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The Effect of Rainfall and Wind on Fishermen's Fish Catches in Bungsus Harbor, West Sumatra

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ABSTRACT

The purpose of this study was to determine the effect of rainfall and wind on fish catches for fishermen at Bungus Ocean Port, West Sumatra. Rainfall and wind data were obtained from BMKG Teluk Bayur, Padang, while fish catch data were obtained from PPS Bungus staff, West Sumatra. The methods used in this research activity are the survey method and quantitative analysis. The results of this study showed that rainfall in the study area ranged from 0.01-15.4 mm, the average wind speed ranging from 1.0-1.6 m/s for the catch ranging from 334.983-560.145 kg. The results of the analysis between rainfall and wind on fish catches showed the correlation is not too intense because, based on the results of interviews, fishermen make voyage trips or fishing trips where fishing trips are carried out for more than one day, sometimes even more than one month, so additional data is needed for future research in the form of fishing trip data and data of ships departing per trip.

Keywords: Rainfall, Samudra Bungus Harbor, West Sumatera, Wind Speed.

1. INTRODUCTION

Indonesia is located on the equator, and most areas in Indonesia are tropical. However, some regions of Indonesia have considerable rainfall intensity. Rainfall in Indonesia varies greatly spatially and temporally. There are annual and semi-annual cycles in Indonesia's seasonal rainfall pattern. Several studies have categorized the seasonal way rainfall is designed in various parts of Indonesia based on three types: monsoonal, equatorial, and local. Until now, this division has also been adopted by the Meteorology, Climatology, and Geophysics Agency (BMKG) (Perdana, 2015).

Rainfall is the amount of water that falls on the surface of flat land during a specific period measured in millimeters (mm) above the horizontal surface. In another explanation, rainfall can also be interpreted as the height of rainwater that collects in a flat place and does not evaporate, seep, or flow. Indonesia is a country that has varying rainfall rates due to its regions that are at different altitudes. Rainfall of one millimeter means that in one square meter on a flat place, one millimeter of water or one liter of water is collected. Rainfall in Indonesia varies greatly spatially and temporally. There are annual and semi-annual cycles in Indonesia's seasonal rainfall pattern (Machairiyah, 2007).

Indonesia is a vast country influenced by land and sea breezes. The daily wind system is essential in climatology because it occurs regularly and frequently. This is the case in several places in the maritime continent of Indonesia. The heat change between day and night is the main driving force of the daily wind system, as there is a substantial heat difference between the air over land and the air over sea. Because of its limited duration, the daily wind system is usually only effective in relatively small areas and rarely extends or penetrates to distant places. Therefore, this wind system causes local variations (Tjasyono, 2006).

Meanwhile, wind, temperature, and rainfall strongly influence fishermen's catches. In conducting voyages, fishermen pay close attention to weather conditions to catch many fish and not face storms / lousy weather at sea. In Indonesia, the main factors that identify climate change are wind, temperature, and rainfall, measured from the pattern and intensity (Aldrian et al., 2011).

The purpose of the study was to determine the pattern of changes in rainfall and wind at sea and the effect of rain and wind at sea on the catch of fishermen in Bungus Ocean Port, West Sumatra.

2. RESEARCH METHOD

Time and Place

This research was conducted in February-March 2023 at Bungus Port, West Sumatra. The materials used are secondary data from the Meteorology Climatology and Geophysics Agency (BMKG) Teluk Bayur, Padang, and Bungus Ocean Port, West Sumatra, in the form of wind data, rainfall, and fish catches from December 2021 to October 2022.

Data Analysis

Data on rainfall, wind and fish catches obtained from the Meteorology, Climatology and Geophysics Agency (BMKG) Teluk Bayur, Padang, and Bungus Ocean Port, West Sumatra, to see the effect of rainfall and wind at sea on fishing activities will then be discussed descriptively by referring to the literature to provide information on the impact of rains and wind on catches as well as good times and months to make fishing trips for fishermen in the study area. To increase the accuracy of the data, interviews were conducted to obtain information directly from fishermen and port employees.

3. RESULT AND DISCUSSION

General condition of the research site

Bungus Teluk Kabung is a sub-district in Padang city, West Sumatra province, Indonesia. The sub-district consists of two nagari areas, Bungus in the north and Teluk Kabung in the south. Bungus Teluk Kabung sub-district is located within 12 km from the city center and is directly adjacent to Pesisir Selatan Regency (Al-Tanto and Kusumah, 2016).

