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ASSESSING THE ECONOMIC INCENTIVE FOR MARINE FISHING AMONG COASTAL COMMUNITIES IN GHANA

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Abstract

Ghana derives over 60% of its annual animal protein from fish. Coastal community fisheries account for more than two-thirds of total marine fish harvests, despite the presence of industrial vessels within Ghana's fishing industry. However, recent assessments indicate that fish landings in most fishing communities have declined, leading to declining fishery livelihoods in fishing communities. Monetizing fishing incentives implies fishing income would be the main reason why marine fishers ply their trade. This is based on Adam Smith's assertion that the self-interest of fishers, not their benevolence would make them provide fish for everyone else. Thus in the face of declining livelihoods, this study sought to assess the role of fishing income as an incentive for sustained marine fishing among Ghana's coastal communities. To construct a fishery production function, the study sought to derive a yield-effort function which gives a steady-state relationship between marine fish yield and fishing effort, where fishing income represents the yield. Cross-sectional data was employed, based on a probability sample of 378 marine fishers from 5 fishing communities in Ghana. The study finds that fishing income, level of education of fishers and fishing trip duration were not significant determinants of sustained fishing in the communities. Ownership of fishing vessel and the age of fishers were however significant determinants of sustained fishing. Therefore, the fisheries sector should provide incentives for the youth in Ghana's coastal communities to obtain alternative employable skills, to reduce the current excessive fishing effort. In addition, the provision of subsidized fishing gear by government will have to cease for artisanal marine fishing to become a means of sustained growth for the Ghanaian economy.

Keywords: Fishing income, Coastal community fishers, Economic incentives, Ghana

INTRODUCTION

Marine fishery resources provide sustenance for a substantial proportion of low income households in many developing economies. About one billion people derive their main or only animal protein from fish. Fisheries also employ over 300 million people both directly and indirectly around the world (IIED, 2016). However, in recent times, fish stocks have dwindled due to overfishing and other causes globally. Despite their importance to several households and economies, fisheries have not received the necessary attention by mainstream policymakers, particularly in developing countries. This neglect has the tendency of aggravating food insecurity, since it puts the livelihoods of several low income communities in jeopardy.

Murray et al. (2011), attribute the inadequate attention to the inability of markets to correctly capture coastal, marine and fishery resource values. This adversely affects policy on the efficient allocation of these resources, leading to excessive exploitation and degradation of marine fisheries, compromising the quality of the services obtained from them (Millennium Ecosystem Assessment, 2005).

Traditionally, fishery resources have been managed to ensure high productivity and substantial economic gains (Salomon et al., 2011). However, fish catch required to satisfy growing food needs appears to have compromised the effectiveness of marine resource conservation (Brander 2010). In view of this, existing regulatory fisheries management and development measures have encouraged a change in unsustainable fishing among coastal fishers but to no avail (Mohammed and Wahab, 2013).

According to Arnason (2000), while some measures to regulate fish exploitation like total allowable catch (TAC) limits and closed fishing seasons could result in increasing fish stocks, their inability to ensure compensation for forgone earnings pose a challenge to the economic condition of fishers. Thus the obvious response to such measures have been the increase in fishing effort thereby offsetting gains realized from such measures.

Under circumstances challenged by failing fishing regulations, economic incentive mechanisms such as payments for coastal ecosystem services (PES) have been proposed to provide the most viable and effective way out. Here, improved practices and benefits forgone through compliance with sustainable fishing practices are rewarded. While incentive based approaches such as PES are not new in terrestrial resource management practices such as forestry, they are still in their formative stage in sustainable fisheries management (Mohammed and Wahab, 2013).

To make economic incentives meaningful to fishing households and to ensure their success, it is worth ascertaining whether these households respond to economic incentives. It is also worth assessing the extent to which these households respond to economic incentives.

Just assuming they do, can lead to policy errors which can exacerbate the existing situation. Therefore, by means of economic incentive instruments and household data, this study sought to ascertain the responsiveness of coastal fishing households to economic incentives in Ghana, to inform policy towards efficient allocation of marine fishery resources for economic growth and development.

Background of the Study

Ghana's fishing industry is made up of fishery resources mainly from marine fisheries, complemented by freshwater fisheries and aquaculture. The sector contributes 4-5% of agricultural Gross Domestic Product (GDP), employing about 10% of the population.

Ghanaians rely on fish and fish products for over 60% of their total animal protein. On the average, Ghana's per capita annual fish consumption is estimated to be between 27 kg and 31 kg. This makes Ghana the 3rd highest consumer of fish worldwide. Marine fisheries contributes over 80% of all fish consumed and exported, with about 75% of the total domestic fish output consumed locally (ENI-SPA, 2015).

