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ESTIMATION OF POTENTIAL ZONE OF MACKEREL FISHING BASED ON SEA SURFACE TEMPERATURE AND CHLOROPHYLL-A IN WATERS INDRAMAYU USING A CITRA AQUA MODIS

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ABSTRACT

The objective of this study was to analyze the relation of chlorophyll-a and sea surface water concentration distribution to the mackerel fish catch in the territorial waters of Kabupaten Indramayu and to estimate the map of mackerel fishing potential zone in the territorial waters of Kabupaten Indramayu. The method used in this research is survey method, descriptive discussion with quantitative and correlation approach. The research data includes sea surface water and chlorophyll-a which were obtained using satellite images from KPL Mina Sumitra Indramayu. The result of this study shows that the highest temporal distribution of sea surface temperature tends to occur in the transition season 1 (March-May). The temporal distribution of chlorophyll-a concentrations shows that values tend to be high in the West season (December-February). Distribution of sea surface temperatures tend to have a cooler pattern toward offshore waters and warmer towards coastal waters. Spatial distribution of chlorophyll-a concentration has a tendency to be smaller in offshore waters and higher in the coastal waters. In general, the correlation between sea surface water and chlorophyll-a on CPUE of mackerel fish was quite high. The correlation between sea surface temperature and CPUE of mackerel fish was 0.436. Correlation of chlorophyll-a concentration to CPUE of mackarel fish was 0,431. The estimation of the potential zone of mackerel fishing is located at the latitude line 5ºS and longitude line 108ºE.

Key words : fishing ground, chlorophyll-a, mackerel, waters indramayu sea surface temperature

Introductions

Capture fisheries business becomes the main sector of coastal communities in Indramayu. In addition, capture fisheries business has an important role in providing food for the majority of the population in Indramayu. Mackerel (Scomberomorus spp) is an important economic fish in Indonesia. Information on the potential zone for mackerel fishing is one of the important factors in determining the success of fishing operations.

One of the problems faced in efforts to optimize fishing, especially large pelagic fish, is the very limited information on where fish are. In general, fishermen are still fishing traditionally, as a result fishermen cannot anticipate changes in oceanographic and weather conditions that are closely related to dynamically changing fishing grounds. Oceanographic factors that influence the presence of fish are sea surface temperatures, this factor greatly influences the presence of large pelagic fish because fish will live at temperatures that are in accordance with their body temperature and fish will always move from one place to another.

Chlorophyll-a is one of the important factors to find out the existence of fish because high primary productivity will attract fish to come looking for food. The abundance of aquatic productivity can be shown by the content of chlorophyll-a concentration and can be used as a measure of the number of phytoplankton in the water (Kushardono 2003).

Efforts to improve the efficiency of fishing activities require spatial and temporal information about perspective locations for fishing activities. At present there is a technology known as remote sensing satellites that has the ability to detect oceanographic parameters such as sea surface temperatures associated with the presence of fish in a waters.

Method

The method used in this research is survey method, descriptive analysis with quantitative approach and correlation. The data used in the form of secondary data consisted of mackerel fish catch data obtained from KPL Mina Sumitra Indramayu as well as satellite image data of sea surface temperature and chlorophyll-a which were downloaded from the NASA database www.oceancolor.gsfc.nasa.gov. Secondary data

is processed using software that produces output in the form of horizontal profiles and analyzed spatially descriptively.

The initial stage carried out in the research was the creation of a map of the study area using mapping software. Data on sea surface temperature and chlorophyll-a distribution are downloaded from the page www.oceancolor.gsfc.nasa.gov in .nc format and converted into .xls or .txt files. Mackerel (CPUE) catch data is obtained from KPL Mina Sumitra Indramayu.

Processing stage of mackerel fish production data, data of mackerel fish catch (CPUE) that has been obtained from KPL Mina Sumitra Indramayu. converted into graphical form and analyzed. Zoning of capture activities that have been obtained is then analyzed and assessed based on predetermined indicators.

The relationship between catches and sea surface temperature distribution is known through descriptive analysis between sea surface temperature and catch (CPUE) and chlorophyll-a with catch (CPUE). Correlation analysis is done using Microsoft Excel software. The degree of relationship is expressed by the correlation coefficient (r). The higher the value of r indicates that the relationship is getting closer (Walpole 1995).

