International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

https://ijpsat.org/

Vol. 54 No. 1 December 2025, pp. 51-67

Spatio-Temporal Variability Of Sea Surface Temperature, Salinity, And Chlorophyll-A On Large Pelagic Fish Catch In West Sumatra Waters

Vera Cahyanti[1], Depison[2], Septy Heltria[1*], Lisna[1], Ester Restiana Endang G[1], Fauzan Ramadan[1]

[1]Department of Utilization of Fisheries Resources, Universitas Jambi, Indonesia

[2]Department of Animal Husbandary, Universitas Jambi, Indonesia

Corresponding author: Septy Heltria. E-mail: septyheltria@unja.ac.id

Abstrak: The Fisheries Management Area of the Republic of Indonesia (FMA) 572, particularly the waters of West Sumatra, has significant potential for the capture of large pelagic fish such as tuna, skipjack, and mackerel. However, this potential has not been fully utilized by local fishermen, likely due to limited knowledge of potential fishing grounds. This study aims to map and identify potential fishing areas in FMA 572 using oceanographic parameters, including Sea Surface Temperature (SST), Chlorophyll-a, and Salinity. The research employed a survey method using secondary data. Oceanographic data were obtained from the Copernicus Marine Service website (https://data.marine.copernicus.eu), while fishing logbook data were collected from the Bungus Oceanic Fishing Port (PPS Bungus). Multiple regression and correlation analyses were used to examine the relationship between oceanographic variables and fish catch data.The results indicate that areas with SST ranging from 28–30°C, chlorophyll-a concentrations between 0.3–2.5 mg/m³, and salinity levels of 30–34 ppt are the most potential zones for fishing activities. The regression analysis revealed a strong relationship between oceanographic parameters and fish catch, with a coefficient of determination (R^2) of 99.69%. Salinity showed the strongest correlation ($r = 0.963$), followed by SST ($r = 0.998$) and chlorophyll-a ($r = 0.993$). These findings highlight that oceanographic conditions play a vital role in determining the distribution and abundance of large pelagic fish. Therefore, integrating oceanographic data into fishing practices can improve fishing efficiency and support sustainable fisheries management in the waters of West Sumatra.

Keywords: Potential area, oceanography, SST, chlorophyll-a, salinity, FMA 572

I. Introduction

The Fisheries Management Areas of the Republic of Indonesia (WPP-NRI) are divided into 11 regions, previously only 9, based on the Minister of Marine Affairs and Fisheries Regulation No. Per.01/Men/2009 concerning the Fisheries Management Areas of the Republic of Indonesia. This change affects the estimation of potential resources, including the allowable catch and utilization rates in the capture fisheries sector (Suman et al., 2017). One of the areas with abundant fishery resources is WPP-NRI 572, located in the waters of West Sumatra, which directly borders the western part of the Indian Ocean.

The waters of West Sumatra have considerable potential for fishery resources. Fishing activities are conducted within the Exclusive Economic Zone (EEZ), extending 200 miles from the baseline, and are dominated by catches of large pelagic fish (Sinaga, 2024). According to data from the Bungus Oceanic Fishing Port (PPS Bungus) in 2020, the four fish species with the highest production were yellowfin tuna (Thunnus albacares), mackerel tuna (Euthynnus affinis), skipjack (Katsuwonus pelamis), and

Spanish mackerel (Scomberomorini) (PPS Bungus, 2020). However, the potential of capture fisheries in this area has not been fully utilized by fishermen, which is suspected to be due to limited knowledge of potential fishing grounds. Siregar et al. (2018) stated that one of the reasons for the low fish catch is the lack of fishermen's understanding in identifying and selecting potential fishing areas.

Several researchers have explained that potential fishing zones can be identified through oceanographic parameters such as Sea Surface Temperature (SST), Chlorophyll-a, and Salinity, which serve as important indicators for determining fishing grounds (Karuwal, 2019; Daqamseh et al., 2019). Prasetya et al. (2023) reported that the extent of potential fishing areas is influenced by chlorophyll-a concentration and SST values—the higher the chlorophyll-a concentration, the greater the potential fishing area. Nagi et al. (2023) found that in Banten Bay, temperature and chlorophyll concentrations affected fish catches by 55.1%. Kuswanto et al. (2017) also emphasized that chlorophyll-a indicates water fertility, as productive waters typically contain higher concentrations of chlorophyll-a.

Furthermore, salinity is a crucial factor affecting the distribution of marine organisms and oxygen levels, which in turn influence fish presence (Patty, 2013). Temperature also plays a significant role in determining potential fishing areas, as it affects fish growth, spawning, and metabolism (Basuma, 2009). Damayanti et al. (2024) further noted that SST and chlorophyll-a significantly influence fish catch volumes. Therefore, oceanographic data are essential to determine potential fishing areas.

These oceanographic parameters can be obtained from the Copernicus Marine Service, which provides real-time and wide-coverage oceanographic data to support spatial analysis of potential fishing grounds (Armansyah et al., 2017). The Copernicus Marine Environment Monitoring Service (CMEMS) is a program of the European Union that provides free, regular, and systematic access to updated marine data and information to support the identification of sustainable fishing zones and enable accurate and rapid predictions (Paruntu et al., 2019).

Information on potential fishing zones is presented in distribution maps using oceanographic parameters such as SST, chlorophyll-a, and salinity. These maps provide comprehensive spatial visualization that helps fishermen access accurate information about potential fishing grounds (Farda et al., 2019). Moreover, mapping potential fishing areas can reduce overexploitation of fish resources and prevent conflicts between traditional and modern fishermen (Rahmadani et al., 2020). This approach can help fishermen increase their catch efficiency. Based on the above background, this study was conducted under the title Mapping of Potential Fishing Grounds Using Oceanographic Parameters in the Waters of West Sumatra.

II. Research Method

This research was conducted at the Bungus Oceanic Fishing Port (PPS Bungus), West Sumatra, from April 10 to April 18, 2025.

International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

https://ijpsat.org/
Vol. 54 No. 1 December 2025, pp. 51-67

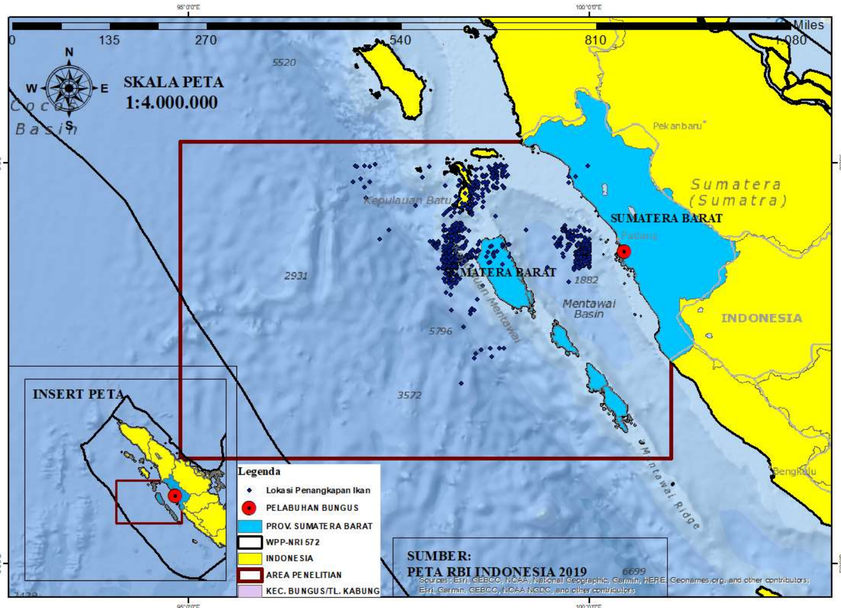


Figure 1. Research Location Map

Materials and Equipment

The materials used in this study consisted of data obtained from the Copernicus Marine Service website (https://data.marine.copernicus.eu) to download oceanographic parameter data (temperature, chlorophyll-a, and salinity) for the year 2023. The equipment used in this research included a camera and a laptop.