The National Development Planning Commission (NDPC) estimated total annual fish requirement for Ghana to be about 1,106,800 metric tonnes in 2016, with an annual domestic production of 465, 356 metric tonnes. The deficit of 641,444 metric tonnes, was catered for with 192,131 metric tonnes of fish imports. The fisheries sub-sector accounted for 1.1% of GDP in 2016 and 1.2% of GDP in 2015 (NDPC, 2017).

The increase in marine fisheries production, the highest contributor to fish supply in 2016, was mainly from semi-industrial, industrial and tuna fishing. The artisanal fisheries sub-sector recorded a 1% decline in output (NDPC, 2017). The Marine sub-sector recorded 243,933.52mt of fish caught in 2017 compared to 294,627.07mt in 2016. This was a 17.21 percent production decline which could be attributed to depleting fish stock levels, combined with negative climate change effects (GOG, 2018 Budget). The small pelagic fish stocks accounting for 70% of fish production in Ghana have dwindled, with recent catches measuring up to only 10% of 1998 catch levels. The result has been increased economic hardship for over 160,000 people directly and livelihoods of about 2.2 million indirect dependents. Also, over 100,000 mt of low cost high nutritionally important fish protein has been lost annually (CFCE, 2017).

Some policy interventions in the subsector have been carried out. These include Ministry of Fisheries and Aquaculture Development (MOFAD) supporting 2,600 artisanal fishers with outboard motors to reduce time spent at sea in 2016 (NDPC, 2017), the implementation of closed seasons and the provision of subsidies on premixed fuel.

MOFAD in its efforts to conserve and protect marine fishery resources, got Industrial Vessel Operators to observe a two-month “closed season” in January and February 2018 based on Section 84 of the Fisheries Act, 2002 (Act 625). To reduce fishing effort, 123 industrial fishing vessels were licensed in 2018 as against a total of 152 in 2017, representing a reduction of 15.45%. Under marine resource management, eleven (11) cluster communities were sensitized on sustainable fishery resource exploitation under the Fisher-to-Fisher Dialogue Initiative. However, the artisanal and tuna fleets recorded landing declines of 33.7% and 5.7% respectively, whiles inshore and industrial fleets recorded increases of about 1,124mt and 797mt respectively from 2017 to 2018 (MOFAD, 2019).

Thus, despite the efforts of state agencies to ensure increased production, there has been a consistent decline in artisanal fish landings since 2016. It may appear as if the harder government tries, the worse the situation gets. The recommended solution under such circumstances is to employ economic incentives. However, a nonresponsive artisanal fishing sector would render economic incentives untenable. Hence the need for this study to determine the extent of responsiveness of Ghana’s coastal household fishers to economic incentives, to inform policy on efficient allocation of marine fish stocks for sustainable development. The following section describes the model used, the variables and the data collection procedure. This is followed by the analysis and discussion of the results. The study concludes with a discussion of the economic implications of the results, with some recommendations on the way forward.

METHODOLOGY

The Study Area

The Ahanta West District of Ghana holds the southernmost point of Ghana, the famous Cape Three Points (Figure 1), and is probably the most priced natural coastal site in the country. The shoreline, is arguably the section of the Ghanaian coastline with the highest landscape value and natural beauty. The extraordinary combination of beaches and rocky outcrops, estuaries, fishing villages, and historic forts combine to give this section of coast its unique qualities (Coastal Resource Centre, 2013).

The study was carried out in five coastal fishing communities (Figure 1) located within the district, namely; Princess Town, Cape Three Points, Akwidaa, Dixcove and Busua. It is estimated that about 60% of the people in the coastal communities of the district engage in fishing.

