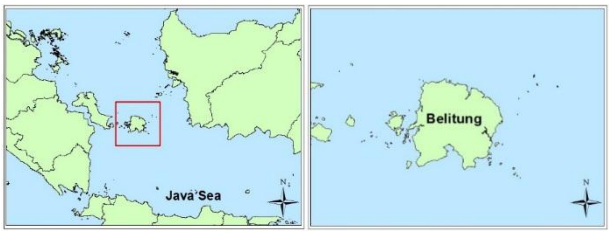


Figure 1. Research Map

The method used is the survey method with spatial analysis. Primary spatial data in the Belitung waters are sea surface temperature data, chlorophyll-a, and tuna fishing production data in the waters of Belitung in 2017. Data on sea surface temperature and chlorophyll-a are obtained from satellite images downloaded from the website http: // oceancolor. gsfc.nasa.gov/cms, while data on tuna fishing production is obtained from Nusantara Fisheries Tanjungpandan Belitung. In addition to validating the fishing position data obtained, interviews were conducted with several fishermen in Nusantara Fisheries Tanjungpandan and participated in fishing with fishermen. Furthermore, the data is processed using software that produces a horizontal profile output and descriptive spatial analysis.

2.1 Analysis of Catches

The catches obtained were analyzed descriptively and presented in the form of tables and graphs. The catch obtained from the sample during the study was combined to analyze the composition of the catch based on the scale of the spread of the fishing area. The catch is presented according to CPUE per fishing gear, ie gill nets are washed away. The formula for calculating CPUE [5] :

$$CPUE = \frac{Catch\ (kg)}{Unit\ Effort\ (trip)}$$

2.2 Analysis of the Relationship between Catches and Sea Surface Temperature and Chlorophyll-a

The Relationship between the catch and the distribution of sea surface temperature and chlorophyll-a is known through descriptive analysis between sea surface temperature and chlorophyll-a with catch. To determine the degree of relationship between the catch variable and the sea surface temperature and chlorophyll-a variables, multiple regression analysis and correlations were performed, the analysis was performed using Microsoft Excel software. The higher the r value indicates that the relationship is getting tighter [6].

2.3 Potential Index Analysis of fishing grounds

Determination of Fishing Areas is based on three indicators, namely with CPUE, distribution of sea surface temperature and chlorophyll-a concentration in the fishing area. To assess CPUE of fish with sea surface temperature and chlorophyll-a, amethod was used *scoring* based on an assessment of CPUE of tuna catches and the distribution of sea surface temperature and chlorophyll-a concentration.

The assessment is done using the criteria as shown in Table 1, the assessment is based on the results of calculations with the CPUE formula.

Table 1. CPUE Category

Cpue category	Score	Criteria	Rating
Low	2	CPUE < Average CPUE	Less Potential
Medium	4	Average CPUE	Medium
High	6	CPUE > Average CPUE	Potential

[7]

The assessment is also carried out on the optimum sea surface temperature concentration in the waters, the assessment is categorized in Table 2.

Table 2. SST Category

Sea Surface Temperature (^oC)	Score	Rating
< 24 ^oC - > 32 ^oC	2	Less Potential
31 ^oC - 32 ^oC	4	Medium
24^oC - 30 ^oC	6	Potential

[8]

The assessment is also carried out on the chlorophyll-a concentration in the waters, these assessments are categorized in Table 3.

Table 3. Chlorophyll-a Category

chlorophyll-a concentration	Score	Rating
< 0,3 mg/m^3	2	Less Potential
0,3 - 1 mg/m^3	4	Medium
> 1 mg/m^3	6	Potential

[9]

Determining the weight of the three indicators is explained in Table 4. After obtaining the weight values for each indicator on a particular fishing area, then the weights are summed. In this case the three indicators are assumed to have the same effect on the assessment of a fishing area. The final step in determining this fishing area is to classify the combined weight values which are the sum of the three indicators into three, namely:

1. If the combined weight values are at the highest range, then the fishing area can be categorized as a potential fishing area.
2. If the combined weight value is in the middle range, then the fishing area can be categorized as medium fishing area.
3. If the combined weight value is in the lowest range, then the fishing area can be categorized as a less potential fishing area.

Table 4. Category Score Fishing Area

Fishing area	Indicator Fishing Area			Rating Fishing Area
	CPUE	Sea Surface Temperature	chlorophyll-a	
Fishing area	CPUE < Average CPUE (s=2)	Less Potential (s=2)	Less Potential (s=2)	Less Potential (s=6-8)
	Average CPUE (s=4)	Medium (s=4)	Medium (s=4)	Medium (s=10-12)
	CPUE > Average CPUE (s=6)	Potential (s=6)	Potential (s=6)	Potential (s=14-18)

[10]

3. RESULT 3.1 Tuna Fish Catches Tuna

fish catch in the waters of Belitung with the *fishing base of* Tanjung Pandan in five years (2013-2017) has fluctuated. The highest catch reached 145,315 kg occurred in 2017 and the lowest catch occurred in 2015 amounting to 27,167 kg (Table 5)

Table 5.Catch Of Tuna Komo

Year	Komo Tuna Production (kg)
2013	47.209
2014	28.270
2015	27.167
2016	86.288
2017	145.315

Catch of tuna in Belitung waters fluctuated, the highest production in the last 5 years (2013-2017) occurred in January 2017 and the lowest production occurred in March 2015 (Figure 2).