Research Method

The research method employed in this study was a survey method, using ArcGIS 10.8 software for data processing and map layout. Data obtained from the Bungus Oceanic Fishing Port (PPS Bungus) included fishing logbook data containing fishing coordinates and catch data of large pelagic fish, which were then analyzed based on the processed data. The data analysis consisted of multiple linear regression analysis and potential fishing ground analysis.

Work Procedures

1. **Data Collection**

The data required for this study included oceanographic parameters, fishing logbook data, and coordinate points. The oceanographic parameter data were obtained from the Copernicus Marine Service website (https://data.marine.copernicus.eu), while fishing logbook data for 2023 were collected from the Bungus Oceanic Fishing Port (PPS Bungus).

2. **Oceanographic Data Processing**

After collecting the oceanographic parameter data, fishing logbook data, and coordinate points, mapping was conducted using ArcGIS 10.8 software to create oceanographic distribution maps and perform map overlay analysis to identify potential fishing zones.

Data Analysis

Distribution Map

The creation of distribution maps for potential fishing grounds in the waters of West Sumatra was conducted using ArcGIS 10.8 software. The oceanographic parameters used included sea surface temperature, chlorophyll-a, and salinity. Supporting data, such as the Indonesia base map (shapefile), were also used. Each parameter was processed in raster format with spatial resolution typically using WGS 1984 projection.

The next step was performing an overlay analysis to produce potential fishing ground maps based on the values of each parameter. The resulting overlay maps were then classified into several fishing potential zones. The final maps included standard map elements such as title, legend, scale, and coordinate grid.

Multiple Linear Regression Analysis

Data analysis in this study used multiple linear regression to identify potential fishing grounds in the waters of West Sumatra. The purpose of the regression analysis was to determine the relationship between oceanographic parameters and fish catch. The regression equation used, based on Saifudin et al. (2014), is as follows:

$Y = a + b_1X_1 + b_2X_2 + b_3X_3$

Where:

Y = Fish catch

a = Intercept coefficient

X_1 = Sea Surface Temperature (°C)

X_2 = Chlorophyll-a (mg/m^3)

X_3 = Salinity (ppt)

b_1 = Regression coefficient for temperature

b_2 = Regression coefficient for chlorophyll-a

b_3 = Regression coefficient for salinity

The F-test was then conducted to determine the influence of oceanographic parameters on potential fishing areas. The statistical F-test was calculated using the following formula:

$$F=\frac{R^2/(k-1)}{(1-R^2)/(n-k)}$$

Where:

R^2 = Coefficient of determination

k = Number of variables including intercept

n = Number of observations

The correlation test (r) aimed to determine the strength of the relationship between variables, expressed by the correlation coefficient (r). A value close to +1 or −1 indicates a strong correlation, while a value near 0 indicates a weak correlation (Putu et al., 2024).

International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

https://ijpsat.org/
Vol. 54 No. 1 December 2025, pp. 51-67

Table 2. Correlation Coefficient Relationship Values

Interval koefisien	Level of Relationship
0,00-0,199	Very Weak
0,20-0,399	Weak
0,40-0,599	Moderate
0,60-0,799	Strong
0,80-1,000	Very Strong

The correlation can be calculated using the formula according to Morissan (2012):

$$r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{(n\sum x^2 - (\sum x)^2)(n\sum y^2 - (\sum y)^2)}}$$

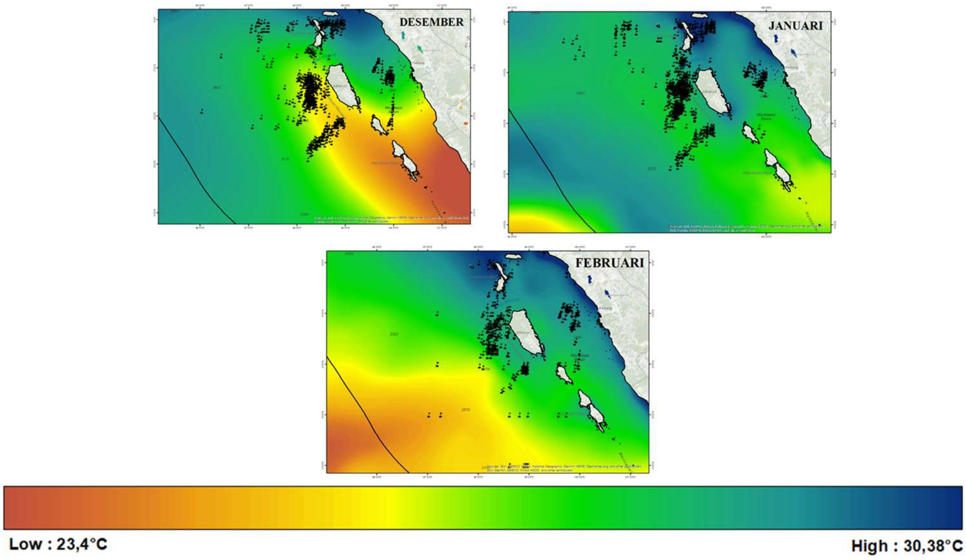
Description:
r: Fishing ground
x: Sea surface temperature value
y: Chlorophyll-a value
N: Number of data points

III. Results and Discussion

Table 3. Values of Sea Surface Temperature, Chlorophyll-a, and Salinity in 2023

Month	SPL (◦C)			Chlorophyll-a			Salinity (ppt)		
	Min	Max	Average/ Montt	Min	Max	Average/ Month	Min	Max	Average/ Month
January	29,14	30,14	29,6	0,12	0,31	0,22	32,56	34,49	33,53
February	27,9	29,58	28,7	0,09	0,24	0,17	32,96	34,59	33,78
March	28,84	29,65	29,2	0,09	0,2	0,15	32,79	34,4	33,60
April	29,81	**30,38**	30,1	0,09	0,22	0,16	32,21	34,29	33,25
May	29,72	30,27	30,0	0,09	0,27	0,18	31,83	34,39	33,11
June	29,53	30,11	29,8	0,09	0,23	0,16	32,56	34,49	33,53
Juli	28,95	30,18	29,6	0,1	0,18	0,14	32,5	34,29	33,40
August	26,42	29,17	27,8	0,12	0,24	0,18	32,38	34,4	33,39
September	**23,4**	29,76	26,6	0,12	0,63	0,38	32,57	34,8	33,69
October	29	29,5	29,3	**0,02**	0,48	0,25	32,56	34,9	33,73
November	24,81	29,67	27,2	0,12	**0,87**	0,50	31,72	**35**	33,36
December	27,14	29,49	28,3	0,13	0,97	0,55	**31,28**	34,9	33,09

Sea Surface Temperature Distribution



West Monsoon Season

Figure 2. Sea Surface Temperature Distribution During the West Monsoon

In Figure 2, during the West Monsoon season (December–February), the distribution of Sea Surface Temperature (SST) in WPP-NRI 572 shows significant variation with relatively high temperatures recorded throughout these months. Temperatures ranged from 27.14–29.49°C in December, 29.14–30.14°C in January, and reached up to 34.4°C in February. This condition is influenced by the west monsoon winds carrying warm air masses, as illustrated in the SST map dominated by red–orange colors indicating high surface temperatures. High sea surface temperatures can affect the distribution of large pelagic fish, as some species tend to avoid overly warm waters by migrating to cooler regions. According to Martono et al. (2008), the SST distribution during the West Monsoon in the Indian Ocean is generally warm, while cooler temperatures are found in the southern areas. However, in December and January, SST values remain within the optimal range of 28–30°C, which supports water productivity and fish availability (Prayitno et al., 2021). This indicates that during the West Monsoon, particularly from December to January, the waters remain relatively potential for large pelagic fishing activities, although the extremely high temperatures in February may limit the distribution of certain species.

