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Factors Contribute the Existence of Fishing in Comoros

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Abstract

Fishing has been continued to be an important social economic activity in Comoros. It contributes to increase employment. However, the sector has been limited in updating information which concern performance such income, selling as well as food. The objective of this paper was to find factors that contribute fishing in Comoros and how should we conserve them in a good manner. In order to achieve the objective, secondary data were taken which were time series data from 1989 to 2019 and run by using Eviews software. The results revealed that fishing activities increasing every year. Fishermen are generally two per motorized boat. Fishing is commonly a cooperative practice whereby a fisher's agent will sell the fish, though some will also sell directly to the vendors without an agent outside. Price is negotiated based on weight (kg). There was long term relationship between the dependent variable and the independent variables. The per capita income increase as fish captured increase. The increasing of fish caught is prerequisite for any increasing of the inputs such as engine, number of fishermen as well as vessels. Therefore, domestic fish processing should be available. Soft infrastructure is required to compete in fishing, and policies on fishing.

Keywords

Fishing, Comoros Islands, Fishing in Comoros, Eviews Software

1. Introduction

Fishing is a prehistoric practice dating back at least 40,000 years. Since the 16th century, fishing vessels have been able to cross oceans in pursuit of fish, and since the 19th century it has been possible to use larger vessels and in some cases process the fish on board (Craven, 2021).

According to the United Nations, FAO statistics, the total number of commercial fishermen and fish farmers is estimated to be 38 million (Alverson et al., 1994).

In 2005, the worldwide per capita consumption of fish captured from wild fisheries was 14.4 kilograms, with an additional 7.4 kilograms harvested from fish farms. In Africa, fishing contributes much more in the gross domestic production (GDP). In West Africa fishing activities, mostly in the marine artisanal subsector, are a major contributor to GDP. In Central Africa, inland fisheries are the major contributor to GDP. In Southern Africa, marine industrial fisheries are the major contributor to GDP. In Comoros, fishing is the second most important sector of the economy after agriculture (Bakar, 2017).

Comoros is a small country with a surface area of approximately 1660 km^2 and a coastline of 427 km, natural resources and biodiversity constitute a major potential for the national economy. Its fishery potential, which is mainly composed of tuna and tuna like species, is an estimated 33,000 MT per year (Breuil, & Grima, 2014).

The availability of motorized boats along with fish aggregating devices has enabled artisanal fishers to travel further offshore and obtain some varieties of tuna, substantially increasing catches (Xia & Gong, 2014). Due to this, the government makes a lot of facilities which permit this activity to run in a well manner, like license in which every boat must has a license, restriction of not using net in order to catch fish, etc.

Fishermen catch enough fish for domestic uses as well as selling in day to day life.

Therefore, this paper intended to identify factors contribute the existence of fishing in Comoros.

It is anticipated that this paper may be useful to add new information to the stock of existing knowledge on fishing activity to fishery sector and therefore contribute to the literature on fishery sector system of Comoros. Also the results from this paper may additionally be used in other related studies as empirical findings especially those assessing the increasing of motorized boats and fishermen as well as the providing of license to the foreign ships that come to fish in the zone on Comoros Islands.

The most theory used in fishing is the theory known as "Solunar Theory". This theory is developed initially by the American John Alden Knight in 1926 and has been supported by the systematic analyses of scientists and biologists in subsequent years. Solunar Theory states that "Food and other animals move according to the location of the moon in comparison to their bodies".

Loden et al. (2016) Economic Impacts into Onshore Fishing Sites and Fishing Tournaments to the Mississippi Gulf Coast. They conducted on-site surveys (N = 475) to collect expenditures of marine onshore anglers and marine fishing tournament participants in the Mississippi Gulf Coast (Loden et al., 2016). Then they determined the extent and economic impacts of these activities and integrated marine onshore angler economic impacts and attendances into a Geographic Information System (GIS) for the Mississippi Gulf Coast.

