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MAPPING OF PELAGIC FISHING POTENTIALS USING SINGLE IMAGE EDGE DETECTION (SIED) AND TEMPERATURE GRADIENT ANALYSIS (TGA) IN THE WATERS OF PADANG CITY

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ABSTRACT : Padang City waters are one of the waters that have very promising potential for fishermen. This study aims to obtain potential areas for catching large pelagic fish which are analyzed using fashionable image data of chlorophyll a and SST. This research was carried out in November 2021. This research covered the period June, July and August, on June 9 potential zones for large pelagic fish were scattered, based on the distribution of potential large pelagic fish zones a distance of beat tween 1,000 meters to 5,000 resulted in 5 zones of potenzones for large pelagic fish and a distance of 1,000 meters to 10,000 or sea II produces 4 zones indicating the potential for large pelagic fish. In July the potential zone for large pelagic fish increased by 14 potential zones for large pelagic fish from a distance of 5. As a result, the distribution of sea surface temperature increases every month and the distribution of chlorophyll tends to crease. Based on the results of the interpolation of the potential for large pelagic fish, August is a month that has the potential for large pelagic fish catching zones, in the distribution of potential fish zones in the waters of Padang City, the average sea depth is between 10 meters and 50 meters. Based on tests of the accuracy of the distribution of fishing vessels in the waters of the City of Padang, only 5,000 meters from the shoreline, this has resulted in fewer fisherfewerbeing able to explore the potential spread across the waters of the City of Padang because there are no ships with engines with tonnage or wide cruising to be able to explore existing the potential.

Keywords: *Fish Potent ial, Sea Surface Temperature, Chlorophyll–a, Aqua MODIS*

1. INTRODUCTION

Large pelagic fisheries are one of the fisheries commodities that have a relatively high economic value compared to other types of fish. National developments in the production of major pelagic commodities indicate that tuna species experienced production growth during the 2007-2011 period of 4.77%; where skipjack was 3.63%; while the type of tuna decreased by -1.08%. The data shows that as the main commodity with high economic value, the production rate in five years is the main indicator for the level of utilization of large pelagic fish species (tuna, skipjack, tuna and others). The production rate in capture fisheries is determined by how much fishing effort is in exploiting fish resources.Fishing effort is determined based on the dimensions of fishing gear, vessel, number of days of operation, and fishing technology used. (Garcia and Richard, 2005).

In terms of volume, in 2018 Indonesia's large pelagic fish exports amounted to 168.4 pelagic tons or 14.96% of the total export volume of fishery products. This type of large pelagic fish has quite promising economic potential and has high nutritional valuecontained in this fish. Pelagic fish is an easy food that is rich in iodine. This substance is needed by the body to be able to form hormones.thyroxine. The content of iodine contained in fish reaches 83 micrograms/100 grams of fish. While meat contains only 5 micrograms/100 grams. Thus high consumption of marine fish can prevent disease disorders due to a lack of iodine consumption (Gaky). While e the fat content in fish is 70% consisting of unsaturated fatty acids (Unsaturated Fatty Acids). Along with the increase in population in the city of Padang, it also has an impact on increasing the utilization of fish resources in the waters of the city of Padang in the period 2010 - 2020, the average population growth rate in the city of Padang is 5% which results in an increasing demand for meeting the needs of animal protein derived from fish. large pelagic (BPS Kota Padang, 2020).

So far, capture fisheries management has tended to lead to unsustainable patterns. This is due to the approaches and patterns of fisheries development that are carried out in a selective and sectoral manner. Conditions of fishery ecosystems which are characterized by complex ecol linkages and consist of various kinds of resources (multiple*resources*) and is a common property resource (common property resources) that requires the planning and management of fisheries development to be carried out in an integrated and sustainable manner (Fauzi, 2006).

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According to data from the Food and Agriculture Organization (FAO) for 2019, Indonesia currently ranks second in the world's capture fisheries production after China. The high production capacity of China is because it is supported.

While Indonesian fishermen determine their fishing grounds, in general they still use instincts by hunting schools using a simple method of detecting using sonar and GPS assistance, this method is still considered less effective and efficient. The level of uncertainty over catches is quite high, because fishermen do not know the potential locations for fishing where fish are located and the determination of potential fishing areas is strongly influenced by oceanographic parameters of the waters (Basuma, 2009).