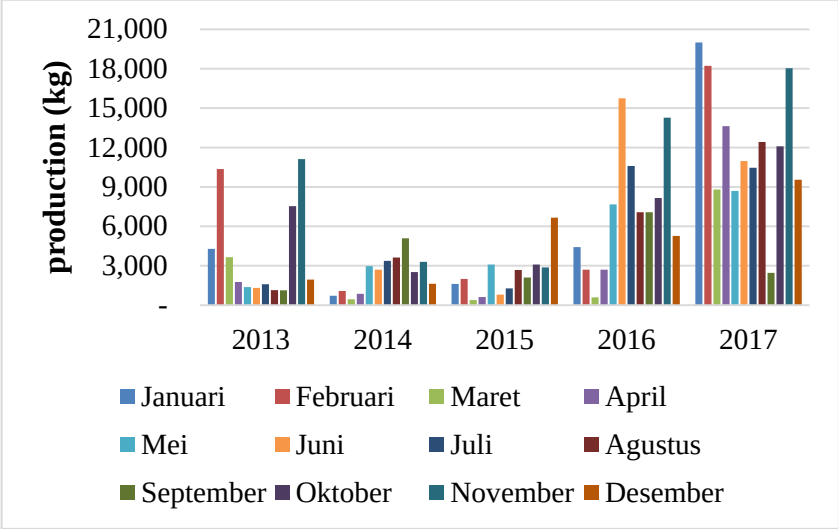


Figure 2.Catch Of Tuna Komo Monthly In 2013 - 2017

The results of the research that have been carried out, the average catch of tuna has decreased in March for the last 5 years (Figure 3).

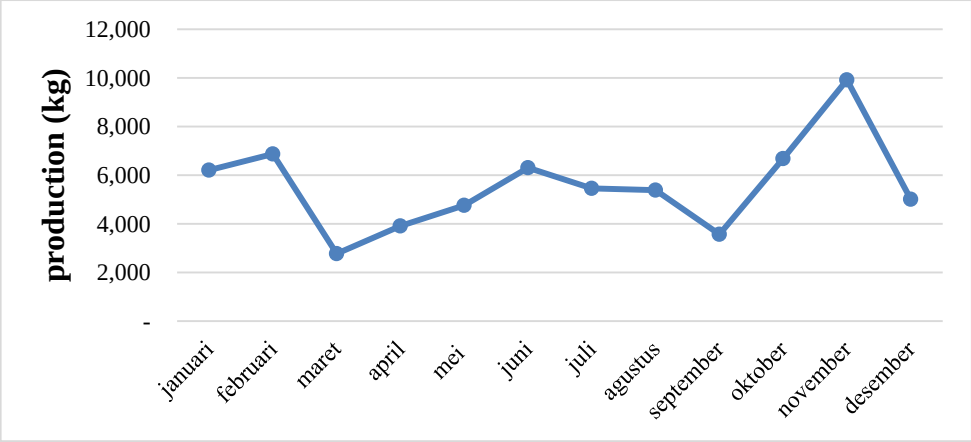


Figure 3. Average Catch Of Tuna Komo

Decrease in tuna production that occurs can be influenced by oceanographic conditions, types of fishing gear and the number of fishing fleet trips, fluctuations in fish catches are influenced by the presence of fish, oceanographic factors, number of fishing efforts and success rates of arrests[11]. The decline that occurred in March was caused by low fishing efforts that occur every year in the waters of Belitung and are also influenced by seasonal factors which are the transition season 1, when the transition season 1 occurs the temperature tends to be unstable which causes erratic tuna and movement large winds which cause the currents in a waters to become high and cause fishing efforts to be low. In the transition season 1 the wind that blows in the Javanese waters is very high which results in rising ocean currents[12]. The decline that occurred in September was influenced by seasonal factors, because September is a transitional season 2 which makes the temperature tends to be unstable but the capture effort that occurs in Belitung waters remains high, which is caused by the current that occurs in the transition season 2 is low due to wind factors which weakens and has an uncertain direction [13].

3.2 Catches Per Unit Effort (*CPUE*) of Tuna Fish

The catches obtained are analyzed descriptively and presented in tables and graphs. The catch obtained from the sample during the study was combined to analyze the composition of the catch based on the scale of the spread of the area fishing. The catch is presented according to CPUE per fishing gear, ie gill nets are washed away.

Based on the production data obtained, the calculation is then performed using theformula *CPUE*.results *CPUE* of tuna in Belitung waters per month for 5 years () are shown in Figure 4.

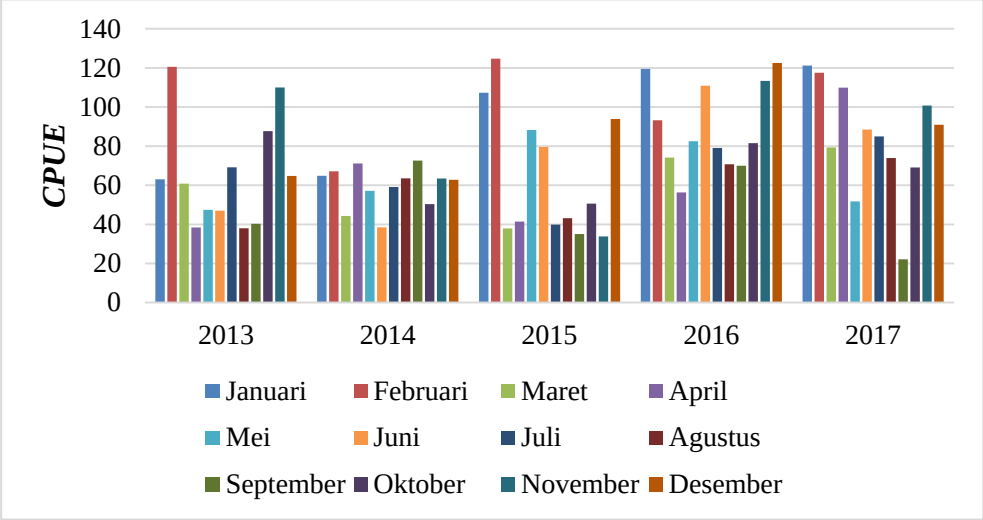


Figure 4. *CPUE* Monthly *of* 2013-2017

Based ongraphs *CPUE* of tuna in Belitung waters experiencingfluctuations *CPUE* every month, *CPUE* highestis found in February 2015 of 125 kg/trip. *The CPUE* highestthat occurred in February was due to the factor of low catching effort while high catches, which means that tuna fishing activities in February were very effective. *TheCPUE* lowestoccurred in September 2017 at 22 kg / trip due to high capture effort and low catch which was also influenced by seasonal factors, September was a transitional season 2 which made temperatures tend to be unstable.