Table 1. Range of Correlation Coefficients

R	Correlation
r = 0	There is no correlation
0 < r < 0.2	Very low correlation
0.2 < r < 0.4	Low correlation
0.4 < r < 0.7	Meaningful correlation
0.7 < r < 0.9	High correlation, strong
0.9 < r < 1.0	High correlation
r = 1	Perfect correlation

In determining the potential fishing area (DPI) scoring method is used. Scoring is intended as a score for each class in each parameter. Potential DPI is an area that has the highest weight based on the three indicators, namely the catch, Sea Surface Temperature, and chlorophyll-a. Whereas the potential DPI is the least weighted by the assessment of the three indicators.

Table 2. Determination of DPI Indicators

DPI	DPI Indicators			DPI Categories
	CPUE (Kg/trip)	Klorofil-a (mg/L)	Sea Surface Temperature (^oC)	
DPI	High (n = 6) - Low (n = 4)	Many (n = 6) Medium (n = 4) Litte (n = 2)	Optimum (n = 6) Medium (n = 4) -	Potential (n = 15-18) Medium (n = 11-14) Less (n = 7-10)

Result and Discussion

Types and Fish Production in PPI Karangsong

Fish production with gillnet fishing equipment landed in PPI Karangsong which is the largest production is mackerel and tuna fish among other fish (Figure 1). Mackerel Fish is one of Indonesia's leading fishery commodities. Indonesian mackerel fish production was once the largest in the world defeating the Philippines, Sri Lanka, Yemen and Pakistan (FAO 1984).

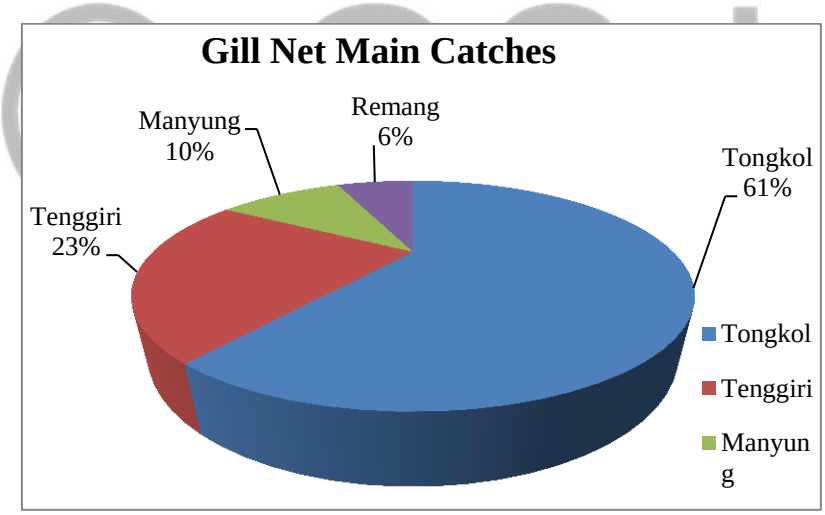

Figure 1. Percentage of Gillnet Main Catches in PPI Karangsong

Mackerel fish production in PPI Karangsong from 2013-2017 experienced an increase and decrease in production each month, the highest amount of production in the last 5 years (2013-2017) was shown in May 2013 and the lowest number of production for 5 years the last (2013-2017) was shown in August 2014 (Figure 2).