2. METHOD

This study focuses on the development of point extraction methods or ZPPI coordinate positions along the single image edge detection line and temperature gradient analysis of the results of thermal front detection from chlorophyll-a images and SST (Sea Surface Temperature) Aqua/Terra MODIS images. The time for research was carried out within a pd of one month, namely in November 2021. The location or place of the arch was carried out in the way of the City of Padang, West Sumatra Province.

Table 1. Research Tools

No.	Tool	Utility
1	Laptops and devices	To process data from the field and make distribution maps of chlorophyll-a and sea surface temperature maps using the application ArcGIS, Surfwith using DataView and sea days
2	Mobile (MOBILE PHONE)	Sea days a documentation tool
3	Stationery	Used to record results community interviews

Table 2. Research Materials

No	Material	Source	Data in extract
1	Imagesatellite Aqua/Terra Fashion Level 3 And 2 Standard mapped Image(SMI)	Image satellite	Chlorophyll A data Temperature Data surface Sea Baimetry data Sea
2		https://earthexplorer.usgs.gov/	Identification ship distribution
3	Dem Sentinel image 1a	https://earthengine.google.com/	through Sar

This index for separating water bodies and land is used to focus research sites on water areas, by applying the NDWI algorithm, it can discriminate between waters and land, where the image bands/waves used are the green bands, swir, equation by (Xu, 2006). Sun glint is also commonly known as Glinting, where sun glint is the spe on the surface of thewater due tothe reflection of the sparkling sunlight, the condition of the sun's glare on the surface of the water can cause errors when mapping the depth of a body of water, then the equation by (Hedley et al. 2005) is applied R'i= Ri-bi(RNIR-minNIR).

The algorithms that work in the empirical bathymetrymethoworkthe ratio transform algorithm, in which this transformation builds the results of the regression equation from the field measurement data with the logarithmic ratio of the two channels. The image used is usually the blue band or coastal band, this algorithm can extract it into a body of wacanepth of 25m, provided the water is in good condition. This method is part of the Empirical Bathymetry method, which is the key in this study using field measurement data, in this study for data

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As a reference for field validation, measurement data is used with eco sounder measurement results by the BWS River Basin Office (Stumpf et.al. 2003)

$$Z = m1n\ (nR\ \lambda i\ )- m0$$
$$n(nR\ \lambda\ )$$

Where :

Z :depth
m1 : is (gain) to each depth ratio
m0 : is (offset)
rw :water reflectance in the ʎi or ʎj band
ʎ : spectral band
n : is a constant value but the area for confidence from the positive logarithm value of each case and the ratio will refer to the linear regression response to the water depth response.

Knowing the condition of SST and the content of Chlorophyll –A

Data processing is carried out to determine the condition and determine the SST of the Aqua MODIS image by performing calculationsusing Brown and Minnet's algorithm (1999) which refers to Algorithm Theoretical Basic Document Modis 25 (ATBD 25) channels 31 and 32 with the followingequation.

$$MODIS\_SST = C1 + C2*T_{31} + C3*T_{31-32} + C4$$
$$*(sec(e)-1)*\ T_{31-32}$$

Keterangan:

T_{31}, T_{32} = *Brightness temperatur* dari kanal 31 dan kanal 32

E = sudut *Zenit satelit*

Data processing carried out in this study for chlorophyll-a level 3 images were processed using the SeaDAS program, for cropping of the study area. According to McClain and Feldman (2004), the OC3M algorithm is used as a standard in processing Aqua MODIS satellite images to obtain global water chlorophyll-a data. The OC3M algorithm equation (O'Reilly et al., 2000), namely:

$$OC3M\ Ca = 10^{0.283 - 2.753\ R + 1.457\ R^2 + 0.659\ R^3 - 1.403\ R\ 4}$$

$$R = \log_{10}\left(\frac{Rrs(443)}{Rrs(550)} > \frac{Rrs(490)}{Rrs(550)}\right)$$

Keterangan : Ca = Konsentrasi klorofil-a (mg/m^3)

R = *Rasio reflektansi*

Rrs = *Remote sensing reflectance*

Interpolation is the process of estimating unknown values using known values around them. The interpolation process is carried out using the ArcMap application10.3. In this research, interpolation is used to interpolate content valuesdistribution of chlorophyll-a and content of sea surface temperature distribution based on sample data. The interpolation process produces a characteristic map of each image.

