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CONDITION OF FISHERY CAPTURE AND PERCEPTIONS OF FISHERS' ON CLIMATE CHANGE IN COASTAL AREA OF BANYUASIN II SOUTH SUMATERA

Fedro Try Buana[1], Desi Aryani[1], Mirna Fitrani[2*], and Yulian Junaidi[1]
[1]Social Economics of Agriculture, Faculty of Agriculture, Universitas Sriwijaya, South Sumatera, Indonesia
[2]Aquaculture, Faculty of Agriculture, Universitas Sriwijaya, South Sumatera, Indonesia

*Correspondence Email: fitranimirna@unsri.ac.id

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ABSTRACT

Climate change is a global phenomenon, namely an increase in the earth's temperature as a result of human activities such as the use of fossil fuels and changes in land use. The impact of climate change is a problem faced by fishers that affect the catch of fishers. This study aims to describe the condition of fishery capture and analyze the fishers' perceptions of climate change in the Banyuasin Regency. This research was conducted in Banyuasin II District, Banyuasin Regency, in 5 villages; Marga Sungsang, Sungsang I, Sungsang II, Sungsang III, and Sungsang IV. The method used in this study was a survey and purposive sampling using specific criteria in sample selection. The data obtained in this study consisted of primary data and secondary data. The results showed that the fishers community in Banyuasin Regency has been experiencing the dynamic of temperature, season, and unpredictable rainfall, which impacted daily life activities, such as; the changes in fish catch, sailing time, and the move of fishing spots. The average fisher's perceptions of climate change score from 4 indicators of information, temperature, season, and number of catches were 40.90, which is a high criterion.

Keywords: *Banyuasin, climate change, coastal, fisher's, fishery*

BACKGROUND

The greenhouse effect is a term commonly used to describe the increase in air temperature at the earth's surface and lower atmosphere due to the continuous increase in the concentration of CO_2 and other anthropogenic greenhouse gases in the atmosphere. This increase triggers high rainfall fluctuations and sea level increases in the lowest atmosphere layer, an increase in global temperature felt by people in various parts of the world (Mimura, 2013).

In the fishery sector, climate change causes an increase in sea surface temperature and the frequency and intensity of extreme weather. El Nino and La Nina are atmospheric and ocean dynamics that affect the weather around the Pacific Ocean. El Nino and La Nina are a phenomenon of global ocean interaction with the atmosphere, which results in fluctuations in the sea surface temperature, frequency, and intensity of extreme weather. El Nino and La Nina will affect the lives

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of people living in coastal areas and those who depend on the fishery sector, which is sensitive to climate (Satria, 2015; Ulfa, 2018).

From an oceanographic perspective, coastal areas are the most vulnerable to climate change due to pressure and direct effects on climate change events (Rositasari et al., 2011; Shalsabilla et al., 2022). One area that has also experienced climate change is the Banyuasin Regency. The vulnerability studies that have been carried out show that climate change has occurred. As the center of economic and population concentration, Banyuasin Regency is vulnerable to the impacts of climate change. Green open spaces, water sources, and catchment areas are minimal, so the risk will be greater if there is a change in rainfall (Efrianto, 2017). The purpose of this study is to describe changes in fishers' catches due to climate change and analyze fishers' perceptions of climate change in the Banyuasin II District.

RESEARCH METHODS

This research was conducted in March 2022 in Banyuasin II District, Banyuasin Regency, South Sumatra. A purposive sampling method is used to determine the location, namely Marga Sungsang Village, Sungsang 1 Village, Sungsang 2 Village, Sungsang 3 Village, Sungsang 4 Village. This study's samples include fishers, fishers' wives, and fishers' catch entrepreneurs. The data collected in this study were divided into two types: primary data and secondary data, with the data collection method used was the purposive sampling survey method, which included interviews, questionnaires, and documentation (Sugiyono, 2013). Primary data is information derived from questionnaire responses and direct interviews with research participants in the field. Secondary data consists of a general description of the research location. The survey method was used in this study to interact directly with fishers, housewives of fishers, and fishers' catch entrepreneurs, who were respondents to be interviewed using a questionnaire in order to obtain primary information and data about the impact of climate change on fish fishing behavior. This study used 20 samples of fishers who were divided based on ship ownership criteria.