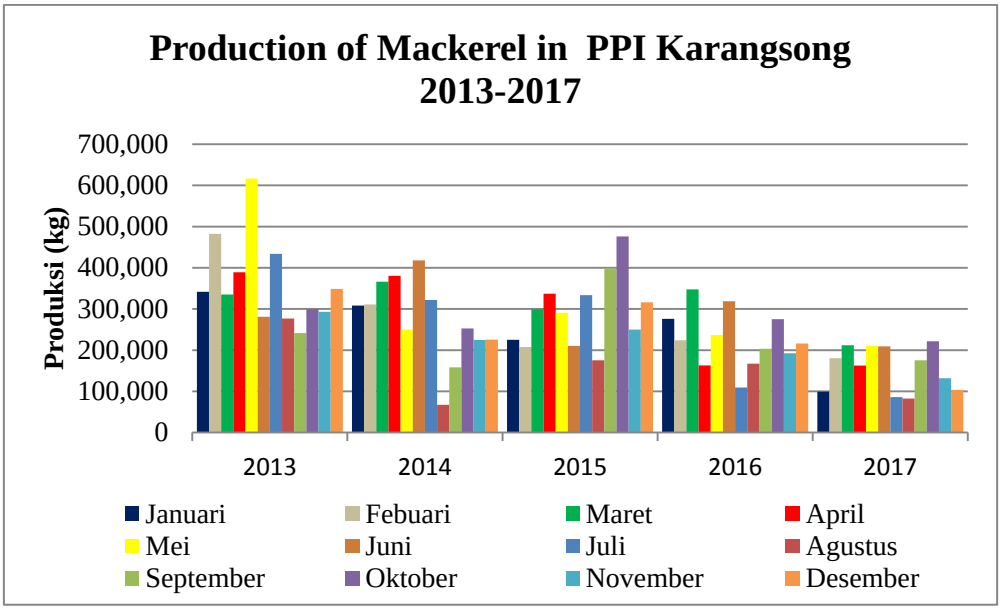

Figure 2. Production of Mackerel in PPI Karangsong 2013-2017

The results of research conducted that the average catch of mackerel fish decreases in July - September every year. The decline that occurred in mackerel fish production was influenced by factors of oceanographic conditions, season, migration, type of fishing gear and number of fishing fleet trips. According to Laevastu and Favorite (1988) fluctuations in fish catches are influenced by the presence of fish, oceanographic factors, number of fishing efforts and the success rate of capture.

Based on production data obtained from the Mina Sumitra KPL with fishing gear used in mackerel fishing, namely gillnet fishing gear, from the production data obtained in PPI Karangsong, CPUE will be calculated. The highest CPUE occurred in the transition season I period with the highest CPUE value of 1646.98 kg / trip in the period of the transition season I in 2013, because there were several factors that affected the high yield of mackerel fish in the Java Sea waters allegedly including the influence of environmental factors such as the season, food availability and biological characteristics. According to Durant & Petit (2003) that the water mass of the Java Sea waters is strongly influenced by the western monsoon winds that carry water masses from the waters of the South China Sea and east monsoon which influence the entry of oceanic water masses from the eastern region (Figure 3).

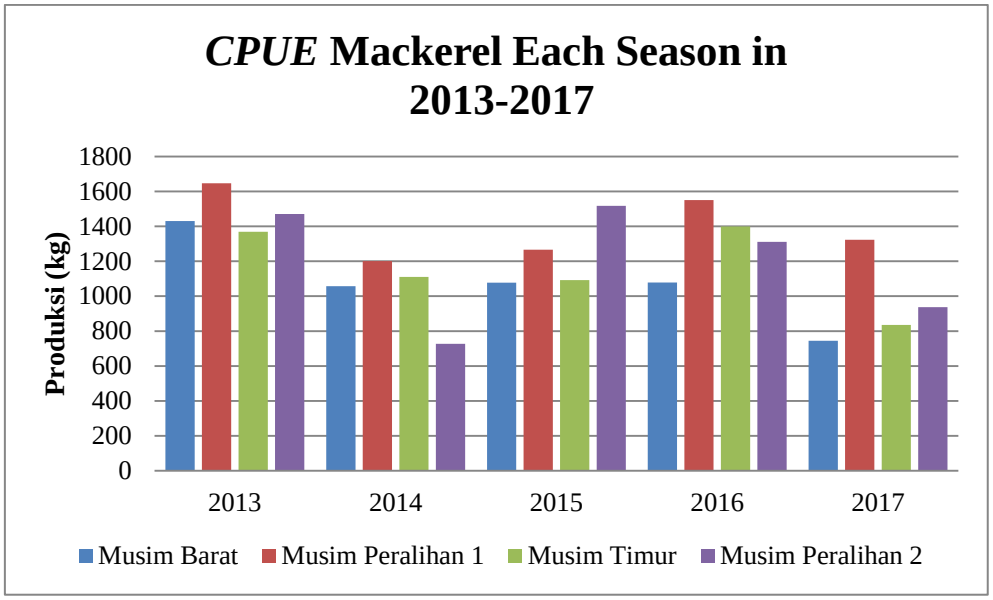

Figure 3. CPUE Mackerel Each Season in 2013-2017

Sea Surface Temperature Distribution for 2013-2017

In the Western season (December-February) in 2013-2017 the condition of sea surface water in the northern waters of Indamayu ranged between 24-34 ° C, while the dominant sea surface water ranged between 28-29 ° C. McPhaden and Hayes (1991) in Ulha (2014) state that wind movement will affect the characteristics of water masses in the sea, one of which is the change in direction of surface currents. Strong wind movements can also affect the occurrence of water mass mixing in the upper layer which results in homogeneous temperature distribution.