3.3 Distribution of Sea Surface Temperature in Belitung Waters

The distribution of sea surface temperature resulting from the extraction of Aqua-MODIS satellite imagery for 5 years (2013-2017) results in varying sea surface temperature distribution values around Belitung waters. The variation in surface temperature distribution for 5 years is used as an indicator in fishing potential. When viewed from the map of sea surface temperature distribution, fishing areas are in the waters of East Bangka, Belitung and the Natuna Sea which are presented in the form of maps shown in (Figure 5) . The coordinates of the data were

obtained from fisherman logbook data at Nusantara Fisheries Tanjungpandan Belitung.

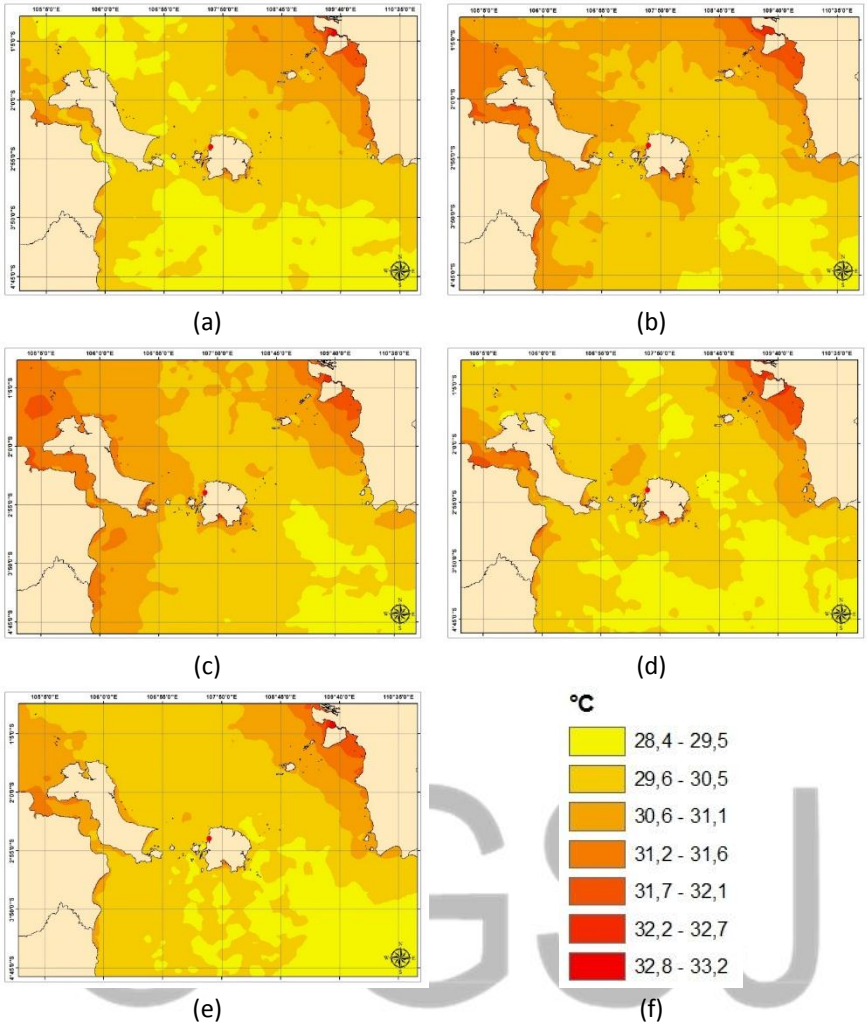


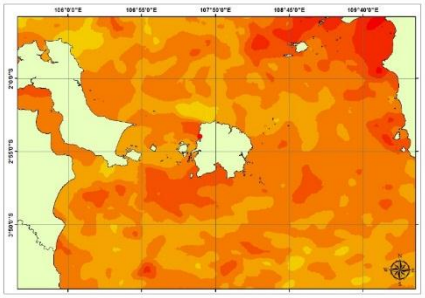
Figure 5. Map of Distribution of SST in Belitung Waters for 5 Years
2013 (a) 2014 (b) 2015 (c) 2016 (d) 2017 (e) Legenda (f)

The results of extraction of sea surface temperature maps at the study site were processed using *software* ranging from 28.4 to 33.2°C shown in Table 6.

Table 6. Distribution Of SST in Belitung Waters

Year	Lowest (°C)	Highest (°C)
2013	29,5	33,2
2014	28,8	32
2015	28,4	31,6
2016	30,1	32,8
2017	28,9	33,2

Based on the data obtained in Table 6, sea surface temperatures in the waters of the Belitung have experienced fluctuations of 1-2°C each year. The data obtained shows the lowest temperature for 5 years (2013-2017) occurred in 2015 amounted to 28.4°C and the highest temperature occurred in 2013 and 2017 amounted to 33.2°C. Distribution of sea surface temperature in Belitung waters for 12 months in 2017 which has been processed produces SST images clearly by giving different colors in each temperature range, the number of image images obtained during 12 months is displayed in figure 6. From the overall surface temperature imagery The sea produced shows that the SST range in Belitung waters ranges from 26-33^{0}C.



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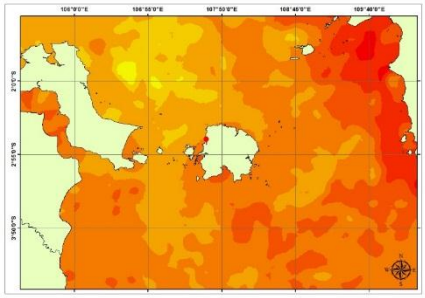

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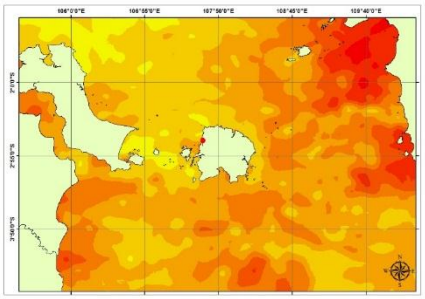