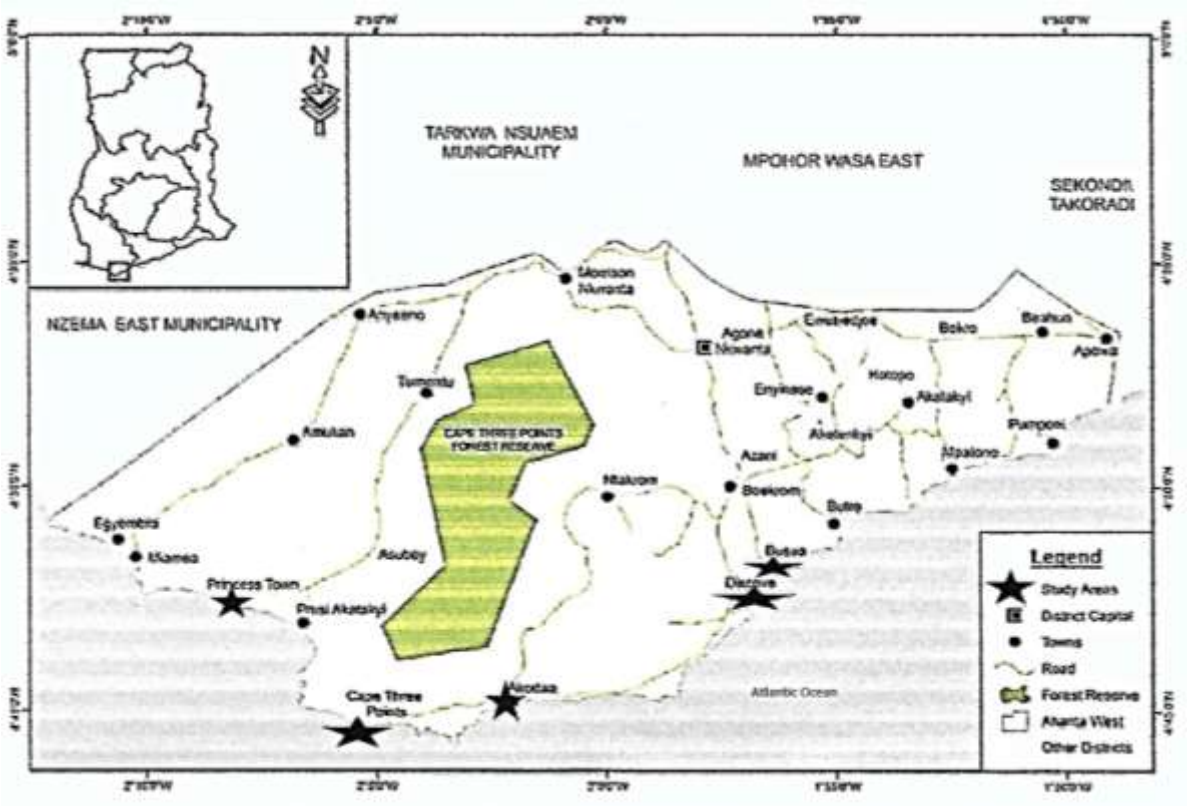


Figure 1: Map of Ahanta West District of Ghana Showing Study Areas

Concerns over declining community livelihoods have been raised over the years in the Ahanta West District. This has contributed to slow economic growth and rising poverty which has been a major issue in the district. The youth of the district have shown interest in illegal small scale gold mining, as observed at Butre, Asemkor, Akwidaa, Princes Town and the Cape 3 Points Forest Reserve. In addition, sand winning, stone quarry and charcoal production, which can deepen the decline in livelihoods in the near future, have been some occupations open to the youth. There is also out migration of the youth for menial jobs in bigger towns like Agona Nkwanta, Takoradi, Sekondi, Tarkwa and others. This has the tendency to weaken the existing human resource base of the communities over the long term (Coastal Resource Centre, 2013).

Active fishing activities occur in about 20 fish landing sites dotting the coast of Ahanta West District. Fish landings have declined over the last 15-20 years, mostly attributed to increasing illegal practices in the fishing industry (Coastal Resource Centre, 2013). The unique fishing related economic circumstances of the district made it a prime choice for investigation into the economic incentive for fishing, given all the competing avenues for income acquisition, which could easily dampen the interest in fishing at such a valuable fishing site in Ghana.

Sampling

A two-stage probability sampling procedure was used to obtain the sample for the study. This began with a selection of the 5 coastal communities, followed by the selection of respondents. The estimated population of artisanal marine fishers in the Ahanta West district was about 25% of the district population (Ahanta West District, 2014). This was about 28, 820 people. In determining the sample size for the survey, consideration was given to the confidence level and the margin of error tolerable. The confidence level considered was 95% with tolerable error margin of 5%. Thus, the computed sample size representative of the population of artisanal marine fishers was 395. To make room for nonresponse, the sample size was rounded up to 400 for the survey.

Data Collection

Structured questionnaire was used to elicit responses from respondents on a face-to-face basis. Respondents allowed to participate in the survey had to be fishers who consented to participate. The questionnaire mainly sought responses related to the socio-economic characteristics of fishers and how they would react to changing fishing incomes within a period of three consecutive years. Data for socio-economic characteristics of fishers included age, education level, average fishing income per trip, whether they owned a fishing boat and number of years spent in fishing.

With regard to fishers' reaction to changing fishing incomes, respondents were asked to make a decision on whether they would continue or exit fishing in the event of a sustained rate of decline in fishing income for the next three years. The rates of decline in fishing income used were 25% and 50%. In all, 378 of the 400 questionnaires were accurately completed and validated. This represents a response rate of 94.5%.

The Theoretical Model

The goal of most operators in the fishing industry is efficiency within a sustainable yield delivery. In such a case, the starting point towards optimization would be a biological model capturing fish stock growth and size generally stated as

$$g = rS\,(1 - S/k) \qquad (1)$$

Where g *is* fish stock growth rate,

r = the intrinsic growth rate for the species under consideration,

S = the size of the fish stock, and

k = the carrying capacity of the fish habitat.