International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

https://ijpsat.org/
Vol. 54 No. 1 December 2025, pp. 51-67

Transitional Season I

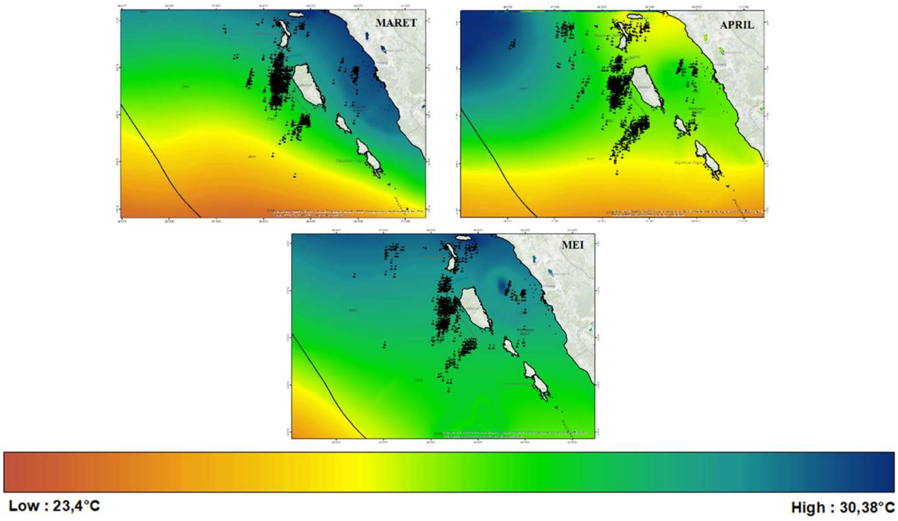


Figure 3. Sea Surface Temperature Distribution during Transitional Season I

In Figure 3, during Transitional Season I (March–May), the distribution of Sea Surface Temperature (SST) shows a stable pattern within the range of 28.8–30.38°C. Temperatures in March ranged from 28.84–29.65°C, slightly increased in April to 29.81–30.38°C, and remained stable in May at 29.72–30.27°C. This range indicates warm sea conditions that remain optimal for supporting phytoplankton growth and the activity of large pelagic fish. According to Lisna et al. (2024), the highest sea surface temperatures during Transitional Season I (March–May) ranged between 29.99°C and 30.95°C. These conditions have the potential to enhance the presence of fishing grounds, as fish tend to gather in waters with stable temperatures close to the optimal range for their habitat.

East Season

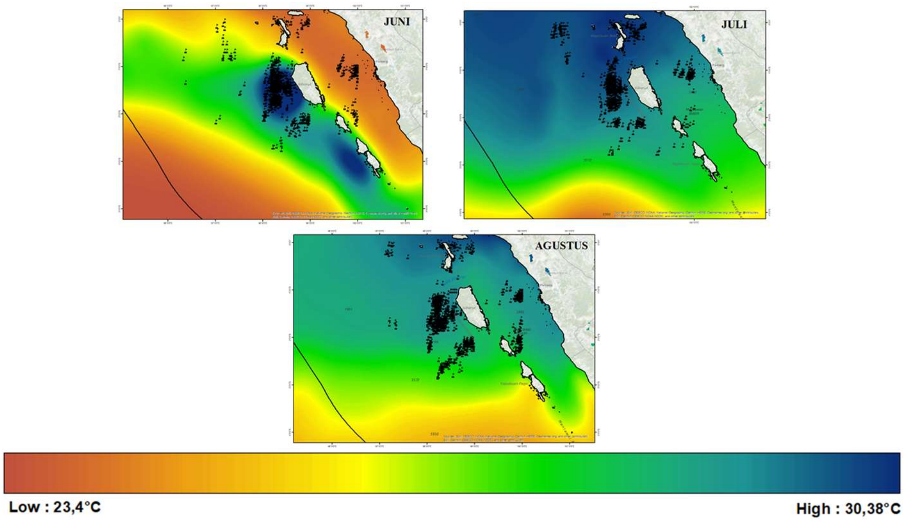


Figure 4. Distribution of Sea Surface Temperature (SST) During the East Season

In Figure 4, during the east season (June–August), the distribution of Sea Surface Temperature (SST) shows a significant decrease compared to other seasons. Temperatures in June ranged from 29.53–30.11 °C, dropped slightly in July to 28.95–30.18 °C, and further decreased in August to 26.42–29.17 °C. This decline indicates the occurrence of upwelling, as the southeast monsoon

International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

https://ijpsat.org/
Vol. 54 No. 1 December 2025, pp. 51-67

winds push warm surface water away and bring up colder, nutrient-rich water from below. The map shows a varied temperature distribution, with lower temperatures dominating the coastal areas. According to Siregar (2017), this season is characterized by winds blowing from Australia toward Asia, including Indonesia, carrying dry air and light rainfall. This is caused by high-pressure systems over Australia and low-pressure systems over Asia, including Indonesia. Therefore, this period is commonly known as the dry season.

Transitional Season I I

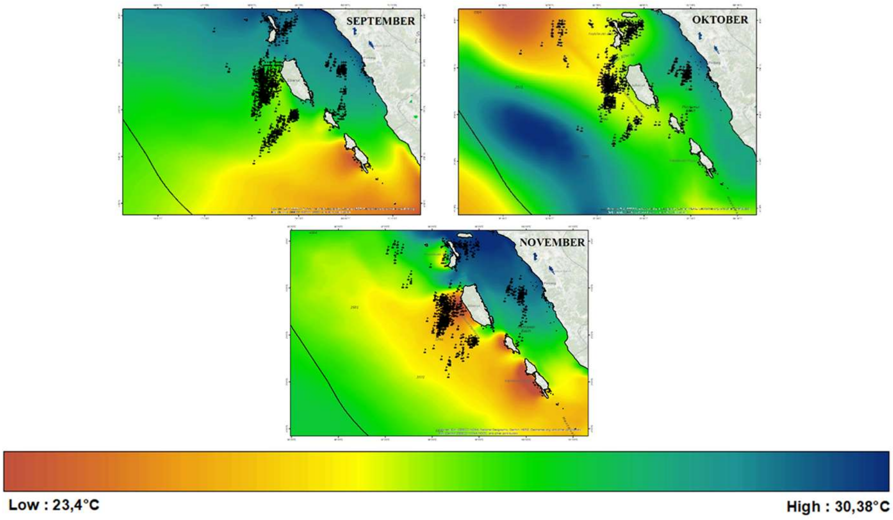


Figure 5. Sea Surface Temperature Distribution During Transitional Season II

In Figure 5, during Transitional Season II (September–November), the distribution of Sea Surface Temperature (SST) shows dynamic variations. Temperatures in September range from 23.4–29.76 °C, increase slightly in October to 29.00–29.50 °C, and vary between 24.81–29.67 °C in November. This period marks the transition from the cooler east monsoon to the warmer west monsoon. The minimum temperature of 23.60 °C in September indicates the occurrence of upwelling, which brings nutrient-rich water to the surface and enhances ocean productivity.According to Putra et al. (2022), temperatures during Transitional Season II are relatively cooler because this season represents the late-year shift from the east monsoon to the west monsoon (the dry to rainy season). This condition often triggers phytoplankton blooms that attract large pelagic fish.