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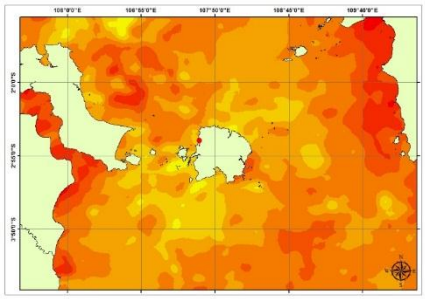

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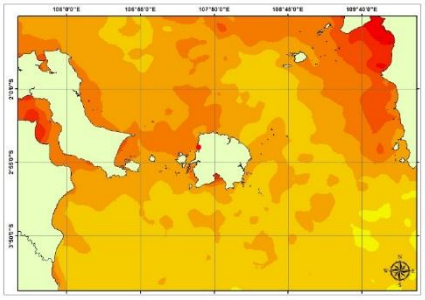

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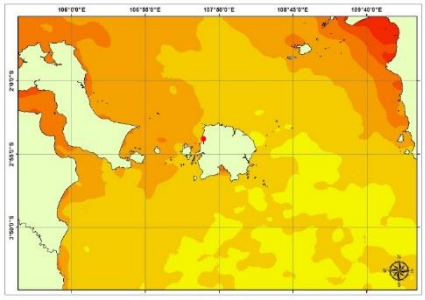

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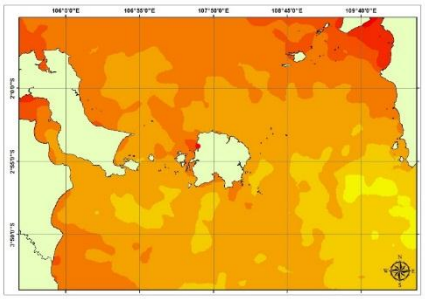

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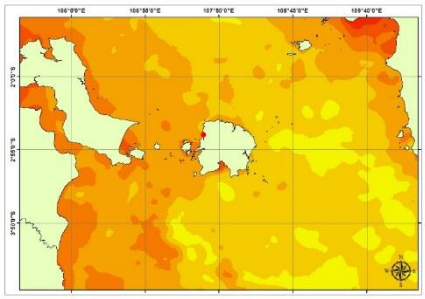

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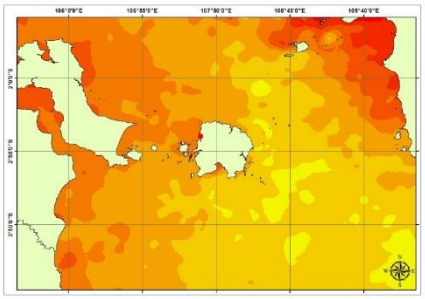

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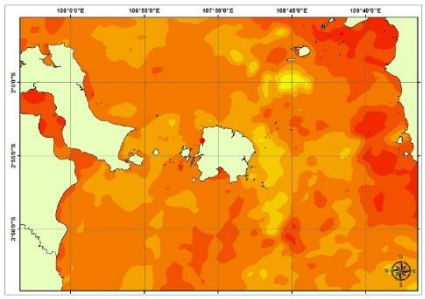

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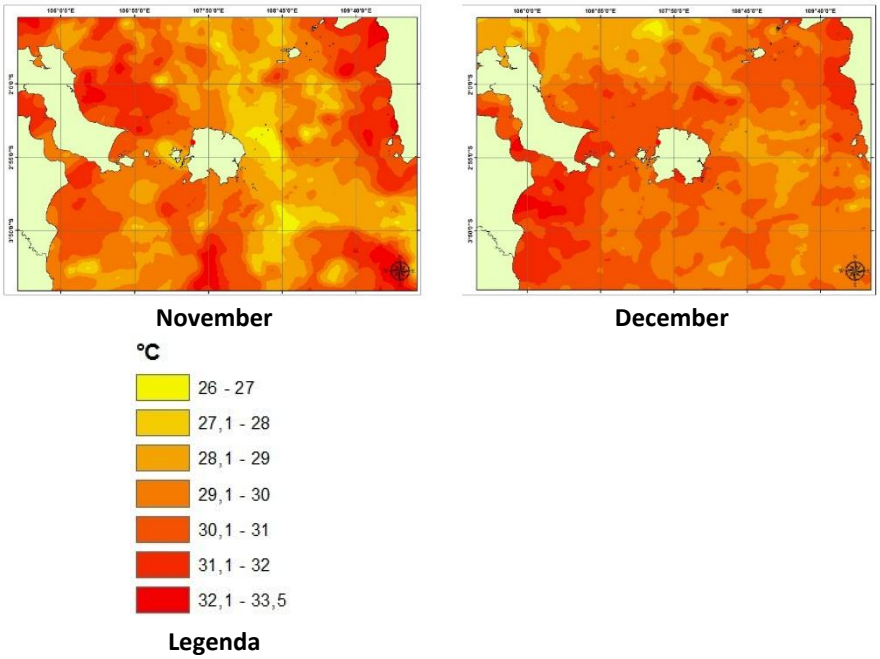


Figure 6. Distribution of Sea Surface Temperature Monthly in 2017

In general, the distribution of sea surface temperature can have a homogeneous distribution from the surface to a depth of 50 m[14]. This is because the depth of 20-50 m is alayer homogeneous [15]. Thedistribution of monthly sea surface temperature in Belitung waters in 2017 has fluctuated. The average graph of the distribution of monthly sea surface temperature in the Belitung waters is shown in Figure 7.