Sea surface water conditions, during the Transition I season (March-May) in 2013-2017 in the northern waters of Indramayu and surrounding areas (Java Sea) which have sea surface water distribution values ranging from 28-34 ° C, with the dominant sea surface water distribution ranging between 29 -30 ° C. Transition season I sea surface temperature values tend to be slightly higher than in the west season. This is because the wind is in a weak state and the sea is very calm so that the heating process can occur continuously on the surface of the water by the sun.

The east season values of sea surface temperature tend to decrease compared to the western season and the transition season I even though it is only 1 ° C. In this season surface currents move towards the Northwest by transporting low-temperature water masses. Can occur continuously on the surface of the water by the sun. Transition

Season II is the month (September-November) there is a pattern of heating exchanges and wind direction, dominant winds blowing from the southeast, it is marked as the end of the east season. So that the sea surface water in the waters is almost the same as the West Season.

Chlorophyll-a Distribution in 2013-2017

Chlorophyll-a distribution values in the waters of North Indamayu and its surroundings in the Western season ranged between 0.06-1.4 mg / L but the dominant chlorophyll-a ranged between 0.2-0.4 mg / L. Chlorophyll-a concentration in the west season when compared with the transition season I has a slightly higher concentration value due to the high rainfall that falls in Indonesia, causing a lot of nutrients entering the ocean waters through the river flow. the value of chlorophyll-a concentration in the northern waters of Indramayu ranged between 0.08-1.5 mg / L but the chlorophyll-a which dominated between 0.1-0.3mg / L.

Chlorophyll-a conditions in the transition season I are almost the same as the chlorophyll-a concentration in the west season, the highest concentration values occur in coastal areas and the lowest occurs offshore. Chlorophyll-a concentration in the northern waters of Indramayu and its surroundings in the eastern season ranged between 0.2-1.5 mg / L and the dominating concentration was 0.3-0.5 mg / L.

the increase in chlorophyll-a concentration that occurred in the waters of Indramayu and its surroundings was suspected to have influenced the input of nutrient-rich water masses from areas that experienced upwelling events (Diskanla Indramayu 2015). Chlorophyll-a concentration in the transitional season II in the waters of Indramayu and its surroundings is between 0.8-1.5 mg / L but the dominating chlorophyll-a concentration is between 0.2-0.4 mg / L.

Relationship of Sea Surface Temperature and Chlorophyli-a with Mackerel Catches (CPUE)

The influence of temperature in each type of fish varies, fish will tend to adjust to the temperature that is in accordance with the rate of metabolism, therefore mackerel fish will choose the area with a temperature that is in accordance with its metabolism. The results of Pearson analysis in this study, it can be seen that the correlation value

shows the r value of 0.436 or the value of 0.4 <r <0.7, so it can be stated that the sea surface water factor is quite influential because the correlation that occurs in the SEA sea surface water relationship with the CPUE average is quite close.

Chlorophyll-a concentration is very close to the food chain, where high chlorophyll-a concentration will be defined as phytoplankton in zooplankton waters which will increase productivity which will produce a food chain. The results of the linear regression test showed that the value of R square = 0.186 or 18.6% based on the data, it can be concluded that the value of 18.6% chlorophyll-a factor affects the catch of mackerel (CPUE) in the waters around Indramayu. The remaining 81.4% is influenced by other oceanographic factors such as sea surface water, Flow, Salinity and Sea Surface Height Anomalies. Pearson analysis results in this study, it can be seen that the correlation value shows r value of 0.431 or 0.4 <r <0.7, so it can be stated that the chlorophyll-a oceanographic factor is quite influential because of the correlation that occurs in the chlorophyll-a relationship with the average CPUE close enough.

Estimation of Mackerel Fishing Potential Zones

Based on a result of DPI assessment in the 5-year period (2013 - 2017), it can be concluded that there are still many potential mackerel fishing areas in the northern waters of Indramayu, in other words potential DPIs are areas that at least fulfill two category parameters such as oceanographic parameters with catch. There are 13 coordinate points of potential mackerel fishing areas based on the results obtained from CPUE data, sea surface temperature images and chlorophyll-a distribution images that the optimum potential zone for mackerel fishing is at latitude 5ºS and longitude 108ºE.

Conclusions

1. Sea surface temperature and chlorophyll-a have a fairly close correlation with the CPUE of Mackerel in the waters of North Indramayu with a value of r = 0.436 for sea surface water and a value of r = 0.431 for chlorophyll-a.
2. The peak of mackerel catch with the optimum potential zone of mackerel in the waters of North Indramayu is located at latitude 5ºS and longitude 108ºE.

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