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Level of income, knowledge, and impact of climate change on fishing household in Limau Subdistrict, Tanggamus Regency

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Abstract. The aim of this study was to analyze the level of income, knowledge, and impact of climate change on fishing household. This research was conducted in Pekon Tegineneng, Limau Subdistrict, Tanggamus Regency. Limau Subdistrict is the center of marine capture fishery in Tanggamus Regency. Data collection was carried out from July to August 2020 with total respondent reached 80 fishing households. Respondents were determined through the approach of simple random sampling. The data collected consisted of both qualitative and quantitative data. Data collection was performed through the method of survey, Focus Group Discussion (FGD), and interview with key informants. Data were analyzed by the qualitative descriptive approach. The level of monthly income and expenditure per fishing household amounted to Rp. 4,110,000 and Rp. 3,971,200, respectively. Knowledge level of fisherman about climate change was considered excellent as most fishermen have already known the phenomena of climate and environmental changes. The impact of climate change on fishing household included: difficulty to predict fishing season, change in fishing location (away from the shore), reducing and unpredictable fishing frequency and fishing time, also declining of fish catch.

1. Introduction

Indonesia is a maritime nation with waters cover over two-thirds of this country. Indonesia has a high diversity of marine biota. Water area occupies 6.32 million km² of Indonesia's total area, far greater than the total land area of only 1.91 million km². Indonesia has approximately 17,504 islands spreading over many provinces with biodiversity of 8,500 fish species and 950 coral reef biota. Unfortunately, marine resource is continuously decreasing, resulting in the extinction of marine biota due to uncontrolled exploitation of coastal resources. Besides, there is also crisis of fisherman resources as marked by the declining number of fishermen. There was decline of 4.98 percent or 2.16 million of fishermen in 2013 compared to those in 2012. Whereas, the need for fish to consume increases over years. In 2014, fish consumption in Indonesia was about 38.14 percent and continued to increase to 46.49 percent in 2017 [1].

Crisis of coastal resources in Indonesia cannot be separated from the damage of coastal ecosystem due to many hindrance and the potential environmental damage. One of factors causing the crisis of coastal resources is climate change. The main reason of climate change is human activity, such as deforestation and fossil fuel burning [2]. Climate change occurs globally and has created huge impact in many countries, for instance the increasing intensity of extreme weather, change in rainfall pattern,



increasing temperature, and rising of sea level [3], [4]. The sector of agriculture and fishery is mostly sensitive to the impact of climate change in Asia region [5].

Fishery sector, especially fish catch cannot avoid the phenomena of climate change since fisherman highly rely on fish catch from the sea. Climate change might lead to damage of coastal ecosystem [6] and disaster like floods, drought, tsunami, and so on [7]. The community in coastal area highly depends on the sustainability of coastal resources. Hence, the condition of coastal area will directly affect the life of fishermen.

Climate change leads to vulnerability to the community, particularly those living in coastal area. One of areas potentially affected by climate change is coastal area in Limau Subdistrict which located in Semangka Bay which is directly bordered by Hindia Ocean. Limau Subdistrict is administratively belongs to the area of Tanggamus Regency, Lampung Province. Limau Subdistrict is one of fishery centers in Tanggamus Regency. Besides fish catch, many home industries that processed fish into fish processed product in this area. Climate change has directly and indirectly affected social and economic condition of coastal community [8], [9]. Therefore, fisherman community conduct various social and economic activities as adaptation to climate change. Climate change has caused decreasing quantity of fish catch besides declining fisherman income [10]. Moreover, many fishermen were lack of knowledge about climate change even though they have felt its impact. This study aimed to analyze income, expenditure, knowledge, and impact of climate change on fishing household in Limau Subdistrict of Tanggamus Regency.

2. Research Methods

2.1. Location and time of research

This research was conducted in Pekon Tegineneng, Limau Subdistrict, Tanggamus Regency. The location was purposively selected with consideration that Limau Subdistrict is located in coastal area of Tanggamus Regency in which the community mostly worked as fishermen and in fish processing center. This study was carried out from July to August 2020.

2.2. Design and method of research

This study applied qualitative research design with survey approach. The format of qualitative research is aimed to describe, summarize various conditions, situations, or phenomena of social reality, and try to bring those reality to the surface as attribute, characters, nature, model, or description about certain condition, situation, or phenomena. Moreover, qualitative research is defined as study that collects and analyzes data in the form of words (oral and written) and human behavior without any attempts to quantify the data obtained [11].