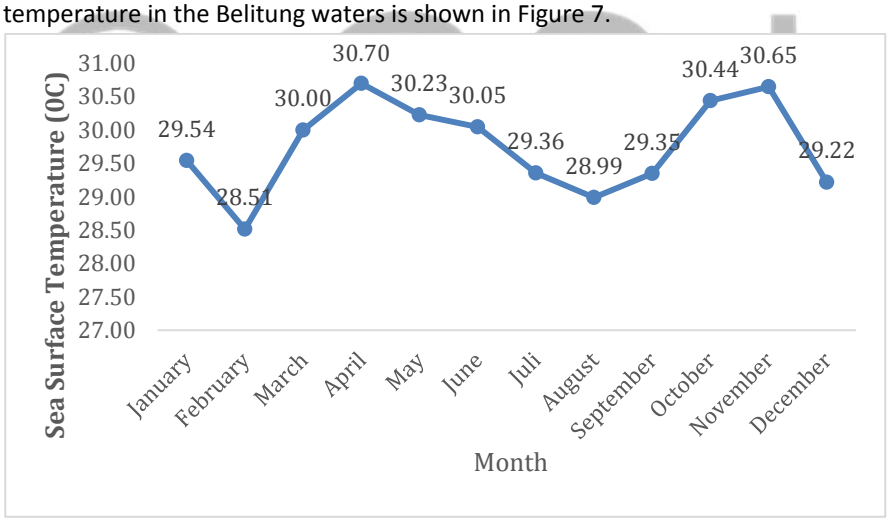


Figure 7. Average Graph of SST Distribution in Belitung Waters in 2017

Based on Figure 7 the average monthly sea surface temperature in 2017 in Belitung waters has an average the highest temperature that occurred in April was 30.70^{0}C. This is because in April it has entered the dry season in Indonesia which causes sea surface temperatures tend to be warmer than the rainy season [16]. The lowest average occurs in February with an average sea surface temperature of 28.51^{0}C. The low temperature that occurred in February caused in February is the peak of the rainy season which causes water conditions to tend to be colder, at the beginning of the year around January-February is a western season that brings winds from the Asian Continent that is cooler to the Australian continent which is hotter and brings high rainfall, causing some waters in Indonesia to tend to be cooler than other months[17].

3.4 Distribution of Chlorophyll-a in Belitung Waters

The distribution of chlorophyll-a in Belitung waters which was processed using *software* for 5 years (2013-2017) resulted in varying chlorophyll-a concentration values in Belitung waters. The 5-year chlorophyll-a concentration variation was used as an indicator of water fertility and potential fishing. When viewed on the distribution map of chlorophyll-a, the fishing area is in the waters of East Bangka, Belitung and Natuna sea which are presented in the form of maps shown in Figure 8. Coordinate data points were obtained from fisherman logbook data at Nusantara Fisheries Tanjungpandan Belitung.

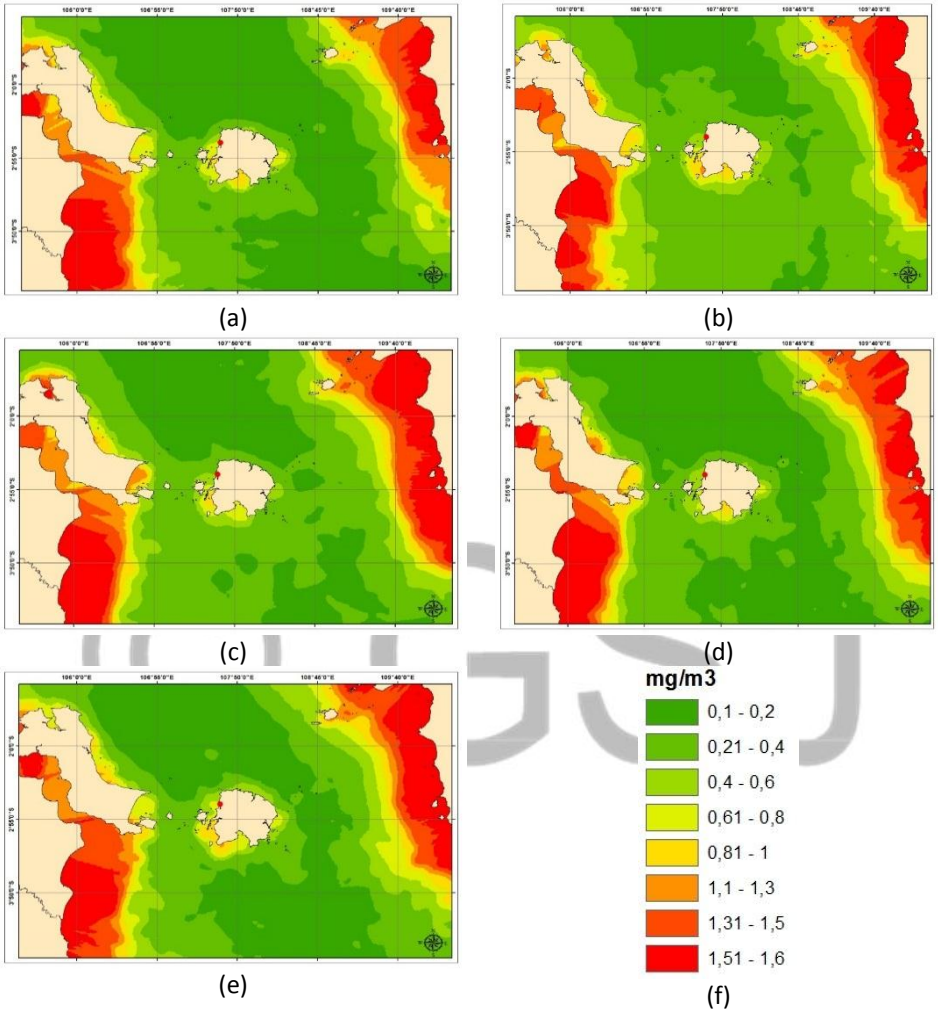


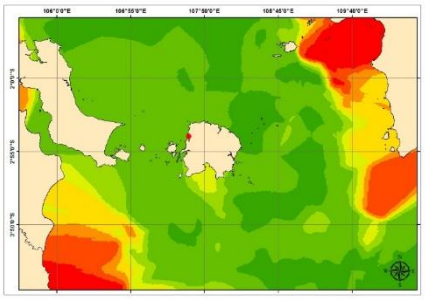
Figure 8. Chlorophyll-a distribution of 2013-2017

The results of the extraction of chlorophyll-a concentration maps at the study site were processed using *software* Seadas and ArcGisranging from 0.14-1.56 mg / m3. The range of chlorophyll-a distribution in Belitung waters for 5 years (2013-2017) is shown in Table 7.