In October, temperatures stabilize within the 29–30 °C range, which remains optimal for pelagic fish activity, keeping fishing grounds productive even though nutrient availability begins to decline. In November, temperature fluctuations occur due to the mixing of water masses driven by changing monsoon winds. Based on Martono et al. (2008), SST conditions in the western Indian Ocean waters are influenced by water masses from the Indian Ocean. These conditions continue to support suitable habitats for large pelagic fish, as temperatures remain within the optimal range.

Chlorophyll-a Distribution

West Monsoon Season

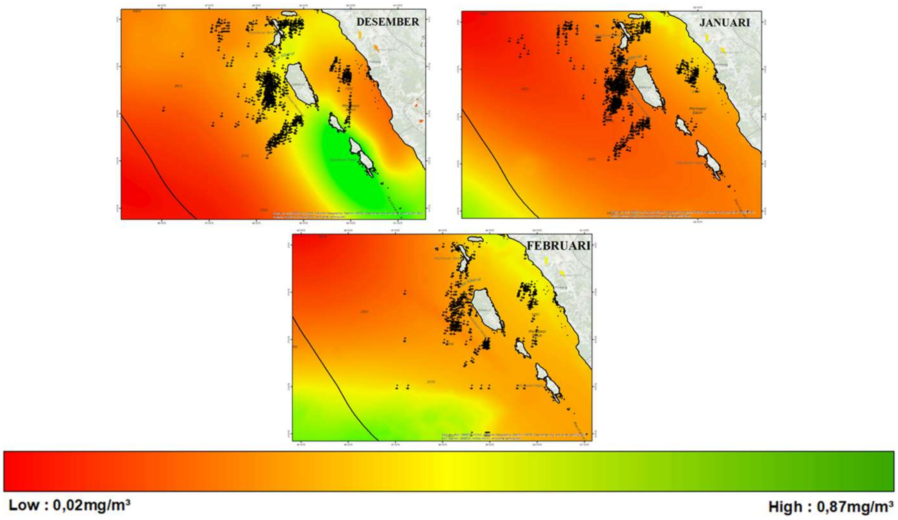
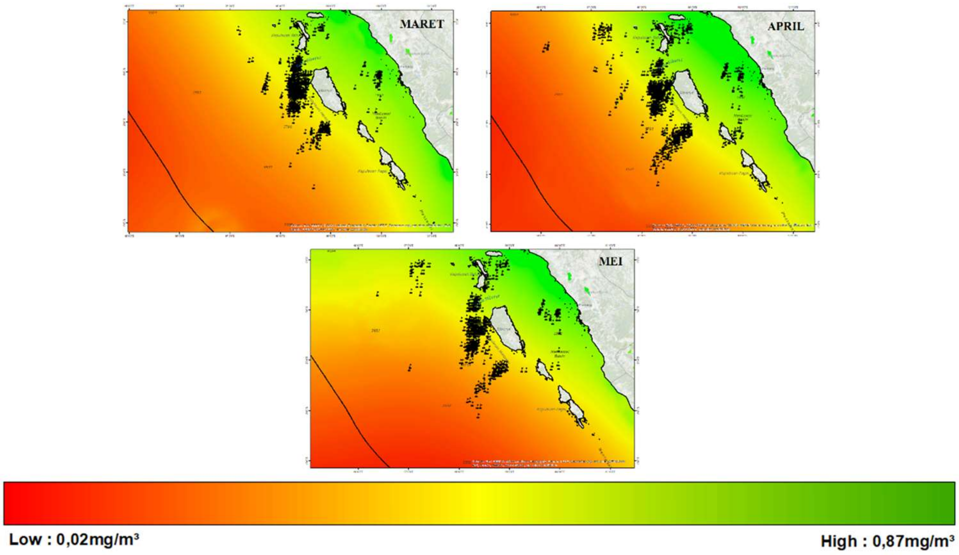


Figure 6. Distribution of Sea Surface Temperature (SST) During the Second Transitional Season

In Figure 6, during the second transitional season (September–November), the distribution of Sea Surface Temperature (SST) shows dynamic variations. In September, temperatures ranged from 23.4–29.76 °C, increased slightly in October to 29.00–29.50 °C, and varied between 24.81–29.67 °C in November. This period marks the transition from the cooler east season to the warmer west season. The minimum temperature of 23.60 °C in September indicates the occurrence of upwelling, which brings nutrient-rich water to the surface, enhancing marine productivity.

According to Putra et al. (2022), temperatures during the second transitional season tend to be relatively cooler because this period represents the late-year transition from the east to the west monsoon (dry to rainy season). Such conditions often trigger phytoplankton blooms, which in turn attract large pelagic fish.

As the season progresses into October, temperatures stabilize within the optimal range of 29–30 °C, maintaining favorable conditions for pelagic fish, although nutrient levels begin to decrease. In November, temperature fluctuations occur due to the mixing of air masses caused by changes in monsoon winds. Martono et al. (2008) also reported that SST in the western Indian Ocean waters is influenced by water masses originating from the Indian Ocean, providing a habitat that remains suitable for large pelagic fish as temperatures stay within the optimal range.



Transitional Season I

Figure 7. Chlorophyll-a Distribution During the First Transitional Season

In Figure 7, during the First Transitional Season (March–May), the distribution of chlorophyll-a shows a stable pattern with low to moderate concentrations. The values range from 0.09–0.20 mg/m³ in March, 0.09–0.22 mg/m³ in April, and slightly increase to 0.09–0.27 mg/m³ in May. Spatially, the distribution appears uniform with a dominance of moderate values, indicating stable water fertility. According to Nababan et al. (2021), the spatial distribution of chlorophyll-a during the First Transitional Season (March–May) in the northeastern part of the Indian Ocean off western Sumatra shows monthly concentrations ranging from 0.10 mg/m³ to 0.21 mg/m³, with an average value of 0.14 mg/m³.