2. Methodology

For this research, the data used were secondary data collected from the existing data of the sectors of fishery in Comoros. This method was used through mail, which was employed.

This study used multivariable model. Researchers used various measures to identify the factors. The availabilty of data and the skills of research leads the the researcher to know which approach should be used. In this research, the output (fish catch) was represented as follow:

$$Y = \beta_0 + \beta_1 v_1 + \beta_2 e_2 + \beta_3 F_3 + \beta_4 Pr_4 + \beta_n Pci_n + \cdots + \beta_n X_n + \varepsilon$$

where Y is the output which are fish caught, v is the vessels used, e is the engine, F are the fishermen, Pr is the price and Pci is the per capita income. where β_0, β_1, β_2, β_3 and β_4 are the parameters to be estimeted $x_1, x_2, \cdots, x_n$ are the predictors and ε is the stodastic error terms.

The data had to be tested to determine whether a series is stationary or not. So the Augmented Dickey-Fuller test was used this study. We assessed each independent variable for it factors that contribute to the existence of fishing in Comoros in every independent variable. So, Pairwise Granger Causality Tests was running to see cause and effects of independent to the dependents variable and the verse visa is true. From the findings in **Table 1**, some of the variable were stationary at level and other were stationary at first difference such as captured (tone), engine and vessel were at level I (0), but number of fishermen, price and per capita were found to be stationary after differencing them once I (1). Therefore, the data were now converted to stationary and ready to be running Johasen Test for Co-Integration and Pairwise Ganger Causality Test.

There were variables which were stationary at level and others at I (1). So it is important to confirm whether there is an existence of a long-run relationship between the dependent and the explanatory variables. A suitable econometric methodology is to use co-integration together with error correction model. Therefore, (Johansen test approach for co-integration) is utilized in this study.

Table 1. Augmented dickey-fuller unit root test results.

Variable	Test Statistic (Level)	*P*-Value (Level)	Test Statistic (Differenced)	*P*-Value (Differenced)	Order of Integration
Captured (ton)	−5.55232	0.0008	-	-	I (0)
Engine	−3.75767	0.03873	-	-	I (0)
Number of Fishermen	0.131019	0.9961	−11.7449	0	I (1)
Per Capita	−2.60939	0.279	−5.40519	0.0008	I (1)
Price	−2.84476	0.1935	−5.55232	0.0008	I (1)
Vessels	−5.19971	0.0011	-	-	I (0)

Source: Author's computation from collected data.

From the results, Table 2, none means that there is no co-integration analysis among the four variables, the null hypothesis can be rejected because the P-value is 0.0005 which is less 5%. For the second one at most 1, which means that there is at least one co-integrated, the null hypothesis can't be rejected due to the P-value which is 0.9742 less than 5%. This shows that there is co-integration among the four variables. This implies that there exists a long-run Relationship linking fish captured with explanatory variables in the model.

3. Factors Contribute the Existence of Fishing in Comoros

From the model estimated we found that

$$Y = -20166.9 + 1.54x_1 + 0.0032x_2 + 1787x_3 + 7.333x_4 + 1.8x_5$$

where Y is the fish captured (output), x_1 is the vessels x_2 is the price, x_3 is per capita income, x_4 is the number of fishermen and x_5 is the engine used. The model estimated is very impressive which means that factors contributing the existence of fishing in Comoros are very important.

Vessel is one among the factors that contribute the existence of fishing in Comoros. This is because the government through the Ministry of Agriculture, Fisheries and the Environment has just tabled a bill relating to the nationalization of the Comorian fishing company "Comoros national fishing Company". This local industry has main objective of fabricating vessels, something which makes the Comorian people to buy vessels in their country (Breuil & Grima, 2019).

Price of Comoros' fish has changed over the years. Prior to 2014, a kg of fish was going for 1.45 US$ in 2011 and 1.5 US$ in 2013. This due to the rising of price of petrol and the bad condition of weather as well as the exportation of some fish directly and indirectly (Breuil & Grima, 2019).