Table 7. Distribution of Chlorophyll-a In Belitung Waters

Year	Lowest (mg/m^3)	Highest (mg/m^3)	Average	Category
2013	0,22	1,56	0,46	Sedang
2014	0,14	1,52	0,46	Sedang
2015	0,22	1,56	0,51	Sedang
2016	0,23	1,55	0,49	Sedang
2017	0,24	1,54	0,52	Sedang

Based on data obtained in Table 7, the distribution of chlorophyll-a in Belitung waters fluctuated, chlorophyll-a concentrations in Belitung waters can be categorized as waters which has moderate chlorophyll-a concentration. The chlorophyll-a concentration is high if the chlorophyll-a concentration is more than 1 mg / m^3 [9]. A watershed has a certain range for fish to gather and to make physiological adaptations to other factors such as flow, temperature and salinity that are more suitable, but the presence of chlorophyll-a concentrations above 0.2 mg / m^3 has indicated that plankton is sufficient to maintain survival. fish[18].Data on the distribution of chlorophyll-a concentrations shown in Figure 8 also shows that the closer to the coast or coastal area, the higher the chlorophyll-a content. The high concentration of chlorophyll-a in the coastal area is due to accumulation of nutrients carried by the river flow into the sea waters in the coastal region. Chlorophyll-a concentrations are generally high in the area around the coast because of the high supply of nutrients from the land[19]. The complete data of monthly chlorophyll-a concentration in 2017 year is shown in Figure 9.



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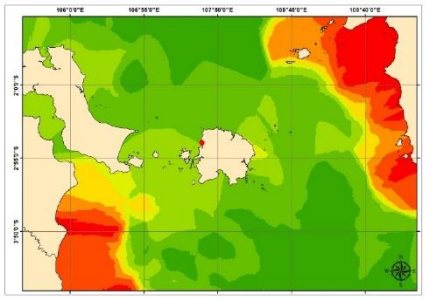

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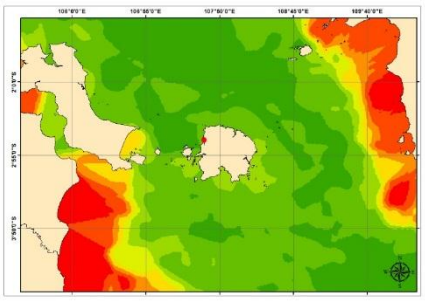

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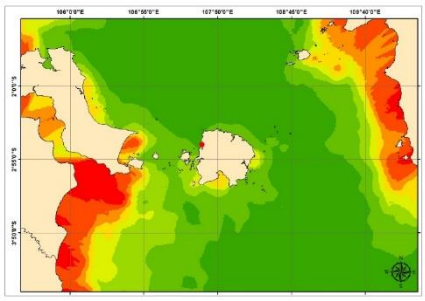

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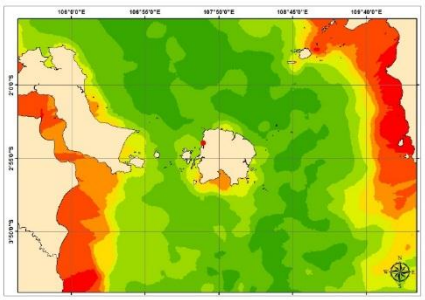

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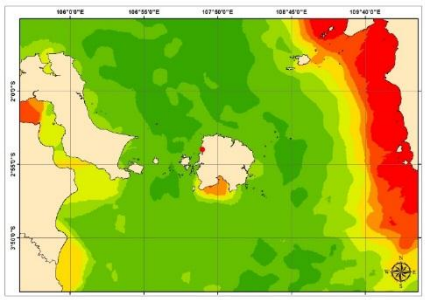

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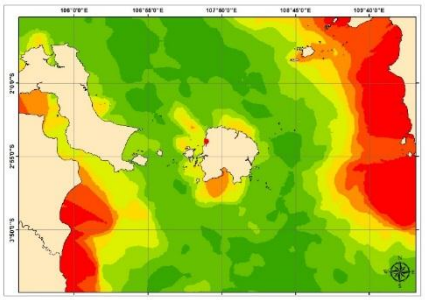

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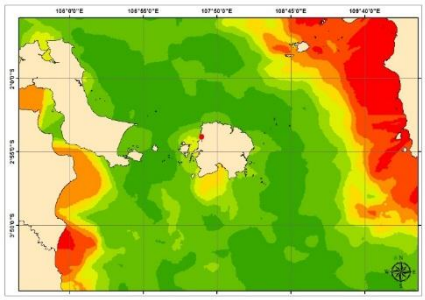

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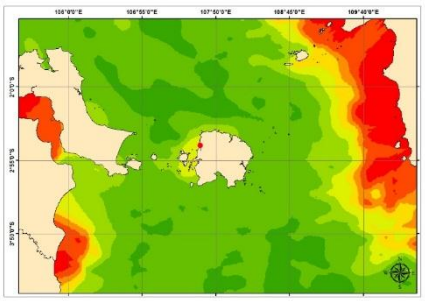

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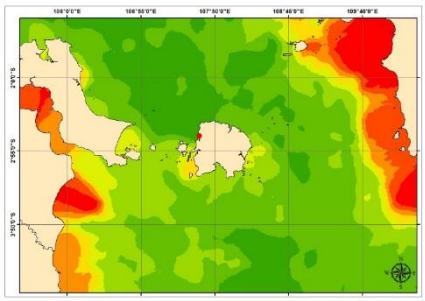