East Monsoon Season

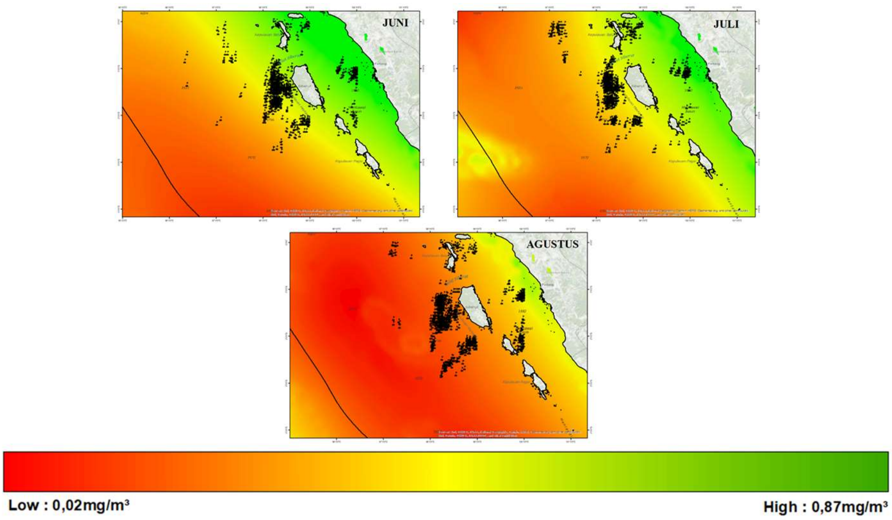


Figure 8. Chlorophyll-a Distribution During the East Monsoon Season

In Figure 8, during the East Monsoon Season (June–August), chlorophyll-a concentrations are relatively lower compared to the west monsoon season. Concentrations range from 0.09–0.23 mg/m³ in June, 0.10–0.18 mg/m³ in July, and 0.12–0.24 mg/m³ in August. The low chlorophyll-a levels indicate less productive waters due to dry easterly winds that reduce nutrient supply and phytoplankton growth. This condition decreases the abundance of large pelagic fish because their main food source becomes limited.

According to Rosalina et al. (2011), chlorophyll-a concentrations in marine waters decline and fluctuate monthly due to complex interactions among physical, chemical, and biological factors. One of the main causes of the decrease is reduced nutrient supply, either from land runoff or from upwelling processes that bring nutrients from deeper layers to the ocean surface.

Transitional Season II

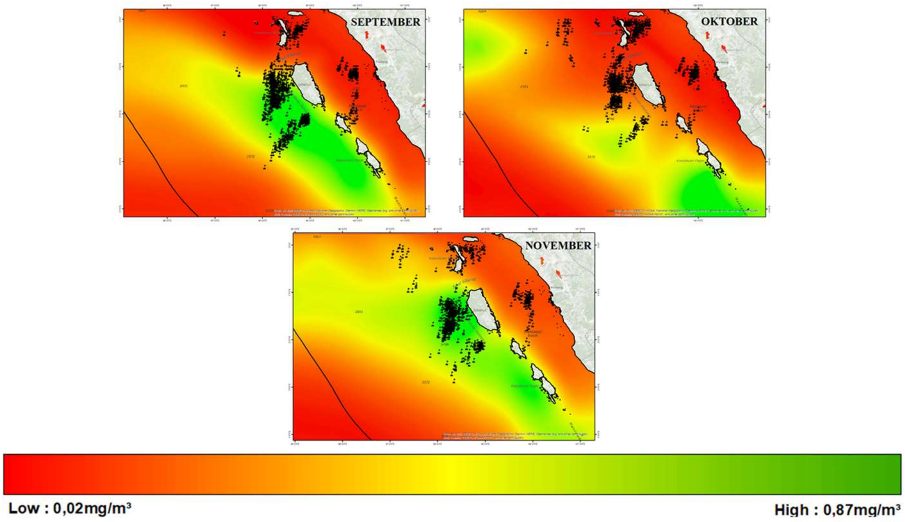


Figure 9. Chlorophyll-a Distribution During the Second Transitional Season

In Figure 9, during the Second Transitional Season (September–November), chlorophyll-a distribution shows a significant increase. In September, concentrations range from 0.12–0.63 mg/m³ due to upwelling that brings nutrients to the surface. In October, levels drop sharply to 0.02–0.48 mg/m³ as upwelling weakens and monsoon winds shift, although primary productivity remains supported. In November, concentrations rise again to 0.12–0.87 mg/m³ as air mass mixing enhances nutrient supply. Subono et al. (2017) also noted that increases in chlorophyll-a can be caused by eutrophication from anthropogenic activities such as domestic or industrial wastewater discharge into marine waters.

Salinity Distribution

In Figure 10, during the West Monsoon Season (December–February), salinity distribution is influenced by high rainfall and air mass mixing. In December, salinity ranges from 31.28–34.9 ppt due to freshwater input. The low salinity distribution during this season occurs because of west monsoon water mass movement (Hariati et al., 2017). In January, salinity increases to 32.56–34.49 ppt, indicating more stable conditions, and in February, it reaches 32.96–34.59 ppt, remaining within the tolerance range for marine organisms and supporting phytoplankton and large pelagic fish presence.

