Household economic models of gill net fishermen at Madura strait

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Abstract. The purposes of this research was to analyze household economic models of gill net fishermen at Madura strait. 30 families of gillnet fishermen were used for purposive sampling. Data analysis used descriptive qualitative and quantitative (regression analysis). Quantitative descriptive analysis was used to analyze research and compare to factors that affecting household economic models of gill net fishermen family. Research results showed the household economic models of gill net fishermen at Madura strait was production value level or fishermen revenue at sea was strongly influenced by reduction asset production, education level, fuel, and work flow. Work flow rate of fishermen families affected by asset production, non fisheries workflow and number of male workforce. Non fishing income level was strongly influenced by non-fishing business assets, number of family members owned and non-fishing work flow. Spending levels of gill net fishermen at Madura strait was affected by fishing income, non-fishing income, fishermen wife education and fishermen family members.

1. Introduction

And those, who, when they spend, are neither extravagant nor sparingly, but hold a medium (way) between those (extremes), Al-Furqon: 67. Indonesia is a maritime country with territorial waters area three times the entire land area. Therefore, Indonesia has high potential for fisheries. The development potential for Indonesian marine business today is directed at the exploitation of marine and seabed resources as well as the utilization of the function of the national territorial waters, including Exclusive Economic Zone, in a harmonious and balanced way with respect to marine capacity and sustainability to improve people’s welfare and expand business opportunities and field works[1]. Indonesia is a maritime country with the longest beach in the world with a coastline of more than 81,000 km. Out of 67,439 villages in Indonesia, 9,261 villages are categorized as coastal villages and most of their people are poor. Coastal villages are potential pocket of structural poverty. The difficulties to overcome poverty in coastal villages force their residents to bear a burden without knowing when it will be over [2].

The resource potential in Indonesian waters is quite large, especially with the announcement of Exclusive Economic Zone (EEZ) within up to 200 nautical miles limit. The areas that can be exploited and utilized become wider. Based on the evaluation results and the available information, the overall potential of marine fishery resources is 4.5 million tons per annum for Indonesian waters and 2.1 million tons per annum for Exclusive Economic Zone. The total potential estimated includes 3.5 million tons of pelagic fish per year, 2.5 million tons of demersal fish per year, 208 thousand tons of tunas per
year, 69 thousand tons of shrimp per year, 275 thousand tons of skipjack tunas (*Katsuwonus pelamis*) per year and 48 thousand tons of reef fish per year[3].

The phenomena of overfishing and poverty are complex and multidimensional. Low livelihood status is often used as a measure of poverty, but it essentially is only the first link of a number of factors of poverty. In the perspective of political economy, poverty is understood as a product of economic forces, relations of production and power relations, all of which lead to poverty process. Poverty and socio-economic pressures faced by fishermen families are also rooted in interrelated complex factors. Natural factors are associated with the fluctuations in natural structure of fishing season and village economic resources. The factors associated with non natural limitation are fishing technology, poor marketing network as well as negative impact of fisheries modernization policies that has been underway in the last quarter century [4].

The characteristics of fishing communities differ from those of farming communities due to the differences in the existing resources. Farming (agricultural) communities work on controlled land resources to produce a kind of commodity with predictable results. With these characteristics, production locations can be settled. The business mobility is relatively low and the business risk factors are relatively small [5]. In dry season, the income gained from fishing activities is minimal, and oftentimes there is no catch at all. This law catch-season lasts for about eight months, and the savings from the yield obtained during the fishing season will not suffice to overcome difficulties in fulfilling the daily life needs of fishermen’s households. In low-income periods, usually the wives and children of fishermen struggle to earn money by doing any kind of work or to generate income.

At times fishermen donot go to the sea. They do any kind of work on land to earn income to ensure household survival. However, the extent to which the employment opportunities can be obtained by the members of fishermen’s households is affected by the structural characteristics of local village’s economic resources[6]. The structural characteristics of coastal village’s economic resources depend entirely on marine fisheries production. The employment opportunities there are very limited. Other business sectors generally rely on the procurement of raw material from the sea. They will cease to operate. Fishing business is an exploitative business, which is not getting any yield because it relies entirely on the nature. According to Reardon et al. [7], in areas with poor agroclimate conditions, risky agriculture and no insurance market, non-farm activities allow these households to cope with severe downturns in the agricultural productivity.