Rainfall and Wind Parameters

Rainfall is one of the weather parameters that can affect fish catches. The monthly rainfall extreme weather threshold criteria according to BMKG Teluk Bayur, Padang are 0.5-20 mm/day: Light rain. 20 - 50 mm/day: Moderate rain. 50-100 mm/day: Heavy rain. BMKG Teluk Bayur also states four seasons: 1) the western season, November-March; 2) the transitional season, April-May; 3) the Eastern Season, June-August, and 4) the transitional season, September-October.

The state of rainfall that occurs around the waters of PPS Bungus can be seen in Table 1.

Table 1. Average monthly rainfall

Years	Month	Rainfall (mm)
2021	December	0.8
2022	January	0.6
2022	February	0.1
2022	March	0.02
2022	April	0.01
2022	May	0.2
2022	June	0.07
2022	July	16
2022	August	12.8
2022	September	15.4
2022	October	7.5

Based on Table 1 shows that the intensity of rainfall around the Bungus Ocean Fishing Port, West Sumatra, is in the low category, the highest only reaching an average of 16 mm in July, followed by September with an average of 15.4 mm, while the weakest with an average value of 0.01 mm in April. Supposedly, December to March is the highest rainfall, but based on the data, it can be seen that the rain is deficient in that month. The highest occurs in July-September, meaning the rainfall in that month is not too high, or it is called the dry season.

Wind classification can be done to give a value to the amount of wind speed and wave height. The variety in this study uses the Beaufort scale, as in the following Table 2 (Dean and Cahyandi, 2015).

Table 2. Skala Beaufort

Beaufort Scale	Description	Wind Speed (m/s)
1	Quiet	0.3-1.5
2	Slightly calm	0.3-1.5
3	Gusting wind	1.5-3.3
4	Slow wind gusts	3.3-5.5
5	Moderate cool wind	5.5-8.0
6	Strong gusts of wind	8.0-10.8
7	Strong	10.8-13.9
8	Approaching strong	13.9-17.2
9	Strong	17.2-20.7
10	Very strong	20.7-24.5
11	Hurricane	24.5-28.4
12	Severe storm	28.4-32.6
13	Hurricane	32.6-<

The following windrose to determine the direction and range of wind speed based on the

west season, transitional season, and east season can be seen in Figure 1.

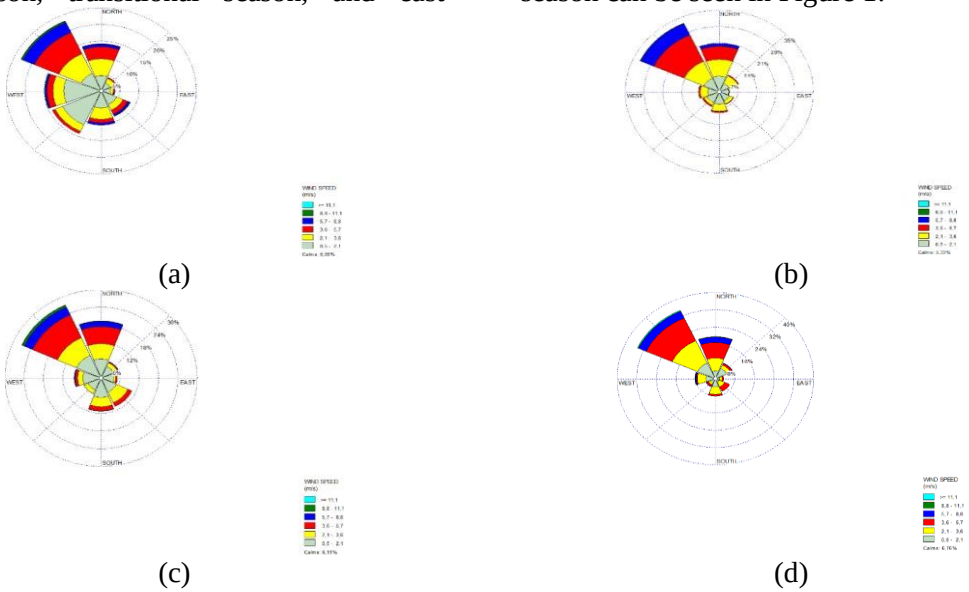

Figure 1. Windrose of west season (a), intermediate season (April-May) (b), east season (c), and transitional season (September-October) (d)

From Figure 1, it can be seen that the dominant wind direction of all seasons is from the northwest. It comes from the northwest with dominant wind speeds ranging from 0.5-2.1 m/s, which is included in the gust wind category according to the Beaufort scale.

Relationship between Rainfall and Wind

Rain is the fall of water particles down to earth when it rains heavily with dense particles that will reduce visibility and be more dangerous if such rain occurs throughout the day, while wind direction and speed affect the safety and security of shipping (Machairiyah, 2007). Meanwhile, wind speed is closely related to the effect of rainfall because the wind can move rain clouds. It also dramatically affects the height of the waves, where the stronger the wind, the bigger the waves (Yogiswara and Sutrisna, 2021).