The direct impact of climate change on fishers is analyzed using data such as changes in yields, costs, and fishing seasons, while indirect impacts include home repair costs and health costs. A Likert scale was used to assess fishermen's perceptions of climate change in the Banyuasin II District. The Likert scale is used to assess a person's opinions, views, knowledge, thoughts, and attitudes toward the social phenomenon under study, and the variables to be measured in research must use several variable indicators (Sugiyono, 2013). There are four indicators of climate change: information, temperature, season, and fish catch, and each question is assigned a score of 1 point for a low standard, 2 points for a medium standard, and 3 points for a high standard. The formula for determining the class interval of each indicator is as follows:

$$VR = HS - LS$$

$$IL = \frac{VR}{NCI}$$

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Information:
VR : Value Range
LS : Lowest Score
HS : Highest Score
IL : Interval Length
NCI : Number of Class Interval

Table 1. Interval Value of Fishers Performance Class in Banyuasin District II

No	Score Total	Score Per Indicator	Score Per-Question	Criteria Score
1	$20 \leq X \leq 33.33$	$5 \leq X \leq 8.33$	$1.00 \leq X \leq 1.66$	Low
2	$33.34 \leq X \leq 44.66$	$8.34 \leq X \leq 11.66$	$1.67 \leq X \leq 2.32$	Moderate
3	$46.67 \leq X \leq 60$	$11.67 \leq X \leq 15$	$2.33 \leq X \leq 3.00$	High

Source: Indonesian Statistics Center, 2019

RESULT AND DISCUSSION

Climate change is characterized by changing world climate patterns resulting in erratic weather phenomena (Hidayati and Suryanto, 2015). According to the Action Plan of the Ministry of Environment (2010), the Marine, Coastal, and Fisheries sector is also a sub-sector that is very much affected by climate change. As the center of economic and population concentration, Banyuasin Regency, South Sumatra, part of the coastal area, is vulnerable to the impacts of climate change. The Sungsang community in Banyuasin Regency said that in recent years the height of the sea waves could even reach 4 meters. Even though many fishing communities are resting at home (not going to sea) because it is hazardous for safety (Ulfa, 2018). Some fishermen are still determined to go to sea (Lidya, 2017). Communities in the area depend on the sea because it is used to meet household needs (Romadhon, 2014; Ulfa, 2018). Fishery commodity fishing activities are distinguished by several types of boats, even those using jool boats and pompong boats, each of which has a different capacity and obtains different results. It proves that the sea in people's lives significantly influences their success.

Impact of Climate Change

The research indicated that climate change had caused changes in rainfall over the last eight years in Banyuasin II District, Banyuasin Regency (Figure 1). This change in rainfall impacts fishing communities and fishing activities using a jool boat and pompong ship in Banyuasin II District, Banyuasin Regency.