The primary problem in this study is related to the household economics of fishermen, which is stated as follows: How is the household economic model of gill net fishermen at Madura strait?

2. Methodology
2.1. Research method
The research conducted was qualitative descriptive research under natural setting, and the data collected were qualitative data. The qualitative methods used were based on phenomenological philosophy that promotes the appreciation toward and tries to understand and interpret the meaning of human behavior in certain situations. Qualitative descriptive analysis was used to look into and to know the characteristics in this study. The problem of this research was poverty alleviation and food security for small-scale fishermen at Madura Strait. The analysis unit of this study were the individuals, families, groups and community members who became small-scale gillnet fishermen [8].

In this research, the sample was taken from the population, and questionnaires were employed as the main data collection tool. The survey results can be used to make certain predictions about social phenomena and to conduct an evaluation of the study results [9].

2.2. Data collection method
This study used qualitative and quantitative data. Qualitative data were used to provide additional explanation of a phenomenon. The data collection techniques were interviews, observation, documentation and questionnaires [10].
2.3. Sources and data types
This study collected two types of data, namely primary data and secondary data. Primary data were obtained from primary resources directly as a result of data collection [11]. The primary data were derived from the parties in the research location. The primary data were collected using questionnaire technique from fishermen conducting small fishing, especially gillnet fishing. Structured questionnaires containing a list of questions were prepared in order to obtain more effective and accurate data in accordance with the research objectives.

Secondary data were collected by data-collecting agencies, and they were republished to users [12]. These data were derived from various literaturesuch as textbooks, research journals, research reports, data from relevant agencies and so forth. Secondary data are also called processed data.

2.4. Sampling techniques
It was stated that samples are part of a population that becomes real object [13]. Population is the total number of analysis units with presumed traits [14]. The population of this study consisted of small-scale fishermen, particularly fishhook skippers and gill net fishermen.

In accordance with the problems, objectives and focus of this study, the researchers interviewed several informants who were considered to have considerable knowledge of or to be directly involved in the business activities of small fishing households, and know the problems of fishermen in the Madura Strait. The sample taken was comprised of two groups, namely fishhook skippers and gillnet fishermen. Several sample units were taken from each group. The respondents were determined using purposive sampling technique, which means that the element within the sample were taken purposively if they were representative [15].

Researchers took 30 small-scale gillnet fishermen families using purposive sampling technique. The sampling criteria were as follows: (1) the catching technology used was simple, with small boats less than 30 gross tonnage (GT) in size; (2) the fishermen used machines of less than 12 PK; (3) the fishermen’s venture capital was limited; (4) the catching member generally were the fishermen’s relatives, neighbors or/and close friends; (5) the fishermen’s economic orientation was to fulfill everyday needs; and (5) fishermen needs.

2.5. Data analysis techniques
The data were analyzed qualitatively and quantitatively (regression analysis). Quantitative descriptive analysis technique was used to analyze the research environment, workflow behavior of fishermen families and fishermen’s production expenses. Meanwhile, qualitative descriptive analysis technique was used to analyze and compare factors affecting fishermen families’ economy. It included variables family income, total revenue, family consumption and fishermen’s workflow time [16].

2.6. Regression analysis
In general, regression analysis is used to analyze the relationship between two or more variables. There are variables influenced by the other variables. The variables affected are called dependent variables, while the affecting variables are called independent variables [17].

Multiple regression analysis is a dependency technique. To use this technique, we need to be able to divide variables into dependent and independent variables. Regression analysis is a statistical tool used when dependent and independent variables are metric variables. However, in certain circumstances, there are non-metric variables (dummy, ordinal or nominal variable) that can also be used [18].

Multiple linear regression analysis was used to analyze the relationship between factors that affected food security in fishermen households. These factors included the variables income, total revenue, consumption and workflow time.