International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

https://ijpsat.org/
Vol. 54 No. 1 December 2025, pp. 51-67

West Moonson

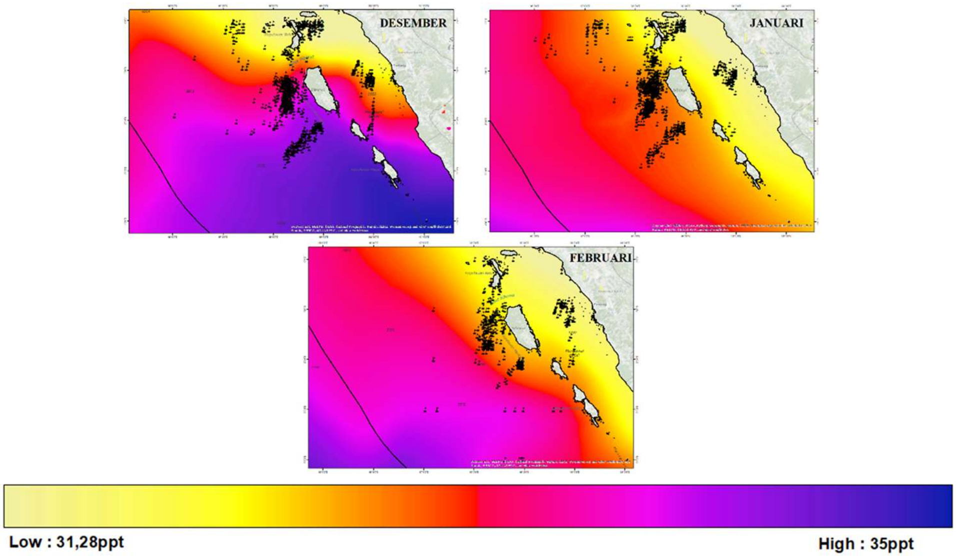


Figure 10. Salinity Distribution During the West Monsoon Season

Transitional Season I

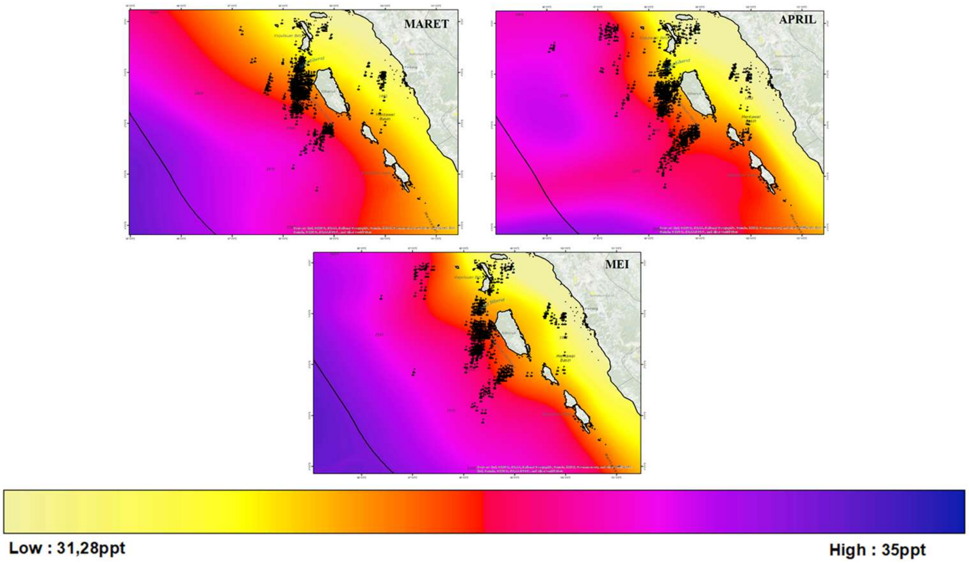


Figure 11. Salinity Distribution During the First Transitional Season

In Figure 11, during the First Transitional Season (March–May), salinity distribution remains relatively stable and within the optimal range for large pelagic fish. In March, salinity ranges from 32.79–34.4 ppt, slightly decreases to 32.21–34.29 ppt in April, and drops further to 31.83 ppt in May due to heavy rainfall introducing freshwater into the ocean. Siregar (2018) also noted that the decrease in salinity during this season is caused by high rainfall during the west monsoon.

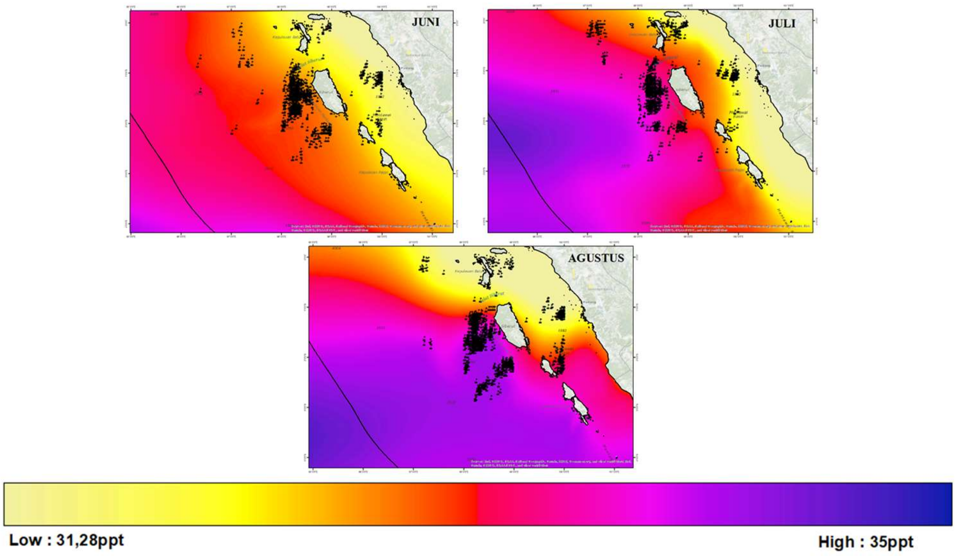
In Figure 12, during the East Monsoon Season (June–August), salinity levels are relatively high and stable, ranging from 32.56–34.4 ppt. In June, salinity ranges from 32.56–34.49 ppt, slightly decreases to 32.50–34.29 ppt in July, and reaches 32.38–34.4 ppt in August. Spatially, salinity is higher in offshore areas than nearshore regions due to limited freshwater inflow. The east monsoon

International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

https://ijpsat.org/
Vol. 54 No. 1 December 2025, pp. 51-67

is characterized by strong southeasterly winds that trigger upwelling along the west coast of Sumatra. Siregar (2018) stated that higher salinity during this season is due to high solar radiation intensity, which increases sea surface evaporation and consequently salinity levels.

In Figure 12, during the Second Transitional Season (September–November), salinity distribution varies but still supports large pelagic fish habitats. In September, salinity ranges from 32.57–34.8 ppt, remains stable in October at 32.57–34.9 ppt, and rises to 35 ppt in November. The main factors contributing to high salinity include intense evaporation, low rainfall, and limited freshwater input, allowing salt accumulation and increasing salinity (Daeng & Umar, 2023).



East Monsoon Season

Figure 12. Salinity Distribution During the East Monsoon Season

Transitional Season II

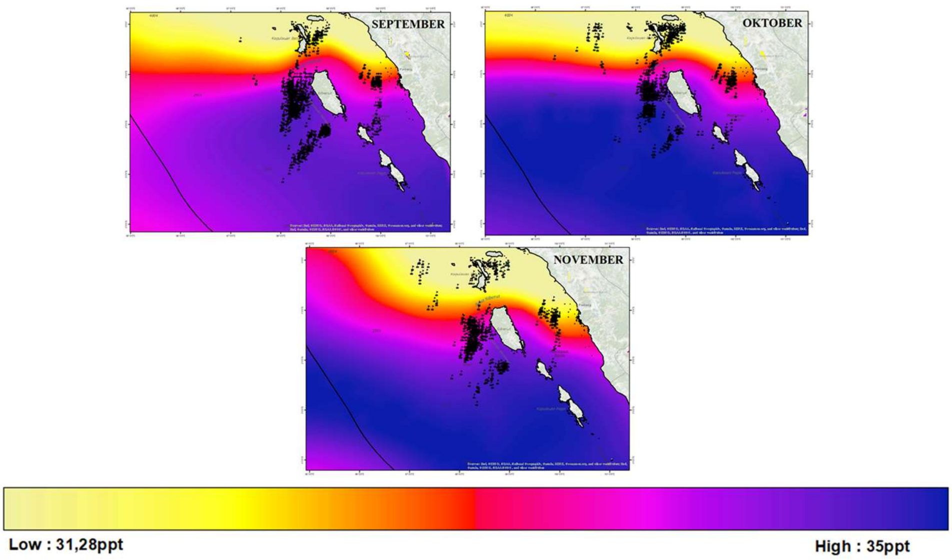


Figure 13. Salinity Distribution During the Second Transitional Season

Fish Catch Production

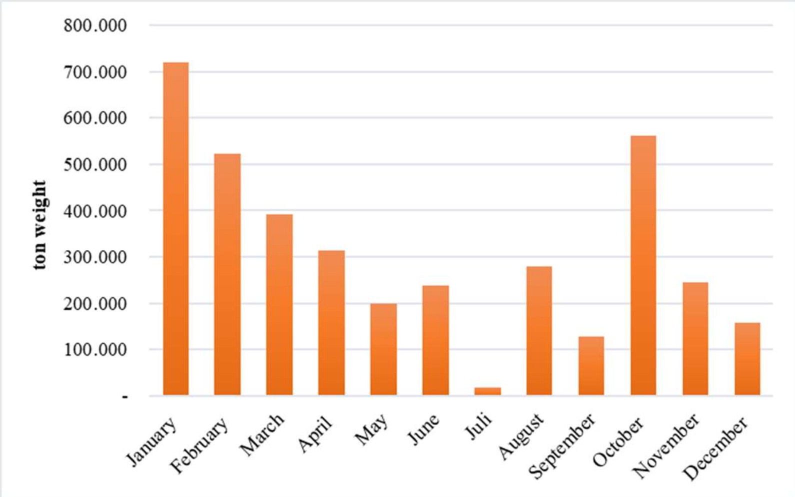


Figure 14. Fish Catch Production

Based on Figure 14, the monthly fish catch production in 2023 at the Bungus Ocean Fishing Port (PPS Bungus) showed significant fluctuations. The highest production occurred in January (720.619 tons), followed by February (522.238 tons) and October (561.079 tons). This indicates that at the beginning and end of the year, marine conditions were highly favorable for fishing activities, likely influenced by stable sea surface temperatures and high chlorophyll-a concentrations that enhance primary productivity.