Obtaining a yield that is both efficient and sustainable means fish harvest h_s, must be equal to the yield or growth rate of the fish stock. This is presented as:

$$h_s = rS\,(1- S/k) \quad (2)$$

Traditionally, an expression of the relationship between the fishing effort and harvest of fish is expressed as:

$$h = qES \quad (3)$$

where *q is* the "catchability coefficient" defined as constant, and *E* the effort level.

This produces the effort level *Emsy* which generates the maximum sustainable yield stated as:

$$E_{msy} = r/2q \quad (4)$$

Economic analysis requires the conversion of the biological relationship into a net benefit relationship. This requires the introduction of the price P, which suppliers obtain for one unit of fish, as well as the marginal cost of effort applied (a), usually assumed to be a constant. Thus the total cost of a harvest would be equal to *aE,* while the net benefit of the harvest is obtained by deducting the total cost of the effort applied from the total revenue. This is expressed as:

$$\text{Net benefits} = PqEk - Pq^2kE^2/r - aE \quad (5)$$

Any effort level which is consistent with sustainable efficiency will maximize net benefit. Thus differentiating equation (5) with respect to the effort level (E) and equating the result to zero gives:

$$Pqk - 2Pkq^2E/r - a = 0 \quad (6)$$

When E is made the subject of the expression it becomes:

$$E = r/2q\,(1 - a/Pqk) \quad (7)$$

The maximum level of effort obtained from equation (7) is thus less than the effort required to obtain the maximum sustainable yield expressed in equation (4). At the open access equilibrium, net benefits equal zero. The open access effort then becomes

$$E = r/q\,(1 - a/Pqk) \quad (8)$$

Thus the open access effort is greater than the effort needed to generate the efficient sustainable yield. Depending on the values assumed by some parameters, this effort level may be lower than or greater than the effort needed to generate the maximum sustained yield.

While effort is currently towards open access fishing in Ghana, an assessment of economic incentives will determine the extent to which effort can be curtailed by reductions in fishing incomes. Such reductions could move marine fishing towards the efficient sustained yield. The next section highlights empirical challenges needed to be addressed through the model.

Empirical Considerations About The Yield-Effort Model

Fish prices and marginal costs of harvests

Two issues arise regarding the use of the yield-effort model empirically. While the assumption of constant marginal costs of fish harvests and prices could be valid under limited conditions, they may not generally be the case in practice. Marginal costs of fish harvests may generally increase particularly when remaining fish stocks dwindle. In addition, prices can go down when harvests get more abundant. This means fish stock conservation could depend on some additional factors than those expressed in the standard model. This however turns out to be an issue with all models, since they capture only the most relevant factors within some period.

In their assessment of how empirically valuable these factors or incentives could be, Grafton et al. (2007) using a reformulated model provide evidence for four specific fisheries. Their findings showed that none of the fisheries had extinction as its efficient goal. Also, their model showed that the stock levels which maximized the present value of net benefits was higher than the stock level required to maintain the maximum sustainable yield.

The Maximum Sustainable Yield

While the Marginal Sustainable Yield (MSY) is biologically feasible, it has several shortcomings in reality when it is required to deliver sustainable fishery. The MSE has been found to result in unsustainable equilibrium particularly in developing countries. This is because the slightest overestimation of MSY could result in depletion of the fish stock. It also cannot be sustained in the long term because of the natural fluctuations in the fish stock. It particularly becomes illogical when two or more species being harvested are interdependent.

Above all, the MSY completely ignores all social and economic characteristics of fisheries resources management. Thus from an empirical position, the MSY could easily degenerate into an open access condition. These issues make the use of the MSY contradictory to the sustainable development concept. It is worth noting however that the MSY equilibrium position once determined for some particular period becomes a useful reference point for fisheries resource allocation.

Open Access Fishing

Two main kinds of negative externalities occur within an open-access fishing setting. First, there is a contemporaneous negative externality borne by current generation. This occurs because excessive amounts of resources get committed to fishing to the detriment of other areas of endeavor. There will be too many boats and their accessories fishing the same space, resulting in relatively lower earnings per fisher.

A breakdown of efficiently defined property rights occurs if the fisheries become open access. Under efficiency conditions, fishers' profits are equal to their share of the fishery scarcity rent. Once more than necessary fishers are allowed in to fish, costs go up and the rent is eroded. Under open access conditions, fishers tend to apply excessive effort till profits become zero. This means fishers will be a situation under which too much effort goes into the catching of too few fish, creating a contemporaneous negative externality, whose cost is significantly higher than costs under an efficient fishery resource allocation.

Findings from Huppert (1990) showed significant overcapitalization in some fisheries in the Bering Sea and Aleutian Islands. The study estimated the efficient number of fishing vessels as 9. However, there were 140 of such vessels in practice, which led to a loss of about US$124 million annually. A slower fish harvest could have yielded the same catch with fewer boats operating almost at full capacity.