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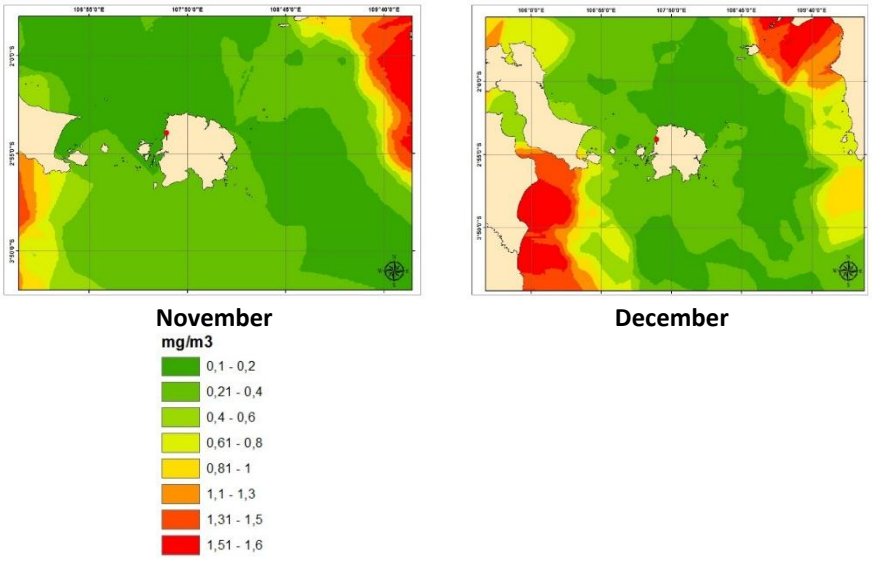

Figure 9. Distribution Of chlorophyll-a Monthly In 2017

The distribution of monthly chlorophyll-a concentrations in the waters of Belitung in 2017 has fluctuations that tend to be uniform. The average graph of Chlorophyll-a monthly in Belitung waters is shown in Figure 10.

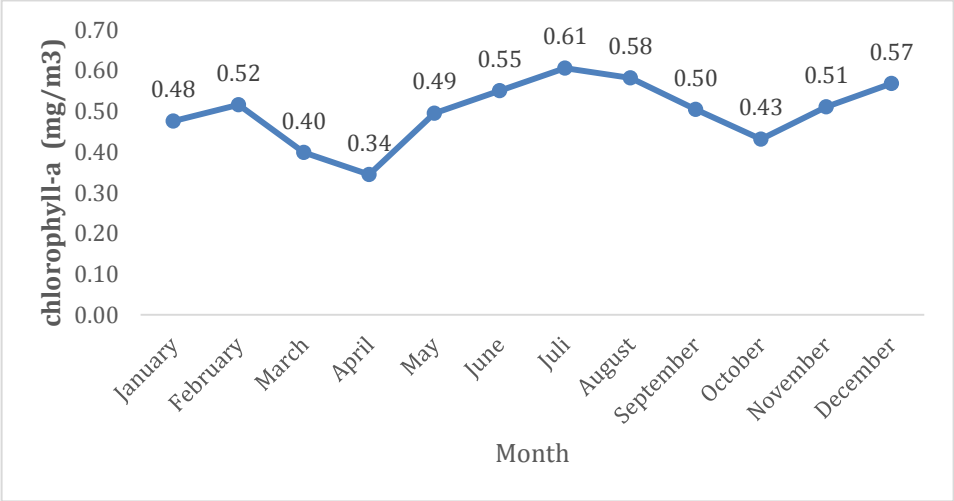

Figure 10. Graph of Average Chlorophyll-a Distribution in Belitung Waters in 2017

Based on Figure 10 the average chlorophyll-a concentration in Belitung waters monthly in 2017 can be concluded that, the average value of chlorophyll-a decreases in April (Transition Season) and the chlorophyll-a concentration increases in June to July (East Season). In the east monsoon there is an increase in water mass (*upwelling*) in several locations in the Indonesian Sea due to the meeting of water masses from the Pacific Ocean, which have values ranging from 0.19 mg / m^3 and 0.16 mg / m^3 during the West Season, and 0 , 21 mg / m3 which occurred during East Season[20]. This causes a high chlorophyll concentration in the east season compared to the western season.

Some oceanographic factors that influence the distribution of chlorophyll-a in the waters include temperature, nutrients, salinity and current. Temperature can affect photosynthesis either directly or indirectly. Directly, reactions that play a role in photosynthesis are influenced by temperature. Indirectly, the temperature affects the solubility of carbon dioxide (CO_2) in seawater, the solubility decreases when the sea water temperature rises and increases when the temperature drops[3].

3.5 Relationship between Sea Surface Temperature and Chlorophyll-a With Cole (*CPUE*)

The relationship of distribution of sea surface temperature and chlorophyll-a with *CPUE* of tuna in Belitung waters was also obtained through statistical analysis using SPSS software. The results of the linear regression test show that thevalue is *Adjusted R Square* 0.326 or 32%, while the *R square* (R^2) is 0.347 or 34.7% with the value of the equation ($y = 1059.01 - 34.769\ x_1 + 262{,}008\ x_2$) . Based on these values, it can be concluded that 34.7% of sea surface temperature and chlorophyll-a factors influence the *CPUE* of tuna in Belitung waters, the remaining 65.3% is influenced by other factors such as flow, salinity, dissolved oxygen and availability. food. The correlation test results show that the value of r (correlation coefficient) is 0.589. This shows that the relationship between the distribution of sea surface temperature and *CPUE* of tuna in Belitung waters is a significant relationship because the value of r is in the range of 0.4 - 0.7. Correlation is stated to have a significant value if 0.4 <r <0.7. Besides this, the relationship between sea surface temperature and chlorophyll-a with the *CPUE* of tuna is said to be quite meaningful but not too large because the sea surface temperature and chlorophyll-a are not only indicators that can indicate potential fishing areas[6].

Based on statistical tests of multiple regression of sea surface temperature and chlorophyll-a, it was found that sea surface temperature and chlorophyll-a did not significantly affect the catch. The results of the graph of the relationship between sea surface temperature and chlorophyll-a with *CPUE* of tuna showed that the catch of tuna was mostly caught at a temperature range of 28°C-29°C and chlorophyll-a 0.4-0.5 mg/m^3 , this result is different from previous research that tuna caught in Indonesian waters is in the range of chlorophyll-a by 0.5 mg/m^3[23].