Conversely, the lowest catch was recorded in July (18.645 tons), showing a significant decline due to environmental factors such as the shift in the east monsoon wind direction and the decrease in sea temperature and chlorophyll-a levels, which affected the availability of large pelagic fish. Production also declined in September (128.473 tons) and May (198.862 tons), which are typically transition periods in oceanographic conditions along the west coast of Sumatra.

These variations suggest that fish catch production is influenced by seasonal patterns, the number of fishing fleets operating, and the frequency of fishing trips (Limbong et al., 2017). Overall, the production pattern demonstrates a strong relationship between seasonal variation and oceanographic conditions, where the west monsoon and transitional seasons are the most favorable periods for large pelagic fishing activities, while the east monsoon tends to yield lower production.

Regression Analysis of Oceanographic Parameters and Fish Catch

This analysis aims to determine the influence of the independent variables — sea surface temperature (SST, X_1), chlorophyll-a (X_2), and salinity (X_3) — on the dependent variable, large pelagic fish catch (Y). Based on calculations using Microsoft Excel 2021, the regression analysis results are presented in Table 4, Table 5, and Table 6.

Table 4. Regression Analysis of Oceanographic Parameters and Fish Catch

Regression Statistics		
Multiple R	:	95%
R Square	:	99,69%
Adjusted R	:	99,68%
Square	:	99,66%
Standart Error	:	6,10853
Observations	:	326

Based on Table 4, the regression analysis shows the influence of the three independent variables on the catch of large pelagic fish. The relationship between the catch of large pelagic fish and the independent variables — Sea Surface Temperature (SST), chlorophyll-a, and salinity — produced a correlation coefficient (R) of 95%, indicating a very strong relationship. The coefficient of determination (R^2) was 99.69%, meaning that 99.69% of the variation in large pelagic fish catches is explained by changes in SST, chlorophyll-a, and salinity. Meanwhile, the remaining 0.31% is influenced by other factors not included in this analysis, such as fishing effort, ocean currents, or meteorological conditions.

This result suggests that oceanographic parameters play a dominant role in determining the abundance and distribution of large pelagic fish in the Bungus fishing area. Variations in temperature, chlorophyll-a, and salinity directly affect the productivity and presence of target species in fishing grounds, reflecting the sensitivity of pelagic ecosystems to environmental changes.

Table 5. ANOVA of Oceanographic Parameters and Fish Catch

	df	*SS*	*MS*	*F-Value*	*Significance F*
Regression	3	137134,43	457114,8	1595,17	0,000
Residual	1300	372530,4	286,6		
Total	1303	174387,47			

Based on the results of the F-test for the relationship between oceanographic parameters and fish catch, it is known that the calculated F-value is 1595.17, with a Significance F value of 0.000. Since the significance value $F < 0.05$, it can be concluded that the regression model involving oceanographic parameters (SST, chlorophyll-a, and salinity) has a simultaneous and significant effect on large pelagic fish catches (Putu et al., 2024).

Table 6. Correlation Coefficients of Oceanographic Parameters and Fish Catch

	SPL	*Salinitas*	*Klorofil-a*
Salinity	0,981		
Chlorophyll-a	0,992	0,961	
Fish Catch	0,993	0,963	0,998

Based on the Pearson correlation in Table 6, the oceanographic parameters show a positive relationship with fish catch. Chlorophyll-a has a correlation of 0.993, salinity 0.963, and sea surface temperature (SST) 0.998. This means that an increase in chlorophyll-a, salinity, and SST within optimal limits significantly affects the rise in fish catches.

The relationship between SST and chlorophyll-a shows a correlation of 0.992, indicating a very strong association. This means that an increase in temperature is followed by an increase in chlorophyll-a, as certain temperature ranges can support phytoplankton photosynthesis. Sea surface temperature and chlorophyll-a are two key indicators influencing fish distribution, especially skipjack tuna (*Katsuwonus pelamis*), as this species tends to migrate for survival. Each fish species has different adaptability to its habitat and environmental conditions (Elisabeth et al., 2017).

The relationship between salinity and chlorophyll-a is also very strong, with a correlation of 0.961, indicating that the optimal salinity range of 30–34 ppt promotes higher chlorophyll-a concentration and marine productivity. Meanwhile, the relationship between salinity and SST has a correlation of 0.981, which is considered very strong. This implies that an increase in salinity is generally accompanied by a rise in sea surface temperature. This is supported by Handayani et al. (2005), who stated that low salinity strongly correlates with increased chlorophyll-a, and by Utami et al. (2016), who noted that excessively high salinity can inhibit photosynthesis and aquatic productivity. Therefore, stable salinity and temperature conditions support phytoplankton growth, increasing food availability for pelagic fish and enhancing fishing productivity.

Conclusion

1. The oceanographic conditions of West Sumatra waters significantly influence fish catches. The optimal zones are characterized by sea surface temperatures between 28–30°C, chlorophyll-a concentrations of 0.3–2.5 mg/m³, and salinity

levels of 30–34 ppt. These conditions are commonly found during the first transitional season, when the waters are more stable and primary productivity increases.

2. The Pearson correlation analysis shows that all oceanographic parameters are positively correlated with fish catches. Salinity has the highest correlation (r = 0.934), followed by sea surface temperature (r = 0.797) and chlorophyll-a (r = 0.751). This indicates that optimal salinity levels, along with stable sea temperatures and chlorophyll-a concentrations, enhance phytoplankton growth — the main food source for large pelagic fish — thereby increasing catch productivity.

References

[1]. Armansyah, D., Sukoco, N. B., Adrianto, D., Dewantono, L., & Pranowo, W. S. 2017. Purwarupa Dukungan Data Arus Laut Operasional Bersumber Dari Copernicus Marine Inviorment Monitoring Service (CMEMS) Dalam Fromat AML IWL Arus Laut Untul TNI AL. *Dinas Oseanografi Dan Meteorologi, Pushidrosal*, 1–16.

[2]. Daeng, R., Umar, T., 2023. Hubungan suhu permukaan laut dan hasil tangkapan ikan teri di perairan Teluk Dodinga. Jurnal Agribisnis Perikanan 16, 199-206. https://doi.org/10.52046/agrikan.v16i1.199-206.

[3]. Damayanti, S. P., Aida, G. R., Kusyairi, A., Marpaung, S., & Setiawan, K. T. 2024. Pemetaan Daerah Penangkapan Ikan Cakalang (Katsuwonus pelamis) di Wilayah Pengelolaan Perikanan 572 yang didaratkan Pelabuhan Perikanan Samudera Nizam zachman Jakarta. *Jurnal Perikanan Unram*, *14*(1), 317–329. https://doi.org/10.29303/jp.v14i1.780.