Once the size of the fish stock goes down, future profits would dwindle leading to an externality which is intergenerational in nature. Initial harvests of open access fisheries could be quite high, however, once it has had an effect on growth rates of fish populations, it will subsequently give a steady-state profit condition, which would certainly be on the decline. The intergenerational external cost, borne by future generations, occurs because overfishing reduces the stock, which, in turn, lowers future profits from fishing (Tietenberg, 2016).

ANALYSIS AND RESULTS

Socio-Economic and Demographic Profile of Respondents

Data showed that a majority (about 33%) of fishers had been fishing for for about 8 years in the community. Only about 3% of fishers had been fishing for over 20 years. The mean number of years a fisher had fished in the communities was 10 years. Most fishing trips (about 38%) in the community lasted for about one day, mainly between 13 and 24 hours. Only about 10% of fishing trips lasted for about 3 days.

The highest mean trip income from fish sales was about 210 Ghana cedis, with a mean of about 109 Ghana cedis and a modal value of about 110 Ghana cedis. About 5% of fishers indicated they earned about 50 Ghana cedis from fish sales per trip. About 38% of fishers owned their fishing vessels, while the remaining 62% operated with boats that were not their own.

None of the fishers was a female. Only male fishers responded to the questionnaire. The mean age of fishers in the community was 31 years, while the oldest fishers (about 0.5%) were about 61 years old. About 38% of fishers were 31 years old with 30% being about 21 years old.

In all, 94% of the fishers were less than 50 years old. The highest educational level of the fishers was Senior High School, attained by only 6% of fishers. The remaining 94% had only basic education or none (37%) at all.

Descriptive Statistics: Changes in Fishing Income

The readiness of fishers to quit fishing is necessary to ensure stocks affected by overexploitation get restored sustainably. It is also essential for fishers' ability to adapt to changing fishing conditions and the management of their vulnerability to displacement from fishing (Daw et al., 2012). Declining fish catch is an indication of reduction in fishing incomes to fishers where fishing is practiced as a major source of income. This imposes a threat on the livelihoods of fishers. Economic theory suggests a shutdown when revenue received from production cannot cover variable costs, where marginal costs are rising.

A declining fish catch is an indication of declining revenue, since fishing serves as a source of income for fishers in the communities of the study area. Fishers are most likely to base their fishing decisions on changes in fishing incomes, particularly under the current situation of rising marginal costs of fishing. Thus, monetizing fishing incentives implies fishing income would be the main reason why marine fishers ply their trade. This is based on Adam Smith's assertion that the self-interest of fishers, not their benevolence would make them provide fish for everyone else. Where self-interest in the form of livelihoods are severely affected, it is generally expected that fishers would want to quit fishing.

Data on whether fishers would exit fishing in the community, in the event of decreases in fishing incomes for the next 3 years showed that, for a 25% decrease in fishing income, only about 29% of fishers would quit fishing, while the remaining 71% of fishers indicated they would not quit fishing. However, with a 50% decrease in incomes, 73% of fishers were certain they would quit fishing while 27% of fishers would still stick to fishing.

With respect to current declining incomes and livelihoods from artisanal marine fishing in the communities, 14% of fishers were already contemplating quitting fishing, while the remaining 86% were prepared to continue fishing.

Regression analysis

To capture the relationship that would provide insight into the economic incentives for fishing, a regression analysis was run between number of years respondents had been fishing as dependent variable and some independent variables which were theoretical determinants of the incentive to continue to fish. These independent variables were the trip income, age of fisher, ownership of fishing boat or vessel, trip duration and the level of education of fishers.

To further investigate the role of income as an economic incentive for fishing, changes in income variables were added to the traditional determinants of fishers remaining in fishing. These were based on responses to questions on whether fishers would quit fishing if their incomes from fish sales reduced by 25% and 50% respectively over the next 3 years.

The study found (as shown in Table 1) that mean trip income, trip duration and the level of education were not significant determinants of how long fishers remain in fishing. However, the mean age of a fisher and ownership of a fishing boat were significant determinants of people staying in fishing at the 5% and 10% levels of significance respectively. Ownership of fishing boat was however negatively related to the desire of fishers to stay in fishing, implying that fishers who owned boats were not staying long enough in the fishing industry in the communities.

With respect to changes in income, the study found that even a 25% reduction in fish sale incomes would not significantly affect the desire of fishers to continue fishing. However, a 50% reduction in fish sales income would significantly affect fishers desire to stay in fishing at the 5% level of significance.