Next, the process of merging the images or what is known as the Overlay is carried out. Overlays were performed to combine the contours of sea surface temperature images, the contours of the distribution of chlorophyll and the depth of the sea. The intersection of the sea surface temperature contour lines and the distribution of this chlorophyll is assumed to be a fishing potential zone or point.

The potential catchment zone for many fish has a sea surface temperature of around 27°C -30°Cwith a high chlorophyll-a value, so that if the conditions of sea surface temperature and chlorophyll-a are not suitable, it is immediately identified as a small fish catching zone. Analysis for determining the zone is carried out by looking

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at the data resulting from image processing of sea surface temperature and chlorophyll-a and adjusted for the catch of fishermen who have been surveyed previously.

At this stage using an accuracy test using the google earth engine by looking at the distribution of shipscatch fish scattered in the sea of Padang City.

3. RESULTS AND DISCUSSION

At a depth of 10 to 200 meters, this is the depth of the sunlight zone. Inward, it is still illuminated by sunlight, making this sunlight zone has a warm temperature. Most of the fish that live in it are large pelagic fish, such as tuna, skipjack, cob, and other animals. such as coral reefs, jellyfish, starfish, whales, seals, lobsters, salmon, seahorses and phytoplankton are the main food for most marine animals.

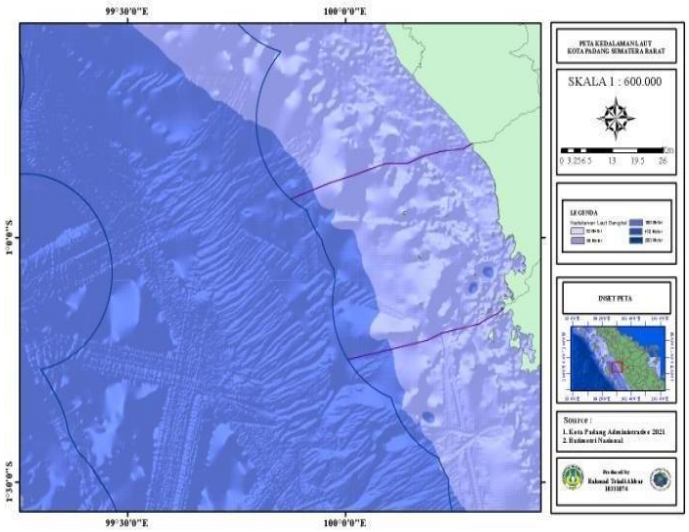

Figure 1. Ocean Depth Map of Padang City

Characteristics of Chlorophyll-a and Sea Surface Temperature in Padang City Waters

Distribution of Chlorophyll – a

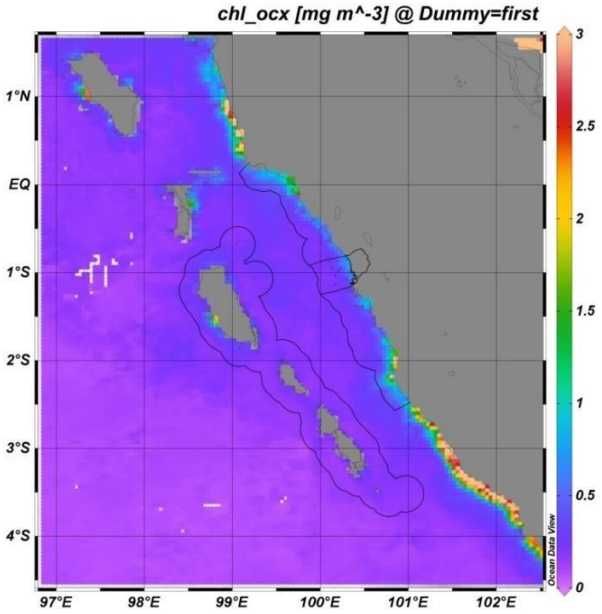

Figure 2. Map of distribution of chlorophyll in July

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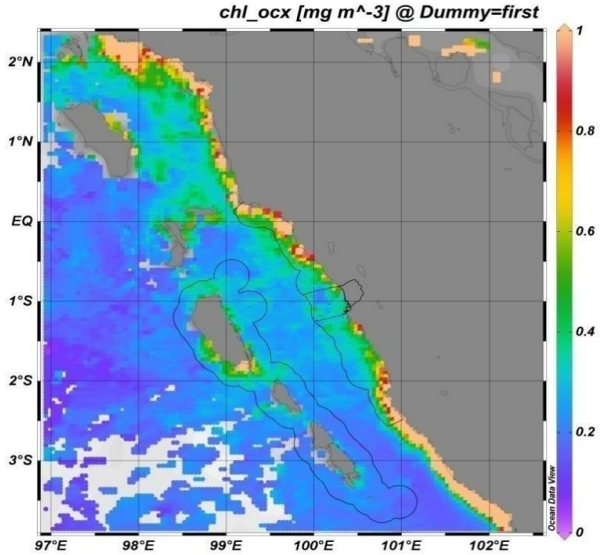