[4]. Farda, N.M., & Jatisworo, D. 2019. Penambangan Pola Ruang Waktu Pada Peta Prakiraan Daerah Penangkapan Ikan Di Perairan Wilayah Pengelolaan Perikanan (WPP) 712, 713 dan 573. Majalah Ilmiah Globe, 21(2): 117-128.

[5]. Gustiawan Agung. 2021. Pemanfaatan Peta Zona Potensial Penangkapan Ikan di Perairan Selat Bangka : Prespektif Pengindraan Jauh dan Sistem Informasi Geografis (SIG). [SKRIPSI : Universitas Sriwijaya]. Inderalaya.1-109.

[6]. Hariati, A., Mustikari, E., Purbani, D., Handiani, D. N.dan M Al-Azhar, M. 2018. Kaitan Sebaran Suhu Permukaan Laut dan Klorofil-a Berbasis Citra Satelit Terhadap Hasil Tangkapan Ikan Tuna di Perairan Sumatera Barat. *Repository Itenas.* Institut Teknologi Nasional. Bandung.

[7]. Lisna. Febryanti, H.R., Heltria, S., Toni, Y., Ramadan, F., 2024. Estimation of the fishing ground potential based on oceanography parameters (GIS-based) of yellowfin tuna (Thunnus albacares) in West Sumatra waters. Bioflux 17.

[8]. Kuswanto, T. D., dan M. L. Syamsuddin. 2017. Hubungan suhu permukaan laut dan klorofil-a terhadap hasil tangkapan ikan tongkol di teluk lampung. Jurnal Perikanan Kelautan, 8(2).

[9]. Martono, Halimurrahman, R. Komarudin, Syarif, S. Priyanto.dan D. Nugraha. 2008. Studi Variabilitas Lapisan Atas Perairan Samudera Hindia Berbasis Model Laut. Lapan: Jakarta.

[10]. Morissan, 2012. Metode penelitian survey.1 st ed. Kencana,jakarta.

[11]. Nababan, B.. Sihombing, E.G.B., Panjaitan, LP, 2021. Variabilitas Suhu Permukaan Laut Dan Konsentrasi Klorofil-a Di Samudera Hindia Bagian Timur Laut, Barat Sumatera. Jurnal Teknologi Perikanan dan Kelautan 12: 143-159.

[12]. Nagi, A., Napitupulu, G., Radjawane, I. M., Nurdjaman, S., Supriadi, D., & Nurhayati, D. 2023. Pemetaan Zona Potensial Penangkapan Ikan Tongkol di Perairan Teluk Banten. *Buletin Oseanografi Marina*, *12*(3), 379–394. https://doi.org/10.14710/buloma.v12i3.50374

[13]. Paruntu, K. P., Rampengan, R. M., K Manengkey, H. W., Mamuaya, J. M., Windarto, A. B., & Moningkey, R. D. 2019. Suhu Permukaan Laut dan Sekitarnya. *Paruntu Jurnal Ilmiah Platax*, *9*(2), 167–177. http://ejournal.unsrat.ac.id/index.php/platax

[14]. Patty, S. I. 2013. Distribusi suhu, salinitas dan oksigen terlarut di perairan Kema, Sulawesi Utara. Jurnal Ilmiah Platax, 1(3).

[15]. Pelabuhan Perikanan Samudera Bungus (PPS Bungus). 2020. Statistik Perikanan Tangkap Pelabuhan Samudera Bungus. PPSB Pro: Sumatera Barat. 175 hlm.

[16]. Prasetya, K. A., Zainuri, M., Dwi, D., & Ismunarti, H. 2023. Pemetaan Wilayah Tangkapan Ikan Menggunakan Parameter Oseanografi di Perairan Kabupaten Batang. *Indonesian Journal of Oceanography*, *01*(05), 28–35. https://ejournal2.undip.ac.id/index.php/ijoceDiterima/.

[17]. Putu, P., Ardhaneswari, N., Wayan, I., & Suwitra, C. (2024). Analisis Korelasi Pearson Dalam Menentukan Hubungan Harga Dengan Volume Penjualan Wardah Matte Lip Cream Pada Platform E-Commerce Shopee. *Jurnal Jis Siwirabuda*, *2*(2), 151–156. https://s.id/JISSiwirabuda

[18]. Putra, Y. E., H. Syarifuddin., dan W. A. Sumadja. 2022. The Effect Of The Distribution Of Sea Surface Temperature In The Indian Ocean South Of Java On The Catch Of Yellowfin Tuna (Thunnus Albacares) Using Aqua Modis Satellite Imagery. Asian Journal of Aquatic Sciences, 5(2), 169-175.

[19]. Rahmadani, N.A.R., & Jaelani, L.M. 2020. Pemetaan Potensi Penangkapan Ikan Menggunakan Metode Single Image (Studi Kasus: Perairan Selatan Jawa). Geoid, 15(2): 249-255.

[20]. Rosalina, D., Adi, W., Martasari, D., 2011. Analisis tangkapan lestari dan pola musim penangkapan cumi-cumi di Pelabuhan Perikanan Nusantara Sungailiat- Bangka. Maspari Journal 02, 26-38.

[21]. Saifudin, S., Fitri, A. D. P., dan Sardiyatmo, S. 2014. Aplikasi sistem informasi geografis (Gis) dalam penentuan daerah penangkapan ikan teri *(Stolephorus Spp)* di perairan pemalang Jawa Tengah (Doctoral dissertation, Diponegoro University).

[22]. Siregar, S. N., L. P. Sari., N. P. Purba., W. S. Pranowo., dan M. L. Syamsuddin. 2017. Pertukaran massa air di Laut Jawa terhadap periodisitas monsun dan Arlindo pada tahun 2015. Depik, *6*(1), 44-59.

[23]. Siregar, E. S. Y., Siregar, V. P.dan Agus, S. B. 2018. Analisis Daerah Penangkapan Ikan Tuna Sirip Kuning Thunnus Albacares Di Perairan Sumatera Barat 41 Berdasarkan Model GAM. *Jurnal Ilmu dan Teknologi Kelautan Tropis*, 10(2): 501-516.

[24]. Sinaga Nurlice. 2024. Pemetaan Suhu Permukaan Laut Terhadap Potensi Kelimpahan Ikan Cakalang *(Katsuwonus Pelamis)* Menggunakan Satelit Landsat 9 Oli Di Perairan Kota Padang. Skripsi Unja.1-60.

[25]. Subono, M., Zainuri, M., Prasetyawan, 1.B., 2017. Distribusi klorofil-a dan suhu permukaan laut di perairan Astanajapura Kabupaten Cirebon. Jurnal Oseanografi 6, 377-386.

[26]. Suman, A., Irianto, H. E., Satria, F.dan Amri, K. 2017. Potensi dan tingkat pemanfaatan sumber daya ikan di wilayah pengelolaan perikanan Negara Republik Indonesia (WPP NRI) Tahun 2015 serta Opsi Pengelolaannya. *Jurnal Kebijakan Perikanan Indonesia*, 8(2): 97-100.

[27]. Suprijanto, J., Widowati. L. Wirasatriya, A., Khasanah, U.N., 2019. Spatio- Temporal Distribution of Chlorophyll-a in the Northern Waters of Central Java Using Aqua-MODIS, in: IOP Conference Series: Earth and Environmental Science. Institute of Physics Publishing. https://doi.org/10.1088/1755- 1315/246/1/012050