2.3. Data source, data collection method, and research respondents

The type of data used in this study consisted of primary and secondary data. Primary data were obtained through household survey, interview with key informants, direct observation, and documentation. Secondary data were collected from literature search/literature study and report/documents from various institutions related to this study. Respondents in this study were fishermen in Limau Subdistrict amounted to 80 fishing households. Data collection method was performed through interview using questionnaire and interview with key informants.

2.4. Technique of data analysis

In term of qualitative research, this analysis was conducted at any time during the study [11]. The activity of data collection and data analysis in this study is inseparable. Both are simultaneously done in a cycle process [12]. Therefore, this study applied the data analysis of interactive model consisted of three stages, namely data reduction, data display, and conclusion drawing/verification [13].

3. Results and Discussion

3.1. Identity of respondents

A total of 80 fishermen were selected as samples (respondents) with average age of 39 years old. This age is included as productive age, indicating that respondents are still able to work optimal in specified job sector [14] [15]. Respondents were dominated by male (61 fishermen) and female (19 fisherwomen). In average, respondents have lived in the area for 27 years and average number of dependents was 2-3 people. Respondent of research was dominated by fishermen of Sundanese ethnic (49 respondents) with education level of SMP (middle school). Education level affects the fisherman capability [16], [17]. The majority of fishermen only had one main occupation, while the the ones who had side job worked as farmer, labor, and entrepreneur. The characteristic of research respondent is provided in Table 1.

Table 1. Characteristics of respondents

No	Characteristics	Description
1	Number of respondents	80 Fishermen
2	Average Age	39 Years old
3	Sex	Male =61, Female 19
4	Length of living in the area (Average)	27 Years
5	Number of Dependents	2-3 People
6	Ethnic	Sundanese=49, Lampungese=18, Javanese=13
7	Education	SD=21, SMP=43, SMA=14, Not graduated from SD= 2
8	Main Occupation	Fisherman=68, Housewife =11, Pekon (Village official)=1
9	Side Job	None=43, Farmer=15, Labor= 6, Entrepreneur=10, Boat builder =2, Driver 2, Teacher=1, Pekon (Village official) =1

3.2. Characteristics of fishing household

Average fishing experience owned by respondents was 19 years, depicting that the community in coastal area of Limau have been fishermen since they were only 18-20 years old. The type of fishing tools used by fishermen in Limau included net and fishing rod. However, local fishermen complained and deeply concerned about the use of dangerous fishing gear, such as tiger trawl by many fisherman from outside Limau area and foreign fishermen who also caught fish in Limau coastal area. The use of tiger trawls could bring negative impact such as damaging marine ecosystem and fish extinction [18], [19]. The type of fish caught was dominated by mackerel tuna, cutlass, selar, mackerel scad, etc. (see Table 2). Fishing frequency of fishermen in Limau coastal area ranged between 1-2 times a week with daily fishing time of 7.1 hours. Characteristics of fishermen in Limau Subdistrict of Tanggamus Regency is presented in Table 2.

Table 2. Characteristics of fishing business

No	Characteristics	Description
1	Fishing experience (Average)	19 Years
2	Type of fishing tools	Net and fishing rod.
3	Type of catch	Mackerel tuna, cutlass, selar, mackerel scad, giant trevally, Spanish mackerel, belida, blue marlin, chub mackerel, tuna, and lobster
4	Daily fishing frequency (Average)	1.55 times
5	Fishing time (Average/day)	7.1 hours

3.3. Level of household income and expenditure

Household income was obtained from the approach of income and expenditure. Two approaches were applied to determine the equilibrium between income and expenditure of fishermen. It is considered as one of efforts to obtain precise and accurate data to identify fishing household income.

3.3.1. Income of fishing household. Income of fishing household was obtained from the sum of income generated by the husband, wife, and children. The source of income is divided into two, namely the main occupation and side job. Not all respondents had side job, there were only 37 out of 80 respondents who had side job. Total fishing household income per month was Rp. 4,110,000, generated from main occupancy of Rp. 3,510,000 and side job of Rp. 600,000. In several fishing households, the wife and children also worked, thus increased the total household income. However, the wife and children did not significantly contributed to the total income as their contribution was only 7.7%, while 92.3% of total fishing household income was gained by the husband (men). Fishing household income in Limau Subdistrict is presented in Table 3.