3.6 Determination of Potential Fishing Zone of Tuna

Determination of fishing area is one of the factors that can determine the success or failure of an fishing business, optimization of fishing activities is determined by several factors, one of the determinants of success by determining fishing area [24]. A waters can be said to be a Fishing Area if in these waters there is an interaction between fish that are the target of capture and the fishing technology used to catch fish [25]. Fishing activities carried out by Belitung fishermen rely more on visual experience and observation.fishing areas are scattered around the waters of Belitung, the vessels used are types of *Mackerelgillnets* using drift gill nets, the vessels have varying volumes ranging from 4 GT to 10 GT which have an average catch in one trip at 115kg [26].

Based on the indicators of the assessment of the fishing area, three categories of tuna fishing areas were obtained, namely the potential, medium and less potential categories (Table 9). The assessment of the fishing area categories carried out in this research began from January to December 2017 with 65 catching coordinates. The highest SST value obtained was 32.5°C which included the less potential category and the lowest was 27.3°C which included the potential category. Meanwhile, the highest chlorophyll-a value is 0.62 mg / m^3 which is in the medium category and the lowest is 0.1 mg / m^3 which is in the less potential category. The highest CPUE value of 400kg / trip is included in the potential category and the lowest value of 10 kg/trip is included in the less potential category.

Table 9. Category Fishing Area

Fishing Area	Indicator Fishing Area			Category Fishing Area
	CPUE (Kg/Trip)	**Sea Surface Temperature (°C)**	**chlorophyll-a (mg/m^3)**	
Fishing Area	*CPUE* < 115kg/trip (s=2)	<24 °C - 32 °C (s=2)	<0,3 mg/m^3 (s=2)	Less Potential (s=6-8)
	115-120 kg/trip (s=4)	31 °C - 32 °C (s=4)	0,3-1 mg/m^3 (s=4)	Medium (s=10-12)
	CPUE > 120kg/trip (s=6)	24 °C - 30 °C (s=6)	>1 mg/m^3 (s=6)	Potential (s=14-18)

Based on the calculations carried out shown in Appendix 7, there are 20 coordinate points for potential tuna fishing, 30 coordinate points for moderate fishing areas and 15 catchment areas with less potential for tuna (Table 10).

Table 10. Result Of Fishing Area

Month	Category			Total
	Potential	Medium	Less Potential	
January	-	4	-	4
February	2	3	1	6
March	1	2	-	3
April	4	1	1	6
May	1	3	2	6
June	4	3	1	8
July	1	2	1	4
August	1	3	1	5
September	3	2	2	7
October	-	1	2	3
November	2	4	1	7
December	1	2	3	6
Total	20	30	15	65

The results of determining the fishing area from January to December 2017, find the final value that varies with each coordinate (figure 11) . The highest final value is in the medium category with a value of 30, while the lowest is in the less potential category of 15. It can be concluded that the catching of tuna in Belitung waters belongs to the medium category. Belitung waters that have caught tuna*(Euthynnus*affinis) are quite high [26].

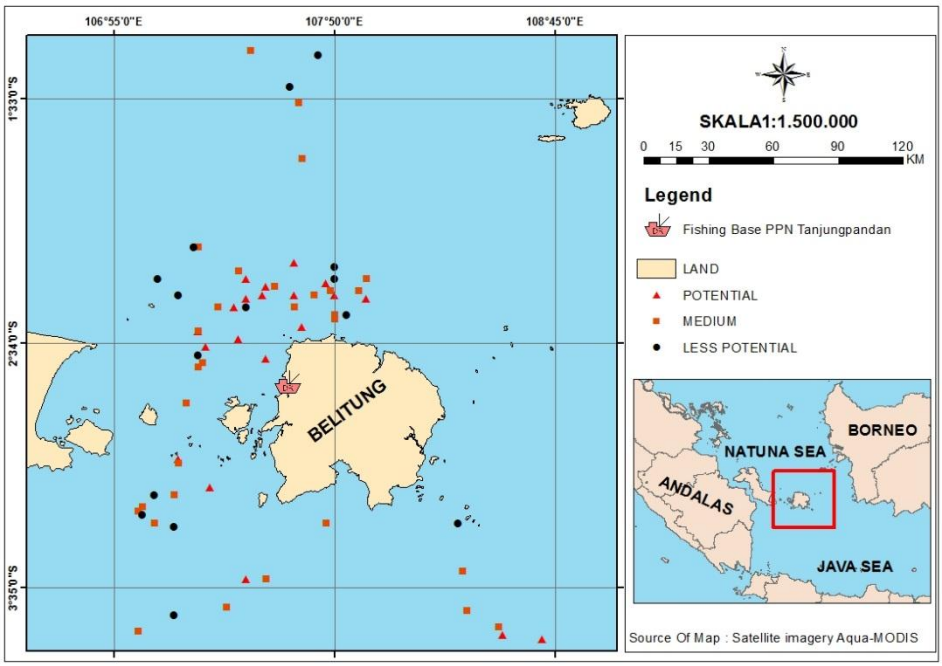

Figure 11. Map Of Fishing Locations

Based on the results of calculations carried out on SST, Chlorophyll-a and CPUE, a map of potential areas of tuna fishing in Belitung waters was obtained. Potential areas of tuna have a diffuse location, but the optimum area for catching tuna is at the coordinates of latitude 2º0'0 "S to Longitude 106º55'0" T and Latitude 2º34'0 "S to

Longitude 107º50'0" T. Because the area has the appropriate SST and Chlorophyll-a values for tuna. fishing activities in Belitung waters, carried out at the coordinates of latitude 2º0'0 "S to Longitude 107º'0" T and coordinates latitude 2º0'0 "S to Longitude 108º'0" T [26]

3. CONCLUSIONS

Based on the results of research on potential catchment areas of tuna based on the distribution of sea surface temperature and chlorophyll-a distribution in the waters of Belitung, it can be concluded that there are 20 potential area coordinate points, 30 medium coordinate points and 15 less potential coordinate points. Based on statistical analysis of multiple regression, it can be concluded that the distribution of sea surface temperature and chlorophyll-a has an effect of 34.7% on the *CPUE* of tuna in Belitung waters and the remainder is influenced by other factors, ie sea surface temperature and chlorophyll-a are not significantly affected against *CPUE* of tuna in Belitung waters.

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