Figure 3. Map of the distribution of chlorophyll in August

The results of the distribution of chlorophyll-a (Chl-a) extracted from the Aqua MODIS satellite imagery recorded from June to August 2018 2021 produces variations in the value of the chlorophyll-a concentration around the Padang City Waters. The chlorophyll-a distribution value extracted from Aqua/Terra MODIS imagery shows that the average chlorophyll-a distribution content value from image recording from June to August was highest in June at 0.607 mg/m3, the chlorophyll-a distribution content value the lowest average in July was 0.210 mg/m3.

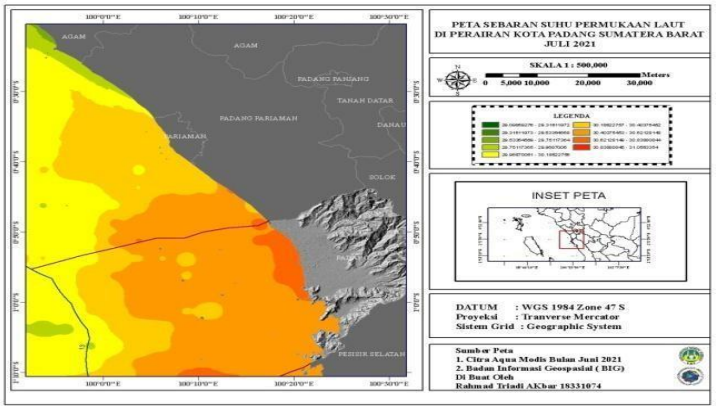

Figure 4. Map of Sea Surface Temperature in the City of Padang for 2021

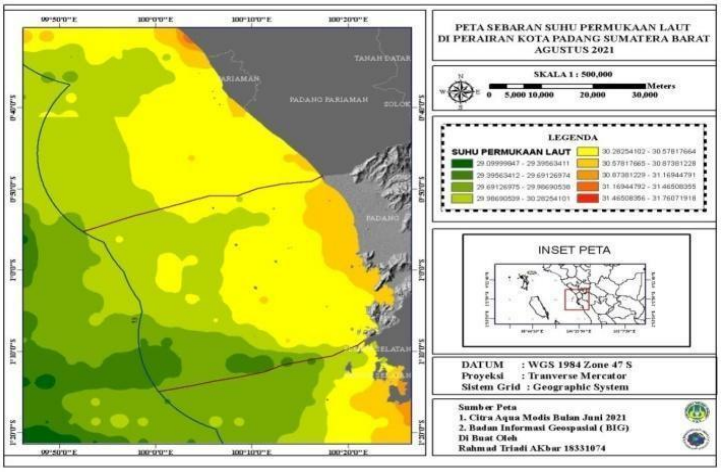

Figure 5. Map of Sea Surface Temperature in the City of Padang for 2021

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The results of extracting sea surface temperature in Padang City waters were carried out using Aqua/Terra MODIS satellite imagery with recordings between June and August 2021. Sea surface temperature distribution values in the range of June – August 2021 shows that the average content value of the distribution The highest sea surface temperature in that month range was in August at 30.56oC, while the lowest content value of the average sea surface temperature distribution was in June at 29.96oC. While the sea surface temperature in the waters of Padang City generally ranges between 28oC - 30oC. At sea depths between 10 – 50 meters the temperature tends to decrease from 25ºC – 15ºC.