This study used dependent variables, fishing production income (SPI) or (Q), non-fishing income (NFI), workflow time at sea (SWF) and total staple consumption (TSC).
So that a regression model is used to identify the relationship between one dependent variable and several independent variables. This model is called multiple regression model [19]. The results of multiple linear regression analysis used in this research are as follows.

a. Sailing Production Income (SPI)

\[ Y = a + b_1x_1 + b_2x_2 + b_3x_3 + \ldots + b_nx_n + e \]  \hspace{1cm} (1)

Description: Q (SPI): Sailing production income (kg/yr). SAV: Ship asset and fishing tool value (IDR). OFS: Operation fuel amount for sailing (L/yr). SWF: Sailing workflow (HOK/yr). EDC: Education (yr)

b. Sailing workflow (SWF)

\[ Y = a + b_1x_1 + b_2x_2 + b_3x_3 + \ldots + b_nx_n + e \]
\[ SWF = a + b_1SAV + b_2OFS + b_3SWF + b_4EDC + e \]  \hspace{1cm} (2)

Description: SWF: Sailing workflow (HOK/yr). SAV: Ship asset and fishing tool value (IDR). FFM: Fisherman's family size (People). NFW: Non-fishery workflow (HOK/yr)

c. Non-Revenue Fisheries (NRF)

\[ Y = a + b_1x_1 + b_2x_2 + b_3x_3 + \ldots + b_nx_n + e \]
\[ NRF = a + b_1NFB + b_2NFW + b_3FFM + e \]  \hspace{1cm} (3)

Description: NRF: Non-revenue fisheries (IDR/yr). NFW: Non-fishery workflow (HOK/yr). FFM: Fisherman's family size (People). NFB: Non-fishery business asset (IDR)

d. Fisherman’s Household Goods Consumption (HGC)

\[ Y = a + b_1x_1 + b_2x_2 + b_3x_3 + \ldots + b_nx_n + e \]
\[ HGC \text{ Scene} = a + b_1ROF + b_2NFI + b_3FFM + b_4FWE + e \]  \hspace{1cm} (4)

Description: HGC: Fisherman's Household Goods Consumption (IDR/yr). ROF: Revenue of fishery activity (IDR/yr). NFI: Non-fishery income (IDR/yr). FMM: Fisherman's family size (People). FWE: Fisherman’s wife’s education (Years)

3.Results

3.1. Regression analysis of sailing production income

The factors that may have affected the sailing production income (SPI) were production asset/IDR (SAV), amount of fuel/L (OFS), sailing workflow/HOK (SWF) and Education/yr (EDC). The results of the calculation to determine the relationship between independent variable and the dependent variable sailing production income (SPI) areas follows:

a. Regression coefficients

The results of the regression analysis areas follows:

\[ Y = a + b_1x_1 + b_2x_2 + b_3x_3 + \ldots + b_nx_n + e \]
\[ SPI = a + b_1SAV + b_2OFS + b_3SWF + b_4EDC + e \]  \hspace{1cm} (5)

\[ SPI = -50 \times 10^3 + 6.34 \text{SAV} + 0.03 \text{OFS} - 0.04 \text{SWF} + 1.60 \text{EDC} + e \]
Table 1. Results of the Regression Analysis of Factors Affecting a Fisherman Fishermen Household Sailing Production Income (SPI).

| Variables | Coef. | t    | Sig. |
|-----------|-------|------|------|
| Constant (a) | -5.00E+08 | -1.71 | 0.09 * |
| (SAV) | 6.34 | 2.07 | 0.05 ** |
| (OFS) | 0.03 | 3.36 | 0.00 *** |
| (SWF) | -0.04 | -1.06 | 0.30ns |
| (EDC) | 1.60 | 0.77 | 0.45 ns |
| Adjusted R² | 0.60 | | |
| F | 8.82 | | 0.00*** |
| N | 30 | | |

The constant 50E107 denotes that when a fisherman is not effected by production assets, fuel amount, sailing work flow and education, he will incur a loss of IDR 50,000,000. A regression coefficient of 6.34 denotes that an increase in production assets by 1 unit will increase fish production revenue by 6.34. A regression coefficient of 0.03 denoted that any addition of fuel by 1 liter will increase fish production revenue by 0.03. A regression coefficient of -0.04 denotes that any addition of sailing work flow by 1 HOK will reduce sailing revenue by 0.04. This was because one works 8 hours at most in 1 day. When working time increases, the revenue will decrease. Furthermore, overfishing in sea fisheries hinders optimum. A regression coefficient of 1.60 denoted that an increase in production assets by 1 unit will increase production revenue by 1.60 at sea. Thus, it is necessary to improve ship technology and fishing tool to increase a fisherman’s productivity [20].