In the side of per capita income, the economy of the Comoros is based on subsistence agriculture and fishing. The Comoros, with an estimated GDP per capita income of about $700, is among the world's poorest and least developed nations. As a result, most of the inhabitants make their living from subsistence agriculture and fishing date (Breuil & Grima, 2019).

Table 2. Johasen test result for co-integration.

Hypothesized				
No. of CE (s)	Eigenvalue	Trace Statistic	Critical Value	Prob.
None	0.911187	195.1209	117.7082	0
At most 1	0.854589	124.9055	88.8038	0
At most 2	0.765977	68.98795	63.8761	0.0175
At most 3	0.417988	26.87019	42.91525	0.6886
At most 4	0.285848	11.17351	25.87211	0.8652
At most 5	0.047471	1.410407	12.51798	0.9933

Source: Author's computation from collected data.

The number of fishermen increase every year, since the inauguration of the National School of Fishing and the Merchant Navy in April 1985, which is part of the "non-refundable donations" of Japanese cooperation, the establishment was only its second promotion before the suspending of its training towards the end of the 1990s (Breuil & Grima, 2014).

The engine used in the process of fishing especially tuna fish, the previous engines used was 15 HP and 25 HP and they were YAMAHA. This type of engine allowed fishers to go on of shore with standard speed. Engine increases due to the increasing of techniciens where engine can be repaired once it's broken (Breuil & Grima, 2014).

In the table below pairwise Ganger Causality test employed, whereby there were 29 observations. In this test we had bidirectional, unidirectional and some pairs variables that they did not have causality effect at 5% level of significance as seen in the table below.

Null hypothesis	*P*-value	Decision	Direction causality
ENGINE does not Granger Cause CAPTURED	55%	Do not reject the null hypothesis	No effect
CAPTURED does not Granger Cause ENGINE	27.97%	Do not reject the null hypothesis	
NUMBER OF FISHERMEN does not Granger Cause CAPTURED	13.74%	Do not reject the null hypothesis	No effect
CAPTURED does not Granger Cause NUMBER OF FISHERMEN	40.16%	Do not reject the null hypothesis	
PER CAPITA does not Granger Cause CAPTURED	69.19%	Do not reject the null hypothesis	No effect
CAPTURED does not Granger Cause PER CAPITA	16.98%	Do not reject the null hypothesis	
PRICE does not Granger Cause CAPTURED	53.42%	Do not reject the null hypothesis	Unidirectional
CAPTURED does not Granger Cause PRICE/TON	0.54%	We reject the null hypothesis	
VESSEL does not Granger Cause CAPTURED	72.57%	Do not reject the null hypothesis	Unidirectional
VESSEL does not Granger Cause CAPTURED	3.39%	We reject the null hypothesis	
NUMBER OF FISHERMEN does not Granger Cause ENGINE	1.99%	We reject the null hypothesis	Bidirectional
ENGINE does not Granger Cause NUMBER OF FISHERMEN	1.66%	We reject the null hypothesis	
PER CAPITA does not Granger Cause ENGINE	83.76%	Do not reject the null hypothesis	No effect
ENGINE does not Granger Cause PER CAPITA	74.88%	Do not reject the null hypothesis	
PRICE does not Granger Cause ENGINE	3.22%	We reject the null hypothesis	Bidirectional
ENGINE does not Granger Cause PRICE	2.23%	We reject the null hypothesis	
VESSELS does not Granger Cause ENGINE	45.56%	Do not reject the null hypothesis	Unidirectional
ENGINE does not Granger Cause VESSELS	0.58%	We reject the null hypothesis	
PER CAPITA does not Granger Cause NUMBER OF FISHERMEN	73.18%	Do not reject the null hypothesis	No effect
NUMBER OF FISHERMEN does not Granger Cause PER CAPITA	21.67%	Do not reject the null hypothesis	