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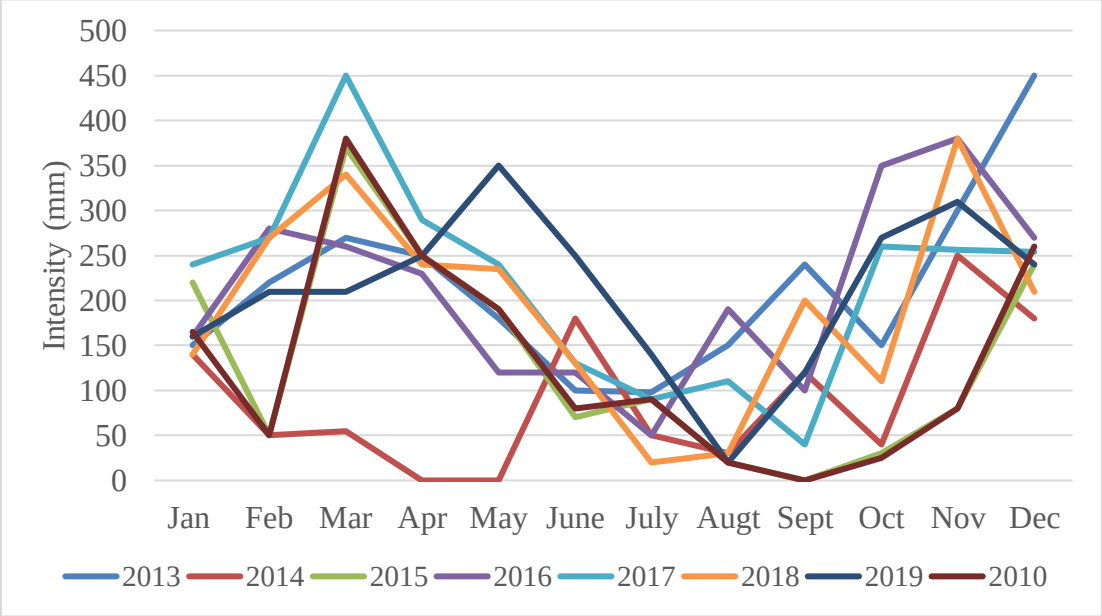

Figure 1. Monthly Rainfall (millimeters) Banyuasin Regency
Source: BMKG, 2020

The rainfall graph in Figure 1 shows the annual change in rainfall by month. The rainy and dry seasons last 5–6 months each year, with the rainy season lasting from September to February and the dry season lasting from March to August, with the latter being fluctuating or unpredictable. The rainfall graph in Figure 1 shows the annual change in rainfall by month. The rainy and dry seasons last 5–6 months each year, with the rainy season lasting from September to February and the dry season lasting from March to August, with the latter being fluctuating or unpredictable.

The rainy and dry seasons shift with different patterns from 2013 to 2020, becoming shorter or longer. As a result, there is a period when the rainy season lasts all year, which has an impact on community activities, particularly fishing, as happened in 2017, when rainfall was high from January to May, then decreased from June to September, and then increased again from October to December. Because of this phenomenon, the fishing community must predict a good time to sail. Climate change also affects the rainy-dry season and fish spawning and directly or indirectly impacts fishing activities (Juana et al., 2013; Muringai et al., 2022). As known, fishers' working hours are determined by the weather and the presence of fish. If the weather is cloudy and windy or there are few fish, the fishers will travel farther to catch them. Fishers in Banyuasin Regency are divided into two groups based on the type of boat they use. A small boat known as a jool boat went to sea around Muara Sungsang or Musi River estuary, and species of fish caught are pirang fish (*Setipinna melanochir* Bleeker), stone head fish (*Osmeridae*), shrimp, and cuttlefish (*Sepia* sp.). Moreover, a large ship known as a pompong travels for a month from the Bangka Strait area to the South China Sea aboard. The direct and indirect effects of climate change on the lives of fishers are shown in the table 2.

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Table 2. Direct Effects of Climate Change

Boat/Ship	Catch Change		Production Cost Change	
	Before year 2013 (Kg/yr)	Within 2021 (Kg/yr)	Before year 2013 (Rp/year)	Within 2021 (Rp/year)
Jool	20,043	15,150	88,949,444	106,739,333
Pompong	14,610	9,818	248,326,737	273,159,411

Source: Primary Data Analysis, 2022

According to Table 2, climate change directly impacts the average catch of jool boat or pompong ship fishers. The average catch of jool fishers decreased from 20,043 kg/year to 15,150 kg/year, and the average catch of pompong fishers was from 14,610 kg/year to 9,818 kg/year. This decrease in catch was followed by increased ship production costs, such as the jool boat's production cost increasing from Rp 88,949,444 to Rp 106,739,333, and the pompong ship's production cost increased from Rp 248,326,737 to Rp 273,159,411. These changes in catches and production costs have forced fishers to rearrange their spending on household and school expenses. It was also expressed by Isdianto & Oktiyas (2019), climate change impacts the changes in fishing activities, such as; increased sea risk, reduced fish production, increased sea costs, ineffective use of fishing gear, and difficulty determining catchment areas. Thus, it resulted in changes in their daily expenditure routine (Helmi & Satria, 2012).