Distribution of Predicted Zones for Large Pelagic Fishing Based on SST and Chlorophyll Distribution- A

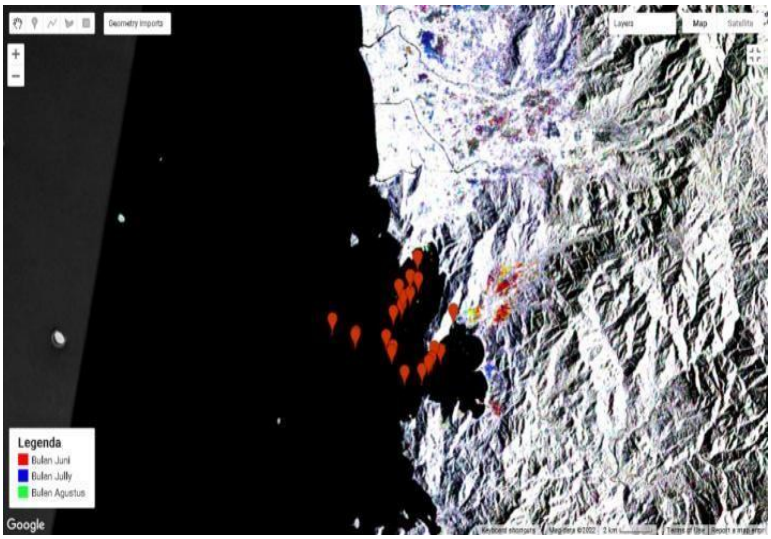

Figure 6. Distribution of fishing vessels in June in Padang City Waters

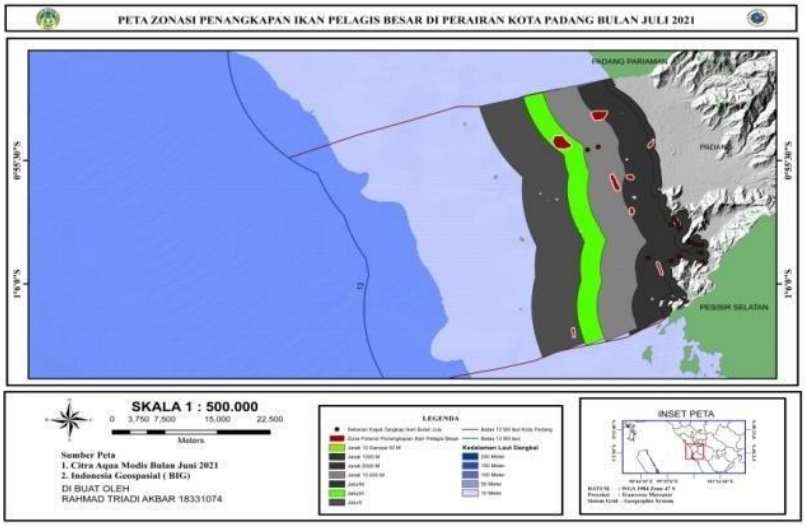

Figure 7. The potential zone for catching large pelagic fish in Padang City waters in July

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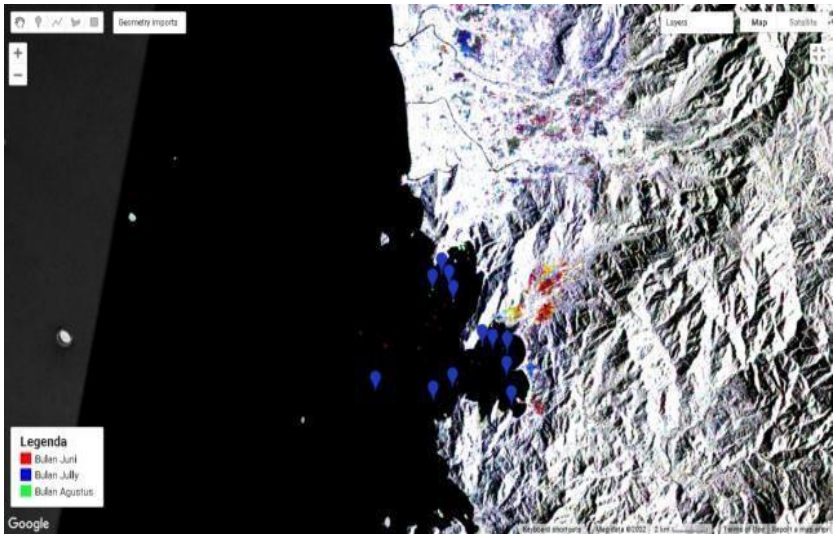