Table 1: Regression results on artisanal marine fishers remaining in fishing in Ghana

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.661	.971		.681	.496
Mean Trip Income	.007	.006	.049	1.155	.249
Mean Age	.254	.020	.539	12.662	.000
Own Fishing Vessel	-.759	.393	-.082	-1.933	.054
Trip Duration	-.026	.181	-.006	-.142	.887
Education	-.285	.212	-.059	-1.346	.179
Exit on 50% Decrease in Fishing Income	1.212	.449	.120	2.699	.007
Exit on 25% Decrease in Fishing Income	.478	.442	.048	1.083	.280
Dependent Variable: Mean Fishing Years	Adjusted R^2 = 32.8		F = 27.302		

The F-Statistic of 27.302 shows that the model with all the variables together provide a correct assessment of the relationship estimated between the dependent and independent variables. The adjusted R^2 of 32.8% indicates that about 33% of the variations in fishers' continuing to fish

is explained by the independent variables. This confirms the fact that several factors, many of which are not quantifiable account for the reasons for which fishers continue to engage in fishing. Fishing profitability has been predicted to be the main driver of entry and exit from fishing through models of economic rationality. However, findings from empirical research show that many fishers may be unwilling to quit fishing even when it becomes economically rational due to some cultural and socio-economic factors (Gordon, 1954, in Daw et al., 2012), as this study also found.

DISCUSSION OF RESULTS

Income as an Economic Incentive for Marine Artisanal Fishers

The study found that income from fish sales was not a significant determinant of the desire of fishers to continue fishing. This means that even with unfavourable fishing income, it was possible to get a significant number of fishers still engaged in fishing. This finding has tremendous support from earlier studies in communities similar to the study area.

Okamoto (2012), found from a study in the lake Inle area, Myanmar, that in the event of dwindling fishing incomes, fishers chose to fish for longer hours. Lives of fishermen who depended on the lake for their livelihood had been changing steadily due to environmental changes of the lake, yielding lower fishing incomes. The study showed that the most common adaptation strategy was to increase the number of hours spent in fishing. This was due to the fact that fishermen considered strategies with least financial cost. Increasing fishing hours required only more labour hours but did not bear any financial cost. Alternative opportunities would have been chosen if the opportunity cost of labour were high enough.

Similar findings came from Shemdoe and Kihila (2012), who found how local fishing communities in Rufiji Basin, Tanzania, counteracted the negative impacts of dwindling fish catch. The strategies included fishing during both day and night and sailing longer distances for fishing. Such moves served to restore the lost incomes, thus rendering the income effect largely unnoticeable.

An implication of this nonexistent income incentive effect is that, the use of closed seasons for fisheries management would not be successful. This is because whatever incomes were lost during the closed season were going to be recovered through overfishing when the open season was restored. Even in the event of alternative livelihoods not being available during the closed season, fishers could contract loans to survive the closed season, which they could easily pay off through excessive fishing during the open season, particularly under the current open access fishing regime in Ghana. The absence of open access fishing would render

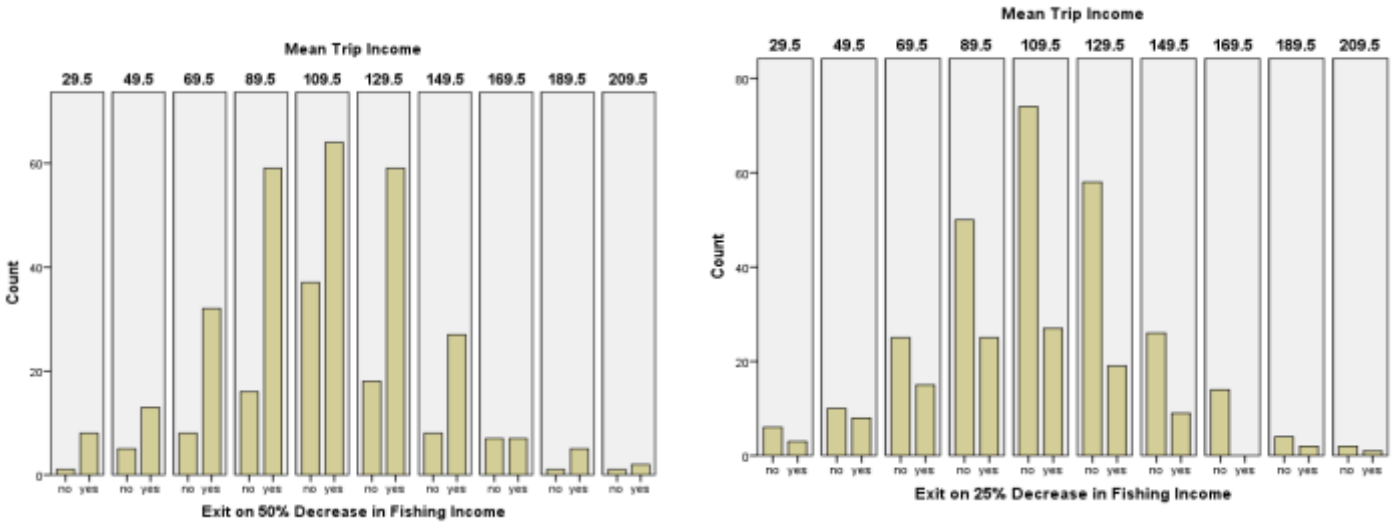
the loss of income during the closed season permanent, compelling inefficient fishers to exit fishing, which would reduce the excessive pressure on fish stocks during the open season.