Table 3. Indirect Effects of Average Climate Change

Boat/Ship	Home Improvement		Health Fee	
	Before year 2013 (Rp/year)	Within 2021 (Rp/year)	Before year 2013 (Rp/year)	Within 2021 (Rp/year)
Jool	750,000	1,150,000	1,250,000	2,500,000
Pompong	650,000	1,000,000	1,250,000	2,500,000

Source: Primary Data Analysis, 2022

Climate change indirectly affects the household of fishing communities, especially jool fishers who build their house using gelam wood and the roofs of zinc houses which will be damaged or broken over time due to erratic heat and rain. The damage was followed by an increased cost of living, raising the cost of repairing the jool fisher's house from Rp 750,000/year to Rp 1,150,000/year, and the cost of repairing the pompong fisher's house from Rp 650,000/year to Rp 1,000,000/year. In addition to the cost of repairing houses, fishing communities must set aside money for health care, which has risen dramatically from Rp 1,250,000 to Rp 2,500,000 for jool fishers and from Rp 1,250,000 to Rp 2,500,000 for pompong boat fishers. These costs are allegedly rising due to environmental and climate change, such as dirtier air, extreme heat or cold, poor water quality, which makes living conditions less suitable, and a decline in public health. As stated by an informant (Sukma), uncertain climate change has reduced the availability of clean water in the environment and has increased the spread of diseases (Cohen et al., 2020; McDermott, 2022). Such as acute respiratory infections (ARIs), cough, and influenza in the community (Mirsaeidi et al., 2016; Towers et al., 2013).

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Climate change also impacts extreme weather conditions (Karl et al., 2010; Huber & Gulledge, 2011). Such as a more extended rainy season accompanied by high sea waves, which cause fishermen to avoid going to sea. According to one of the informants (Renaldang), the current season period cannot be predicted. Because fishers were unaware of changes in weather forecasts, they could not predict the season that would occur. Furthermore, fishers still use traditional and simple methods to determine the best time to go to sea. Another informant (Herman) said that they used the direction of the wind for their fishing activities. When the wind blows from the south, jool fishers can still work to catch fish because there are no waves, but when the wind blows from the west, jool fishers are unable to go to sea, and their catch is reduced due to massive waves. Fishers from pompong boats had a different experience, as they could go out to sea and catch more fish despite the high waves.

Another informant (Alamsyah) added that due to migration patterns changes, fishers need help determining where the fish are located. Bad weather conditions, such as heavy winds, prevent fishers from going out to sea. On the other hand, fishers still dare to go to the sea if the weather conditions are only rainy without heavy winds. Climate change not only affects the time fishers go to sea, but it also reduces fishery resources. Because of diminishing fishery resources, fishers must travel further to the sea to catch fish or shrimp. Despite the stormy seas, Pompong fishers will continue to look for fish from Sungsang Village to the Bangka Strait. It is done in the hope of catching more fish to meet their economic needs. Unlike the pompong boat fishers, the jool fishers cannot go to sea, so they must find alternative ways to meet their daily needs, such as saving, becoming a rickshaw puller, or joining the workers on the pompong ship.

Previous research has found that climate change will significantly impact the physiology and behavior of individuals, populations, and communities. Unfavorable environmental conditions can reduce metabolic rate, change metamorphosis, and affect fish's endocrine system, distribution patterns, growth, and spawning ability (Roessig et al., 2004). All of these changes have a direct impact on the fish population and community structure, which in turn has an impact on the fishery stock (Syahailatua, 2008).

Indicators of Fishers' Perception of Climate Change

Fishers have different perceptions of climate change that occurs in their environment. In this study, fishers' perceptions were measured based on fishers' knowledge of information, temperature, season, and total catches.