Continued

PRICE does not Granger Cause NUMBER OF FISHERMEN	93.25%	Do not reject the null hypothesis	No effect
PRICE/TON does not Granger Cause NUMBER OF FISHERMEN	37.02%	Do not reject the null hypothesis	
VESSELS does not Granger Cause NUMBER OF FISHERMEN	71.85%	Do not reject the null hypothesis	Unidirectional
NUMBER OF FISHERMEN does not Granger Cause VESSELS	0.09%	We reject the null hypothesis	
PRICE does not Granger Cause PER CAPITA	49.09%	Do not reject the null hypothesis	No effect
PER CAPITA does not Granger Cause PRICE	43.09%	Do not reject the null hypothesis	
VESSELS does not Granger Cause PER CAPITA	11.77%	Do not reject the null hypothesis	No effect
PER CAPITA does not Granger Cause VESSELS	20.42	Do not reject the null hypothesis	
VESSELS does not Granger Cause PRICE	76.63%	Do not reject the null hypothesis	Unidirectional
PRICE does not Granger Cause VESSELS	0.07%	We reject the null hypothesis	

4. Pairwise Ganger Causality Test

Therefore, there is relationship between the variable which can lead us to identify factors contributing the existence of fishing in Comoros.

The results of granger Causality shows that there is existence of unidirectional as well bidirectional in some variables and their probabilities were 3.39% for vessel to captured, 1.99% for number of fishermen to engine, 1.66% for engine to number of fishermen, 3.22% for price to engine, 2.23% for engine to price, 0.58% for engine to vessel, 0.09% for number of fishermen to vessel, and 0.09% for price to vessel. This means there is possibility between these variables that one variable can be used to forecast the other.

Fishers provide per fish unit (i.e., quantity of fish caught) into weight (kg) based on an estimated per unit fish weight provided by the fisher. Catch rates (with two fishers on board) ranged from 30 kg/day to 300 kg/day, and averaged at 110 kg/day. The average catch per day was 120 kg during Hasihazi, 80 kg during Husi, and 100 kg during Mbeni.

Fishers' daily income and expenses are highly dependent on catch numbers and composition, seasons, prices, and weather. Powerboat fishers earn on average 62.71 €/day. The minimum earning is 21.19 €/day and the maximum is 211.86 €/day. Powerboat fishers have the capacity to catch much more than canoe fishers. But they are also required to divide their catch in three parts: 1/3 is for the fuel, 1/3 is for the boat owner, and 1/3 is split between the two fishers and 83% of them satisfied with the amount earned from fishing. Fishing enables them for somehow to feed their families, and put their children through school. However, it is important to note that profit margins and income can be high, catch rates can fluctuate significantly and fishing is only in abundance for about 6 months of the year (Béné & Tewfik, 2001).

5. Policy Implication and Recommendation

There is possibility between these variables that one variable can be used to forecast the other such as for vessel to captured, number of fishermen to engine, engine to number of fishermen, price to engine, engine to price, engine to vessel, number of fishermen to vessel, and price to vessel.

Because it is possible to use vessel in forecasting the number of fish captured, price to forecast engine, engine to forecast vessel, etc. There is a need of having factory with high technological management. This can be reached by having infrastructure and capabilities and foreign investment in domestic processing. The access of finance for investment in boats should be provided so as to upgrading the fishing fleet from canoes to fiberglass and increasing the sizes of boats, to travel further. Institutional structure that allows fishermen to overseeing fishing, and human and other resources should be promoted in the country. Workshop and familiarization trip should be organized to investigate the areas that tuna fish is available in high level. Foreign direct investment (FDI) should be invited to help the fishermen to develop various communication tools to be used for promoting those areas as a destination (Moussa et al., 2005).

6. Expectation of the Future

In regard with the above research results, it is obvious that there are other possible factors contributing to fishing in Comoros. Therefore, other variables to be considered and expected for further research includes weather, gear as well as petrol. This study was only limited to the observation of a single direction between the dependent and independent variables. But for the case of future studies one could use panel data in order to oversee the performance of fish catch due to the inputs or independent variables.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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