A serious economic implication emanating from the issue of nonresponsive fishing incomes is that the application of economic management incentives like payment of royalties for fish cannot succeed. This is because fishers would always find ways of making up for the lost income which should have served as a check on inefficient harvests. This means efficient sustainable fish harvests would be elusive.

Fishing Income Elasticity

While income was not a significant determinant of fishers' continuing to fish, the extent to which incomes change showed significance beyond a certain point. A 25% decrease in fishing income did not show any significant sensitivity to the desire to continue fishing (Table 1). Here, over 70% of fishers were still prepared to continue fishing. However, a 50% decrease in fishing income showed a high level of sensitivity to fishers desiring to fish. This saw only 27% of fishers desiring to continue fishing.

Thus, while quitting fishing is not income elastic at lower levels of income changes, it tends to be fishing income elastic with higher levels of changes in fishing incomes. The decision to quit or remain in fishing based on the 25% and 50% fishing income decreases were consistently related to the mean trip income, mean years of fishing and fishing trip duration as shown in Figure 2.



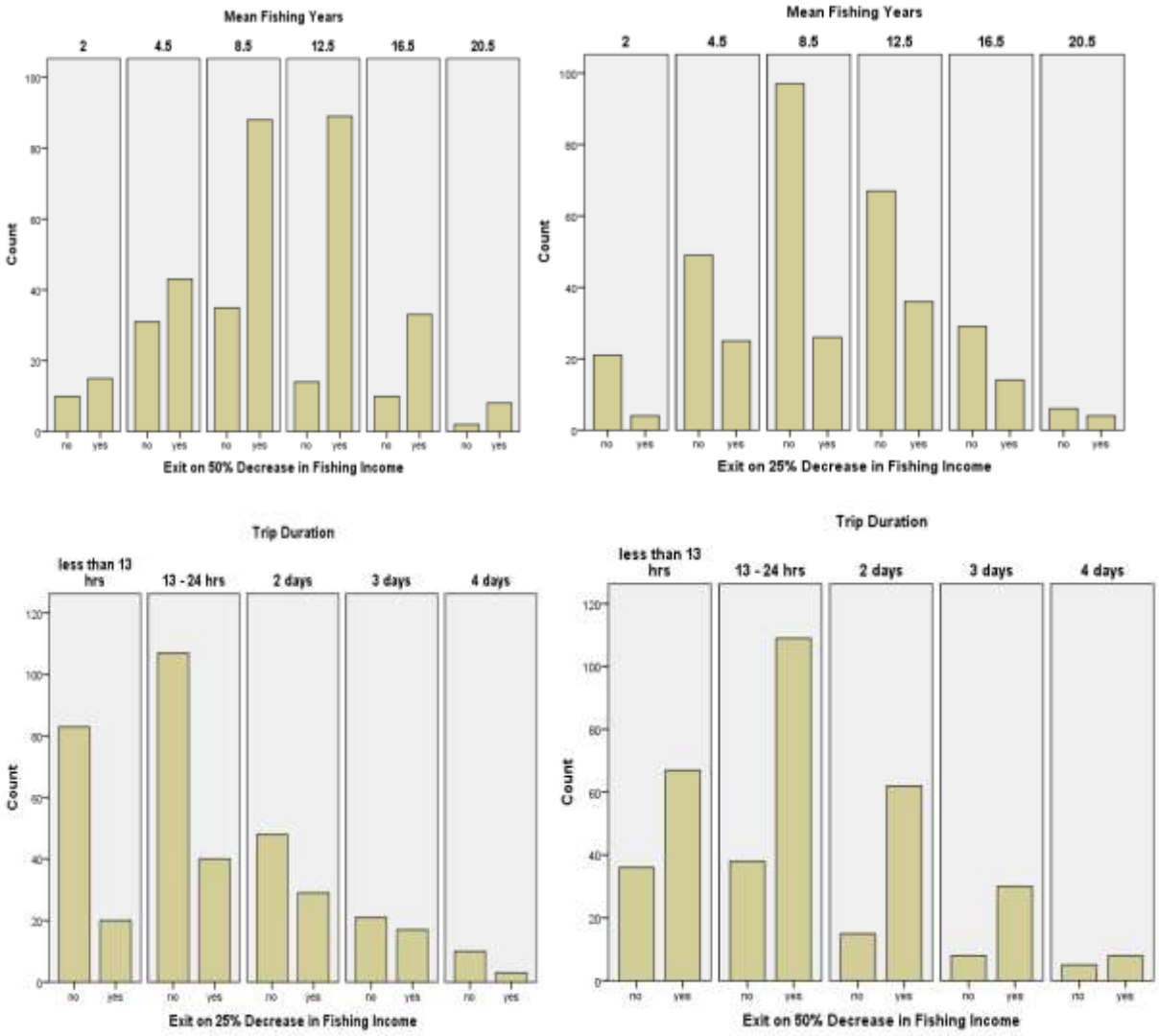


Figure 2: Consistency of exit responses for marine fishers

The implication for economic incentive measures is that payments for royalties for instance will have to be such that they can capture at least 50% of artisanal marine fishers' incomes if they had to be successful. This does not mean an imposition of excessive royalty payments. It serves as a guide to the extent that, any royalty which does not capture at least 50% of artisanal marine fishers' fish sales income, will not result in efficient sustainable artisanal marine fish harvests in Ghana.

Wholesale Fishing Subsidies

The issue of fishing subsidies is linked to fishing income and elasticity of fishing income incentives. Since the desire to stay in fishing is not significantly influenced by fishing income as well as up to 25% reduction in fishing incomes, it means that current subsidies going to fishers

cannot significantly result in efficient sustainable marine fish harvests. At best these subsidies reduce the marginal cost of fishing, thereby worsening the situation of overfishing. This is exacerbated by the situation of open access fishing that prevails within the artisanal marine fisheries sector in Ghana. To reduce the excessive fishing effort, the wholesale subsidies must be done away with. This will send off all the inefficient fishers who are merely surviving on subsidies. Once the system is cleared of all inefficient fishers, appropriate subsidies could then be rolled out for the efficient performers to boost their full capacity output.

One important benefit which can emanate from this clean-up is the introduction of royalty payments for fish catch in Ghana. Efficient sustainable harvests necessarily imply the inclusion of fish royalty in the cost of fishers. This can only succeed in a clean and well-organised fishing industry.

The Age and Educational Level of Fishers