Table 4. Average Score of Fishers' Perceptions of Climate Change in Banyuasin Regency

No	Fishers' Perception of Climate Change	Score	Criteria
1.	Information	8.70	Moderate
2.	Temperature	11.80	High
3.	Season	10.75	Moderate
4.	Total Catches	9.65	Moderate
	Total	40.90	High

Source: Primary Data, 2022

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The average score of Banyuasin Regency fishers' perceptions of climate change is 40.90, indicating a high level of concern (Table 4). Fisher's perception of climate change showed that the indicator has an average score of 8.70, categorized as a moderate criterion. Since fishers in Banyuasin Regency rarely get information from the local government, only a few fishers use sophisticated communication devices such as android to get information quickly. For the temperature indicator, the average score of 11.80 is included in the high criteria because most fishers in Banyuasin Regency have experienced and felt changes in temperature in their daily lives. In the season indicator, the average score of 10.75 is included in the moderate criteria because the current fishers have experienced difficulties in determining the season period and need accurate data as their guide. Furthermore, the average score for the indicator of the number of fishers' catches is 9.65, which also includes the medium criteria, because, in recent years, the number of fish catches has decreased due to uncertain climate change, so fishers have difficulty in determining the fishing season (Ulfa, 2018). Climate change is the most significant threat to fisheries and fish productivity, more than other stressors (Mohammed & Uraguchi, 2013; Ndebele-Murisa et al., 2011; Cohen et al., 2016).

Information

Fishers' perception of the information they get about climate change and global warming can be seen in Table 5.

Table 5. Average Score of Fishers' Perceptions to the Information in Banyuasin Regency

No	Indicator	Score	Criteria
1.	Do fishers know about climate change	2.45	High
2.	Ever heard of climate change	2.30	Moderate
3.	Have you ever heard of global warming?	1.90	Moderate
4.	Have you ever experienced land drought?	1.00	Low
5.	Have you ever experienced land flooding?	1.05	Low
	Total	8.70	Moderate

Source: Primary Data, 2022

The perception of fishers in Banyuasin Regency on climate change and global warming is moderate, with an average score of 8.70 (Table 5). Based on this information, a few fishing communities have heard about climate change through television broadcasts or by searching for information using gadgets. However, only a small number of these fishing community groups are aware of the cause of global warming. Even the phrase "global warming" is still foreign to them. It is in line with the information conveyed by Isdianto dan Luthfi (2019) in the Popoh Bay area, East Java, and many coastal communities claim not to understand what climate change is. It also occurs in the north coastal area of ambon island, as informed by Subair et al. (2014). The community does not directly realize the changes that occur. According to Hernawan et al. (2019), knowledge and fishermen's understanding of climate change is empirical based on experience and pragmatic based on weather anomaly characteristics. They have a specific capacity to deal with climate change

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problems. Fishermen make a relatively similar pattern of adaptation, namely changing professions temporarily, but still, as a fisherman is a top job.

Temperature

Fishers' perception of temperature in Banyuasin Regency is described in detail in Table 6.

Table 6. Average Score of Fishers' Perception of the Temperature in Banyuasin Regency

No	Fishers' Perception of Temperature	Score	Criteria
1.	Feel the temperature getting hotter	2.45	High
2.	Feel the wind blowing harder	2.55	High
3.	Feel the temperature getting colder	2.35	High
4.	Feel the impact of climate change	2.35	High
5.	Climate change greatly affects fishing activities	2.10	Moderate
	Total	11.80	High

Source: Primary Data, 2022

The average score of fishers' perceptions of temperature changes due to climate change is a high criterion, with a score of 11.80 (Table 6). Although the score for fishers' perceptions of the effect of climate change on fishing activities is included in the moderate criteria, all perceptions indicate that fishers in Banyuasin Regency have felt the effects of climate change on temperature very clearly. Some of the perceived temperature changes are quite extreme and fluctuate every time. Some of these effects have only a minor impact on fisherman's catch but have a significant impact on the method of determining fishing locations and times. Similar information was reported by Kusnadi (2000), Lekatompessy et al. (2013), and Ulfa (2018) that fluctuating weather, rainfall, and temperature (Aliadi et al., 2008) resulted in the ability of fishermen to determine the seasons. Fishermen were not daring to go to sea, and fishery resources were decreasing, so fishermen chose to look for fish at greater distances.

