Forecast fishing areas in the waters of the Kei Islands based on satellite data

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Abstract. Maluku is one of the provinces in Indonesia which is dominated by the sea. The region of Maluku consisting of small islands and separated by the ocean, makes the majority of the people in this province choose to use the sea as their main livelihood. The sea of Kei Island is one of the considerable fisheries potential. The purpose of this study is to make an estimate of fishing areas by utilizing sea surface temperature data and satellite image data. This study use descriptive method using MODIS-Aqua Chlorophyll-a satellite data and sea surface temperature data. These data will be used to forecast fishing area. Chlorophyll-a as food source of fish in the sea while sea surface temperature influence viability of organism in the sea. With good content of chlorophyll-a and fit the sea surface temperature, that zone has the potential to become a fishing area.

Keywords: sea surface temperature, Modis-Aqua, chlorophyll-a

1. Introduction

Indonesia is one of the biggest maritime country in the world. More than half area in Indonesia covered by the sea, causing the diversity of the ocean varies greatly [1]. Kei islands is one of the area in Indonesia with great ocean diversity, makes the majority of the citizens in this island choose the sea as their main livelihood. To maximize the results in fishing they need to know potential fishing ground. Fishing ground is the area that is targeted for fishing which is there’s a high potential of fish gather around that area. Usually the fishers chose their fishing ground conventionally by seeing the ripples on the sea surface or based on the flying birds that fly over the sea surface.

Sea surface temperature is one of the most important thing for the living things in the oceans because the temperature greatly affects the metabolism and breeding process of marine organisms. The distribution of sea surface temperature could also give us any information about front, upwelling, current, weather and climate and of course the fishing ground [2]. Chlorophyll-a also has an important role in life in the ocean because it was one of the food soure for the fish. Seasonal differences which include rainy, dry, and transitional seasons also affect chlorophyll-a [3]. In the research by Hasyim [4] says that when the surface temperature of the sea in a range of 26°C to 29°C and contains 0.5 mg m⁻³ of chlorophyll, there could be a high potential of fish in that area. Ryan [5] identified forecasting fishing areas in Banda sea based on satellite data and it shows the results of chlorophyll-a and sea surface temperature are very influential in determining the location of fishing area. Sea surface temperature climatology data used in this study are the data during day and night. The satellite image data was obtained from Giovanni NASA server https://giovanni.gsfc.nasa.gov/giovanni included 2018 MODIS-Aqua Chlorophyll-a data.

2. Data and Methods

2.1. Data

The focus area in this research is the sea around Kei Islands with geographical location at 131°E-135°E and 4.0°S-7.5°S. This area covers the entire Southeast Maluku Regency.
The data used in this study is satellite climatology data of sea surface temperature (ºC) and chlorophyll-a (mg m⁻³). This data was obtained from Giovanni NASA’s server (https://giovanni.gsfc.nasa.gov/giovanni) in the form of a netted file format. The range of climatological data used in this research is the average of 2018 data. The sea surface temperature data divided into the day-time data and the night-time data.

2.2. Methods
This study uses a Python programming script. First, these two types of data are readed separately. This data comes in the form of a two-dimensional matrix with latitude and longitude as its dimensions. Each grid in the data has their respective values. The selected Chlorophyll-a data was the monthly data with grid criteria above 0.5 mg m⁻³. The selected sea surface temperature data used the grid of value between 26ºC and 29ºC. Later these two separated selection grids will be combined to make another selection. Grids that meet the criteria of the two previous selections are verified as the grids or the fishing grounds and then the chlorophyll data will be paired with sea the surface temperature data to create a map of the estimated fishing area every month during the day and night.
3. Result and Discussion
The data processing of climatology satellite image of chlorophyll-a with sea surface temperature during day and night-time around the sea of Kei Islands produced a map of the estimated monthly fishing ground around day-time and night-time.
Figure 3. Comparison map forecasts of fishing ground from January to June during the day and night.
Figure 4. Comparison map forecasts of fishing ground from July to December during the day and night.

Figure 3. shows the results of the data processing during January to June of the potential fishing ground around the sea of Kei Islands. Around January to April there only a small distribution of dominant fish gathering areas occurred to the east of the Kei islands which is around the Aru Islands especially at night. The potential areas of fishing ground around the sea of Kei Islands could be seen in
May to its peak in June 2018. The area of potential fishing ground has increased in June around the southwest and southeast of the Kei Islands region. The potential fishing ground area during January to June is dominant at night. In June, the fishing ground area extends further to the sea of Kei Islands and there still no significant differences between day and night conditions. Based on the study of [6] for the Aceh region, the dominant distribution of chlorophyll-a for fishing occurs in June.

The result of the data processing during July to December (Figure 4.) showing the differences in the area of potential fishing ground started in July (a), during the day-time the area of fishing ground is wider compared to the night-time. The peak of the potential fishing ground distribution area thorough to the sea of the Kei Islands was seen August (b), with day-time distribution is still wider compared to the night-time condition. In September, the area with potential fishing ground spread to the northeast of the Kei Islands to the Aru Islands. The potential of the fishing ground area during the day is still greater than at night.

In the research of Variability of the Sea Surface Temperature, Wind Surface, and the Distribution of Chlorophyll-A in Banda Sea during 2006 to 2015 by [7] showing that in the east monsoon season started from June to August, there was a significant decreasing of the sea surface temperature and increasing of the distribution area of chlorophyll-a. This shows the relationship between the decrease in sea surface temperature to the distribution of chlorophyll-a. At this season, the wind blows at quite high speed which caused the vacuum of the water mass above the sea level and makes the deep layer of the mixed mixture of ocean, so the water from the sea contain nutrients rises to the surface of the sea characterized by an increase of the distribution of chlorophyll-a at sea level.

The potential fishing ground map in October shows no significant differences during day and night. Near the end of the year, the condition of the potential fishing ground area is getting narrower and the night condition is greater compared to the daytime.

From the day and night fishing ground map there is a similar pattern in the sea for the cycle of the fishing area contain chlorophyll-a above 0.5 mg m⁻³ and the sea surface temperature between 26°C and 29°C. This cycle is a fishing ground area which is predicted to increase rapidly starting in May and reaching its peak in August where the area of fishing forecasts is the widest compared to the other months and then started to decline in September to the end of the year.

4. Conclusion

The concentration of Chlorophyll-a and the sea surface temperature around 26°C to 29°C in the sea of Kei Islands are quite high in June to August. The highest concentration of chlorophyll-a occurred in June and August. During June, July and August the potential of dominant fishing ground was seen thorough the sea of Kei Islands. In January to April and November to December there were only less potential of the fishing ground areas in the sea of Kei islands.

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