The study found that the youthfulness of fishers, particularly between 20 and 60 years old, significantly influenced the desire of fishers to continue to fish. This means that if artisanal marine fishing has to be encouraged, conditions in fishing communities must be attractive to the youth. This will keep them in the communities so that they can continue to fish. However, if the desire is to reduce the pressure on fish stocks by reducing fishing effort, one effective way to do so is by targeting the youth. While it will not be prudent to worsen conditions in the fishing communities to compel the youth to migrate, alternative sources of employment can be generated to attract the youth away from fishing, so that the desired fishing effort can be attained. This finding is closely related to the finding on educational level of fishers.

Most people in coastal fishing communities lack skills and knowledge necessary to compete for jobs in major towns and cities. They resort to small-scale fishing and farming as a source of livelihood. Jobs that flow from these fisheries have small start-up costs and do not require specialised skills; as a result, many of the world's poor rely on this sector for survival (Matthews et al., 2012).

The study showed that educational level of fishers was not a significant determinant of fishers' desire to continue to fish. This means that educating the youth will have no significant effect on their decision to quit fishing. However, the low level of education among fishers in the fishing communities, where 93% of fishers have only primary level of education or none at all, does not augur well for alternative jobs which require skills to be attractive enough to draw the youth away from fishing. This means a special policy initiative has to target fishers with scholarships and attractive incentives to get their children into school.

CONCLUSION AND POLICY RECOMMENDATIONS

The research findings showed that the capacity for economic incentives to positively influence artisanal marine fisheries is nonexistent in the communities. Economic incentives would therefore not be efficient for sustainable allocation of fishery resources within the artisanal marine sector in the communities. Fish sales income, educational level of fishers, fishing trip duration and a 25% reduction in fish sales income were not significant determinants of the desire of fishers to remain in fishing. The age of fishers and a 50% reduction in fish sales income were found to significantly influence the desire of fishers to continue fishing at the 5% level of significance. Also, the ownership of a fishing boat was found to have a negative but significant influence on the desire of fishers to continue fishing at the 10% level of significance.

These findings pose challenges for an economically sustainable marine resource allocation. This is because the current closed fishing season would be ineffective since the nonexistent economic incentive linkage will create a leakage through overharvesting. Also, the application of economic management incentives would be undermined due to the absence of causality between economic incentives and the desire to continue to fish at small to moderate changes in fishing income.

It is therefore recommended that the current wholesale subsidy for artisanal marine fisheries be removed to help clean up the sector for efficient delivery. When this is done, royalties for fish catch should be introduced to help maintain fish stocks. In addition, special educational schemes should be designed to provide attractive employable skills for the youth in fishing communities. The removed subsidy could be used to fund these educational schemes. This will help the youth acquire alternative sources of livelihood to curtail the current excessive fishing effort, toward sustainable allocation of marine fishery resources in Ghana.

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