Season

Fishers' perception of seasons in Banyuasin Regency is described in detail in Table 7.

Table 7. Average Score of Fishers' Perceptions of Seasons in Banyuasin Regency

No	Fishers' Perception of Seasons	Score	Criteria
1.	Feel the longer rainy season	2.55	High
2.	Experience a longer summer	2.50	High
3.	Feel the uncertain season	2.30	Moderate
4.	Feel the climate change since the last 5 years	2.05	Moderate
5.	Climate change causes disease attacks on fish	1.35	Low
	Total	10.75	Moderate

Source: Primary Data, 2022

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The average score of fishers' perceptions of the season is 10.75, which is a moderate criterion (Table 7). It is due to the fishing community has felt the uncertainty of the season period, both the rainy season and the dry season, which is longer than the previous season. It can make it difficult for them to go to sea because if the rainy season lasts for an extended period, the risk when fishers go to sea will be greater due to high water waves (Yao-Dong et al., 2013; Santoso, 2015). Vice versa, if the dry season becomes longer, the difficulty of getting clean water becomes a significant problem in the lives of fishers who use rainwater as a source of clean and drinking water. This condition is also expressed by Yao-Dong et al. (2013) also Wibowo and Satria (2015), that climate change has disrupted conditions of seawater intrusion, coastal erosion, damaged coastal facilities and infrastructure, and inundated low-lying coastal areas or tidal floods. Desmawan (2010) reported that tidal flooding in the area Sayung Sub-District, Demak Regency, Central Java, has caused changes in land use and abrasion on the lips coast, thus making the shoreline more concave into the land and groundwater becomes saline.

Number of Catches

Fishers' perceptions of the number of catches in Banyuasin Regency are described in detail in Table 8.

Table 8. Average Score of Fishers' Perceptions on the Number of Catches in Banyuasin Regency

No	Fishers' Perception of the Number of Catches	Score	Criteria
1.	Have you experienced a decrease in the number of fish or shrimp catches?	2.20	Moderate
2.	Have you ever had trouble catching fish or shrimp?	2.00	Moderate
3.	Have you ever experienced a decrease in the quality of fish or shrimp?	1.60	Low
4.	Have you ever had trouble finding the right place?	1.65	Low
5.	Climate change causes a decrease in the number of production catches	2.20	Moderate
	Total	9.65	Moderate

Source: Primary Data, 2022

Fishers' perception of the impact of climate change on the number of catches has an average score of 9.65 (Table 8). Based on the data, it is known that the fishing communities in Banyuasin II Subdistrict have experienced a decrease in the number of catches, difficulty catching fish or shrimp, a decrease in the quality of their catch, and difficulties in finding suitable places for fishing. These difficulties are caused by climate change, which causes changes in fish migration, high sea waves, hot weather, and erratic rains. That situation has also been reported by Sagala et al. (2014) that according to fishermen interviewed, the western monsoon (rainy season) causes a lot of big waves; in (2010), fisher's did not go to the beach for five days because of high waves. Fishermen have to go to sea as far as 8 miles (10 km from the shoreline) to get fish. A similar condition has been informed by Wibowo and Satria (2015) that climate change impacts storms, flash floods and abrasion, inundation on land low and swamp, coastal erosion, extreme waves and floods, and groundwater, especially extinction of fish habitat.

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CONCLUSION AND SUGGESTION

Climate change has impacted the fishing communities in Banyuasin Regency, such as; changes in fishery activities, time and frequency for sailing, the determination of fishing spots, an increase in temperature, and the uncertainty of seasonal changes that decrease income and health problems. The total average Fishers' Perceptions of Climate Change score from 4 indicators of information, temperature, season, and the number of catches is 40.90, which is included in the high criteria. That data shows how climate change has impacted the lives of fishing communities. This study suggests the involvement of many parties, especially the active role of the government at all scales in supporting the community in their efforts to adapt to the impacts of climate change, including the contribution of non-governmental organizations to identify and increase public awareness of the impacts of climate change.

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