Table 3. Fishing household income in Limau Subdistrict of Tanggamus Regency

Income/Month	Main (Σ /IDR)	Side (Σ /IDR)	Total (Σ /IDR)
Husband	3,290,000	503,750	3,793,750
Wife	157,500	96,250	253,750
Children	62,500	0	62,500
Total Household Income	3,510,000	600,000	4,110,000

3.3.2. Expenditure of fishing household. Fishing household expenditure in Limau Subdistrict reached Rp. 3,971,200.00/month. Fishing household expenditure in Limau Subdistrict consisted of 13 components of expenditure included consumption (foods), fuel or energy, electricity, wage of worker, maintenance of tools and boat, fishing services, education, health, clothes, communication, toiletries and washing equipment, social cost, and unexpected expenses.

The biggest components of fishing household monthly expenditure were the cost for fuel or energy of Rp. 1,325,093.75 and consumption/foods of Rp. 1,135,625. Both components contributed to 61.96% of total expenditure. Moreover, the smallest components were health expense of Rp. 30,500.00 and fishing service of Rp. 32,312.50. Expense for catching fish was low because most fishermen in Limau Subdistrict caught fish individually without hiring any workers. Hence, only fishermen who sold the fish (called *toke*) who employed workers to catch fish. The level of fishing household expenditure by the source of expenditure is listed in Table 4.

Table 4. Level of fishing household expenditure in Limau Subdistrict

No	Sources of Expenditure	Expenditure/Month (IDR)
1	Consumption/Foods	1,135,625.00
2	Fuel/Energy	1,325,093.75
3	Electricity	123,727.50
4	Wage of workers	185,000.00
5	Maintenance of tools and boat	374,625.00
6	Fishing service	32,312.50
7	Education	264,875.00
8	Health	30,500.00
9	Clothes	56,250.00
10	Communication	43,750.00
11	Toiletries and washing equipment	59,250.00
12	Social (gathering, attending wedding party, etc.)	395,187.50
13	Unexpected Expenses	200,000.00
Total Cost		3,971,200.00

3.4. Knowledge of fishermen about climate change

The data on the knowledge of fisherman in Limau regarding climate change was obtained from the result of questionnaire to identify climate change and social change in the community. Respondents commonly found difficulty to comprehend the implication of climate change, yet they already felt climate and environmental changes in the last few years. Out of 10 questions about climate change, respondents provided positive response concerning climate and environmental changes. The highest percentage of fishermen who answered “yes” when given the statement about climate change was 91.25%, while the lowest was 51.25%. Four statements observed to have the highest answer were: 1) Climate change caused natural disaster (91.25%), 2) Natural condition in coastal area increasingly changed (90.00%), and 3) Air temperature was increasing (90.00%). Normally, the community have already known and felt the occurrence of climate change and natural change in coastal areas [20], [21]. Knowledge level of fisherman on Climate Change in Limau is presented in Table 5.

Table 5. Knowledge of Fisherman about Climate Change

No	Knowledge/Perception	Percentage (N=80)	
		Yes	No
1	Increasing temperature	90.00	10.00
2	Change in coastal area	90.00	10.00
3	Rising sea level	73.75	26.25
4	Ocean waves are getting bigger	62.50	37.50
5	Hurricane frequently occurs	51.25	48.75
6	Hurricane is getting harder to predict	87.50	12.50
7	Wind direction is more unpredictable to predict	76.25	23.75
8	Climate change is caused by excessive use of fuel	88.75	11.25
9	Human activity greatly affect climate change	82.50	17.00
10	Climate change leads to disaster	91.25	8.75

3.5. Impact of Climate Change on Fishing Business

Several studies proved that climate change has caused negative impact on many aspects of life, particularly the life of farmers and fishermen [22], [23] [24]. Based on those studies, climate change led to changes in ocean current, temperature, and eventually the decreasing quantity of fish catch [25]. Moreover, this declining fish catch quantity will decrease income obtained by fishermen, hence climate change will either directly or indirectly affect fisherman welfare.