3.1 Multiple regression analysis of sailing work flow time
The factors affecting the sailing work flow (SWF) were asset production/IDR (SAV), fisherman’s families size (FFM) and non-sailing work flow/HOK (NFW). The results of the calculation to determine the relationship between independent variable and the dependent variable non-fishery income areas follows.

Regression coefficients: Based on the data analysis, the regression equation is:

\[ Y = a + b_1x_1 + b_2x_2 + b_3x_3 + \ldots + b_kx_k + e \]  \hspace{1cm} (6)

Table 2. Results of regression analysis of factors affecting fishermen’s Household pouring out Sailing Work Flow (SWF).

| Variables | Coef. | t    | Sig. |
|-----------|-------|------|------|
| Constant (a) | 378 | 3.20 | 0.00*** |
| SAV | -1.50 | -1.19 | 0.24ns |
| FFM | -17.27 | -0.43 | 0.67ns |
| NFW | -0.19 | -0.54 | 0.59ns |
| Adjusted R² | 0.08 | | |
| F | 0.71 | | |
| N | 30 | | |
A constant of 378 denotes that if a fisherman is not affected by production assets, total workforce and non-fishery work flow, he will have a sailing work flow of 378 HOK. A regression coefficient of -1.50 denotes that an increase in production assets will reduce work flow by 1.50 day labourer at sea fishing. This negative result was due to the fact that the addition of production assets will increase a fisherman’s productivity as technological advances will lower physical labor. Weather/season factor is unpredictable, and there is an indication that the sea has been overfished. In this case, local wisdom like andun should be developed to look for other untapped fishery resources [21]. The regression coefficient of -17.27 denotes that an increase in work force will lower sailing work flow by 17.27 HOK. The negative result shows that the waters at Madura Strait have already been overfished. It corresponds to the results obtained from fishermen families, because they worked as artisans, workshop worker and construction workers [22]. A regression coefficient of -0.19 denotes that every additional sailing workflow for off fishing. This is because the work was converted from fishery to non-fishery to get maximum results in a period of 8 hours. Non-sailing workflow per season very small. Therefore, their income is mainly earned from sailing. Lower workflow time for fisheries will allow for time to seek alternative income. This is especially the case for fishermen’s wives, where they voluntarily work in fish processing as local wisdom in fishing communities [23].

3.2. Regression analysis of Non-Revenue Fisheries (NRF)

The factors presumed to have affected non-revenue fisheries (NRF) were the variables non-fishery business asset/IDR (NFB), non-fishery work flow/HOK (NFW) and fisherman’s family size (FFM). The results of the calculation to determine the relationship between independent variable and the dependent variable non-fishery income areas follows:

Regression coefficients:

Based on the data analysis, the regression equation is:

$$ Y = a + b_1x_1 + b_2x_2 + b_3x_3 + \ldots + b_kx_k + e^u $$  \hspace{1cm} (7)

Non Revenue Fisheries (NRF):

$$ NRF = -0.07 + 0.01 \text{NFB} + 0.04 \text{NFW} + 0.02 \text{FFM} + e^u $$  \hspace{1cm} (8)

| Variables   | Coef. | t   | Sig. |
|-------------|-------|-----|------|
| Constant    | -0.07 | -0.03 | 0.98 |
| (NFB)       | 0.01  | 2.74 | 0.01*** |
| (NFW)       | 0.04  | 2.76 | 0.01*** |
| (FFM)       | 0.02  | 0.32 | 0.75ns |
| Adjusted R² | 0.45  |     |      |
| F           | 6.80  |     | 0.02** |
| N           | 30    |     |      |

A constant of -0.07 denotes that if a fisherman is not affected by non-fishery business assets, non-fishery workflow and number of family members, he will lose non-fishery income at 0.07. A regression coefficient of 0.01 denotes that an increase in non-fishery by 1 unit of business assets will increase non-fishery income by 0.01. A regression coefficient of 0.04 denotes that each addition of non-fishery...
work flow by 1 HOK will increase non-fishery income by 0.04. A regression coefficient of 0.02 denotes that each addition of 1 family member will increase non-fishery income by 0.02.