Figure 8. Distribution of fishing vessels in July in the waters of Padang City

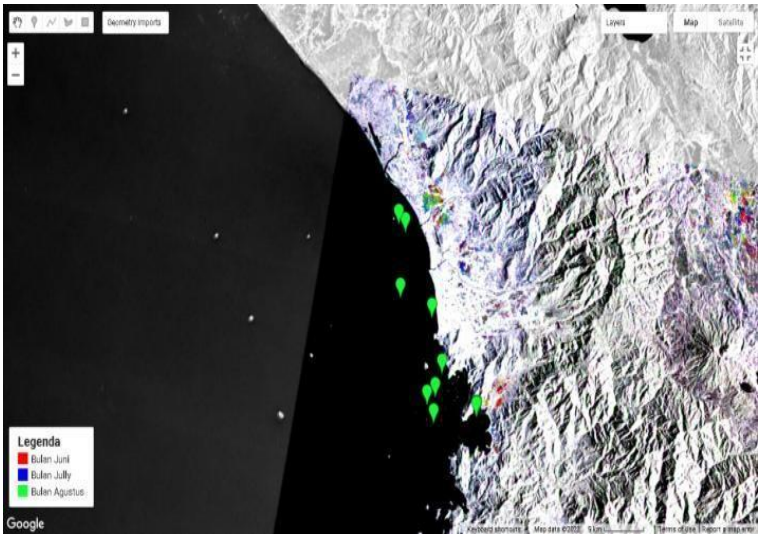

Figure 9. Distribution of fishing vessels in August in Padang City waters

Based on the spatial distribution of MODIS satellite imagery, sea surface temperature in Padang city waters ranges from 27°C - 31°C. This is not much different from Indonesia's sea surface temperature, which ranges from 28°C - 33°C. SST in the waters of Padang City follows the pattern of monsoons that occur in Indonesian waters. In general, the trend of changes in SST that occurred in the waters of Padang City during the research period showed instability. SST in Padang City waters in June shows an average of around 31.2oC and is experiencing the average increase in temperature in July is around 0.2°C, which is in the range of 31.4°C,For the Month of August return experienced an increase that is around 0.08°C SPL instability suspected caused used by factors of meteorology such as air temperature rise. Fertile what contains high chlorophyll concentration, because chlorophyll-a is an indicator of fertility waters.

The concentration of chlorophyll-a content is also strongly influenced by currents in watersheds. Spread concentra chlorophyll-aquatic waters of Padang range from 0.069 mg/m³ to5,282mg/Chlorophyll-radiusedused as an abundance indic phytoplankton in some waters and is one of the parameters influential in determining primary productivity in the waters.Concentration chlorophyll-ain the waters have different values, because they are influenced by oceanographic factors such as sea surface temperature, wind and currents. The distribution of chlorophyll-a concentrations in the ocean generally differs based on time, and at one point the maximum concentration of chlorophyll-a is found near the surface, but at other times it may be more concentrated at the bottom of the euphotic depth (Parsons et al, 2013). The high or low concentration of chlorophyll-a in the waters is very dependent on the oceanographic conditions of a waters. Several parameters that influence and control the distribution of chlorophyll-a are light intensity and nutrients. One of the factors that can increase the concentration

of chlorophyll-a in waters is the presence of upwelling caused by the monsoon wind system. Low concentration of chlorophyll a affected by the lack of nutrient concentration caused by upwelling does not occur on a large scale (Nontji, 1993).

4. CONCLUSION

Based on the results of mapping the potential of large pelagic fish and the accuracy test that has been carried out in this study, it can be concluded as follows:

1. From the results of mapping the potential of this large pelagic fish zone, it can be concluded that the potential distribution of large pealgic fish is generally at sea depths between 10 meters and 100 meters into the sea of Padang City.
2. The monthly average SST in the sea of Padang City in a time series shows an increasing trend of SST in the sea of Padang City in a period of 3 months the sea surface temperature rises 1℃ or 2℃ every month. The value of chlorophyll a concentration every month fluctuates following the ongoing wind season. The concentration of chlorophyll a in the sea of Padang City tends to decrease in the range of 0.22 mg/m3 – 1.15 mg/m3 3. Distribution of SST and chlorophyll-a in Cwaterters Padang changes every month during
3. Month at a predetermined time, namely from June-August 2021, this change occurs in SST which tends to experience an increase and chlorophyll-a which tends to decrease. Based on the overlay results of oceanographic parameters, namely SST and chlorophyll-a, the pelagic fishing zone The biggest potential is in August.

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