In this study, fisherman has experienced climate change which significantly affected fishery business. Approximately 67 or 83.75% respondent confirmed that climate change has contributed to the difficulty in predicting fishing season. Furthermore, about 81.25% fisherman have felt the change in fishing location as fishermen were insisted on catching fish further away from the coast. Later, about 58 of 80 fishermen felt the decreasing and unpredictable frequency and fishing time (catching fish) for the last several years due to uncertain environmental condition. A total of 73 fishermen (91.25%) realized that their catch were continuously decreasing in the last few years (See Figure 1). This finding proved that climate change has significantly affected income and economic condition of fishermen in Limau Subdistrict. Thus, systematical effort which involves multi-stakeholders is necessary to enhance resilience and welfare of fishermen in facing climate change.

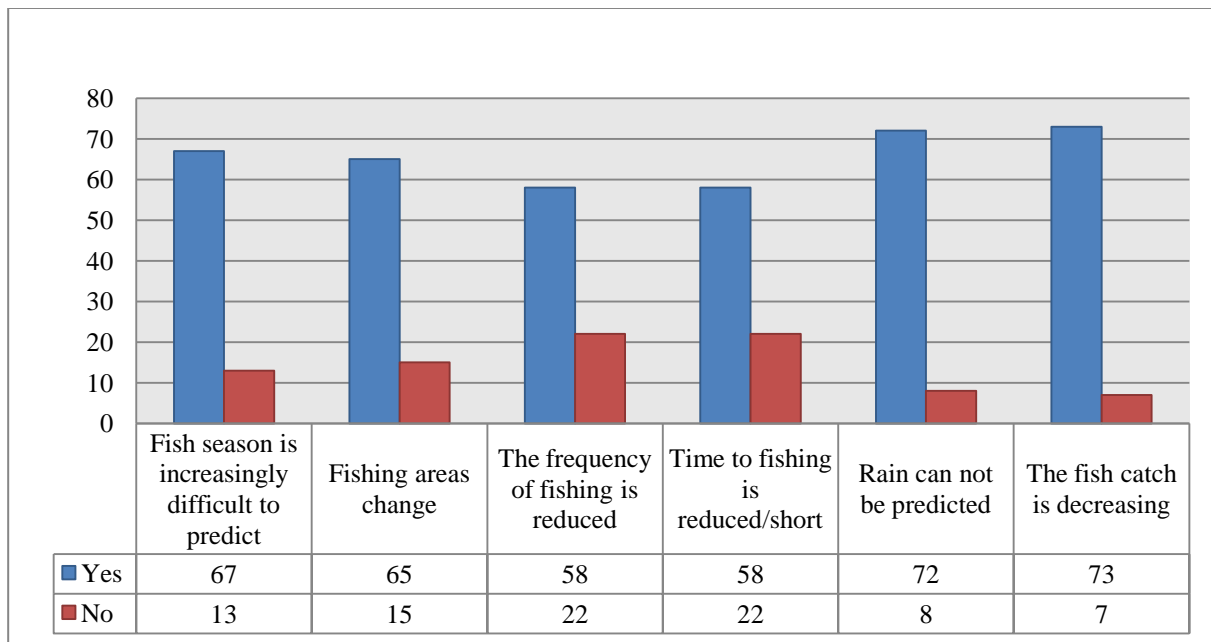


Figure 1. Perception of fisherman about the impact of climate change on fishery industry in Limau Subdistrict of Tanggamus Regency

4. Conclusion

Monthly income and expenditure of fisherman in Limau Subdistrict of Tanggamus Regency reached Rp. 4,110,000 and Rp. 3,971,200 respectively, thus depicting that fishing activity provided sufficient income since it was higher than the monthly household expenditure. Knowledge level of fisherman about climate change was considered excellent. Fishermen mostly have realized the occurrence of climate and environmental changes by observing the aspect of higher intensity of disaster, increasing temperature, and change in coastal area. The impact of climate change experienced by fishermen included: the difficulty to predict fishing season, change in fishing location that is further away from the coast, reducing and more unpredictable fishing frequency and fishing time, unpredictable rainfall, and decreasing quantity of fish catch. Climate change has created impact on the declining fish catch quantity and fisherman income. Therefore, integrated cooperation among several stakeholders is required to build resilience and enhance the welfare of fishing household in facing climate change.

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