3.3. Multiple regression analysis of fisherman’s Household Goods Consumption (HGC)

Fisherman’s Household Goods Consumption (HGC)

\[ Y = a + b_1x_1 + b_2x_2 + b_3x_3 + \ldots + b_kx_k + e^u \]  \hspace{1cm} (9)

\[ HGC = a + b_1ROF + b_2NFI + b_3FFM + b_4FWE + e^u \]  \hspace{1cm} (10)

Description: HGC: Fisherman’s Household Goods Consumption (IDR/yr). ROF: Revenue of fishery (IDR/yr). NFI: Non-fishery income (IDR/yr) FFM: Fisherman’s family size (People). FWE: Fisherman’s wife’s education (yr).

The factors presumed to have affected the Fisherman’s Household Goods Consumption (HGC) were: Revenue of fisheries (ROF), fishermen family members (FFM) and fisherman’s wife education (FWE). The results of the calculation to determine the relationship between independent variable and the dependent variable Fishermen’s Household Goods Consumption (HGC) areas follows:

Regression coefficients:
Based on the data analysis, the regression equation is:

\[ Y = a + b_1x_1 + b_2x_2 + b_3x_3 + \ldots + b_kx_k + e \]

\[ HGC = 13.82 - 0.01ROF - 0.16NFI - 0.51FFM + 0.21FWE + e^u \]

Table 4. Results of the regression analysis of factors affecting the analysis of Household Goods Consumption fishermen (HGC).

| Variables | Coef.  | t     | Sig.  |
|-----------|--------|-------|-------|
| Constant  | 13.82  | 3.98  | 0.00***|
| ROF       | - 0.01 | - 3.13| 0.00***|
| NFI       | - 0.16 | - 6.03| 0.00***|
| FFM       | - 0.51 | - 8.40| 0.00***|
| FWE       | 0.21   | 0.50  | 0.60ns |
| Adjusted R² | 0.83  |       |       |
| F         | 8.90   |       | 0.00***|
| N         | 30     |       |       |

A constant of 13.82 denotes that if a fisherman is not affected by food and consumption, number of his family members and his wife education, he has a total staple consumption of 13.82 per year. A regression coefficient of ROF of -0.01 denotes that revenue increase will reduce the total staple consumption by 0.01 per year. This is related to the desire to increase business investment in order to increase revenue alternatives. This also affects the fishery revenue when their marine resources have already been overfished [24]. A regression coefficient of NFI of -0.16 denotes that an addition of non-fishery income will lower the total staple consumption by 0.16. Non-fishery income is low because very few fishermen work in the non-fishery fields. This means that the fishermen still rely on sailing in come [25]. A regression coefficient of FFM of -0.51 denotes that an increase in the number of family members will lower the total staple consumption by 0.51. This is because the number of family members linearly will increase the amount of staple and non-staple consumption [26]. A regression coefficient of 0.21 denotes that an increase in a fisherman’s wife’s education (FWE) will increase total staple consumption by 0.21.
The Household Economic Model of Madura Strait Fishermen was as follows: The production value or fishermen’s revenue at sea was strongly influenced by production asset, fuel, work flow and education level. The work flow rate of fishermen’s families was affected by production asset, number of male workforce and non-fishery work flow. Non-fishing income level was strongly influenced by non-fishery business assets, non-fishery workflow and number of family members. The spending levels fishermen at Madura Strait were affected by fishing income, non-fishery income (NFI), family size (FFM) and fisherman’s wife’s education (FWE).

The suggestions of this study are as follows: (1) The examination of fisherman’s household economic model shows that fishermen should meet basic needs such as food, clothing, shelter, health and education. (2) Local production infrastructure and facilities (production asset) should be provided for Madura Strait fishermen communities to obtain cheap, quality infrastructure and facilities. (3) The institutional role of Madura Strait fisherman communities as a collective action platform should be enhanced to achieve individual goals. (3) There should be a promotion of productive economic activities in areas with characteristics corresponding to local resources and have a clear market, which should be carried out continuously with special attention paid to the resource capacity and implemented in the local communities, and to the appropriate use of advanced technology according to the assessment and research. (4) Economic structure of Madura Strait fishermen communities should be realized based on the economic activity in coastal and marine areas as a form of natural sea resources utilization.

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