The relationship between rainfall and wind speed can be seen using linear regression analysis, which can be seen in the following Table 3.

Table 3. Determination coefficient test

Regression Statistics	
Multiple R	0.675225
R Square	0.030704
Adjusted R Square	0.415377
Standard Error	0.241416
Observations	11

Based on Table 3, the determination (multiple R) value is 0.675225, which can be categorized as a high correlation value. In contrast, the value of decision (Adjusted R Square) 0.415377 can be interpreted as the value of wind speed, which is quite influential but not too strong or moderate, with the influence being only 41.5%. Other factors influence the rest.

Effect of Rainfall on Catch

The following is the average monthly catch data.

Table 4. Catch data

Years	Month	Average catch (kg)
2021	December	391.988
2022	January	471.108
2022	February	437.266
2022	March	470.435
2022	April	488.720
2022	May	438.479
2022	June	341.430
2022	July	334.983
2022	August	408.908
2022	September	355.355
2022	October	560.145

The lowest catch in July 2022 was 334,430 kg, while the highest was in October 2022, with an average value of 560,145 kg. The relationship between rainfall and yield can be seen using linear regression analysis, which can

be seen in the following Table 5.

Table 5. Determination coefficient test

Regression Statistics	
Multiple R	0.389533
R Square	0.151736
Adjusted R Square	0.057484
Standard Error	67318.28
Observations	11

The value of determination based on Table 5 (Multiple R) is 0.389533, which can be categorized as a low correlation value. In contrast, the value of adjusted R Square 0.057484 can be interpreted as the deal of rainfall on catches having no effect. Still, it is influential based on the significant value between rain and catches (Table 6).

Based on the table, it can be seen that the significant value is 0.02, where the value is smaller than the value of 0.05, so the rainfall data substantially affects the catch and vice versa.

Table 6. Significant values between rainfall and catches

	df	SS	MS	F	Significance F
Regression	1	7,3E+09	7,3E+09	1,609905	0,23633702
Residual	9	4,08E+10	4,53E+09		
Total	10	4,81E+10			

Effect of Wind Speed on Catch

Changes in weather and climate have influenced fishermen to change their fishing times and areas, which will change the overall amount of fishing effort. Interviews with fishermen and stakeholders from PPS Bungus and Teluk Bayur Meteorology Climatology and Geophysics Station (BMKG), Padang, showed that catches are influenced by meteorological parameters such as wind, waves, currents, and rainfall. In addition to these meteorological factors, the fishing season and voyage trips also affect the catch.

The following linear regression analysis test to determine whether wind affects the catch can be seen in Table 7.

Table 7. Determination coefficient test

Regression Statistics	
Multiple R	0.25292
R Square	0.063968
Adjusted R Square	-0.04004
Standard Error	70715.2
Observations	11

From Table 7 (multiple R), 0.289533 can be categorized as a low correlation value. In contrast, the determination value (Adjusted R Square) -0.040484 can be interpreted as the wind speed value on catches having no effect. However, based on the significant value between rainfall and yields, it affects, as seen in Table 8.

Table 8. Significant values between wind speed and catches

	df	SS	MS	F	Significance F
Regression	1	3,08E+09	3,08E+09	0,615059	0,453035
Residual	9	4,5E+10	5E+09		
Total	10	4,81E+10			

It can be seen in Table 8 that the significant value is 0.04, where the value is smaller than the value of 0.05, so the wind speed data has a substantial effect on the catch and vice versa.

Based on interviews with fishermen at Bungus Ocean Port, West Sumatra fishermen at Bungus port, on average, make a voyage trip or fishing trip where fishing trips can be done once a day, namely leaving in the morning and returning in the afternoon or leaving in the afternoon and returning in the morning/afternoon the next day. But one fishing trip at PPS Bungus can also occur not in one day, more than one day, sometimes even more than one month, and some fishermen say that the most influential on fishing trips are strong currents and high waves.

4. CONCLUSION

Based on the results of the study, it can be concluded that the average wind direction in the waters of Bungus Harbor comes from the northwest, with the category of gusts and

rainfall classified as light rain. The effect of rainfall and wind on catches based on the determination coefficient test has no effect but based on the significant value of rain and wind speed on yields has an impact where the significant f value is small than the value of 0.05 for fishing time at the Bungus Ocean Fishing Port, West Sumatra based on data obtained that wind speed and rainfall are not high in the area so the weather is not an obstacle for fishermen in PPS Bungus, West Sumatra.

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