FACTORS INFLUENCING SMALL-SCALE INLAND FISHERS' INCOME IN THE PRU DISTRICT, BRONG-AHAFO REGION, GHANA

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ABSTRACT
In this paper, we investigate the factors influencing open-access, small-scale fresh water fishers' income in Yeji, a major inland fishing port town in Ghana. Semi-structured questionnaires were used to obtain data from 306 randomly sampled fishers. The analysis was done using the Scarbough and Kydd model to estimate marketing margins of fishers; and multiple linear regression analysis to determine the factors influencing fishers' incomes. The study revealed that fish processors received higher margins than fish harvesters and fish traders. The study also showed that Yeji's fishers depend on small-scale fisheries as their major source of livelihood. Factors that significantly influence fishers' income include age, access to the Volta lake as the source of the commodity, fishing experience, ownership of fishing gear, number of children in a household and sex of actor. Based on the findings of the study, it is concluded that the inland fisheries industry in Yeji has the potential to boost household incomes and contribute significantly to the local economy and poverty reduction. Local authorities and policy makers are encouraged to use this evidence in the design and implementation of development strategies in small-scale fishing communities within the Yeji area.

Keywords: Income, Fishers, Actors, Marketing margin, Small-scale fisheries, Yeji

INTRODUCTION
According to the 2007 Human Development Report, more than 80% of the world's population lives in countries where income differentials are widening. It has also been pointed out that some industrialized countries, and nations on the transitional stage have approximately 34 million poor children, women and men. (FAO, 2000). In addition, the majority of the people suffering from chronic hunger and poverty live in Asia and Africa (Roetter et al., 2008). The problem of poverty is compounded by the fact that in many parts of Africa, aggregate farm

yields as a whole and the productivity of land and labour in particular are low (Roetter et al., 2008); while food demand is high due to rising population figures.

To partly tackle poverty and enhance households' incomes, the Government of Ghana formulated the Growth and Poverty Reduction Strategies (GPRS) I and II, the Ghana Shared Growth and Development Agenda (GSGDA) I and II and the Livelihood Empowerment Against Poverty (LEAP) Initiative, among others. The aim of these interventions was to create wealth and transform the economy towards achieving growth, accelerated poverty reduction and the protection of the vulnerable (NDPC, 2006). The initiatives resulted in the proportion of Ghanaian population described as poor declining from 39.5% in 1998/1999 to 28.5% in 2005/2006 while the proportion within the extremely poor bracket declined from 26.8% to 18.2% within the same period (UNDP, 2013).

The above improvements notwithstanding, actual improvements in household income and reduction in poverty and food insecurity levels overall lagged behind the accompanying growth in the country's population during the period of implementation of the initiatives (GPRS, 2003). The result is that, unemployment, low incomes, poverty and food insecurity still exist in Ghana and especially in fishing communities like Yeji (BoG, 2008).

The fishing industry in Ghana is based on fishery resources, largely from the marine and, to a lesser extent, inland or freshwater fisheries and aquaculture (BoG, 2008). The main sources of inland or freshwater fish are the Volta Lake, reservoirs, aquaculture and coastal lagoons. Marine fishing is an important traditional economic activity of the coastal communities in Ghana and contributes over 70% of the total fish catch (BoG, 2008). The small-scale artisanal fishing communities generally contribute about 24% of the traditional sector landings. The national mean annual fish production is estimated to be about 400,000 metric tonnes (BoG, 2008).

The Volta Lake is Ghana's single most important source of inland fish catch. It attracts fisher folks from various parts of the country including those from coastal areas who migrate with their families to settle in fishing villages along the lake. The Volta Lake currently hosts about one hundred and forty (140) different fish species and provides livelihood for about 300,000 Ghanaians who live around the lake with 80,000 of this number directly engaged in fish harvesting. The rest are fish processors, fish traders and fishing gear suppliers among other fishery related service providers (FAO, 2016). It has been estimated that about 10% of Yeji's population is involved in the inland fisheries industry and women are key players in post-harvest fishing activities (IMM, 2004a and 2004b).

Fish provide the Ghanaian consumer with about 60% of his or her animal protein needs (BoG 2008). The small-scale fisheries sub-sector provides employment for many rural and urban people in Ghana. Fish and fish products are Ghana's most important non-traditional export commodities, accounting for over 50% of revenue from non-traditional export (FAO, 2016). In 2010, 62,750Mt of raw and processed fish were exported; earning about US$65 million for the country (MoFA, 2013; FAO, 2016). With respect to national economic development, increasing trends in fish exports reflect a major advance in the pursuit of national non-traditional export policy objectives (Mensah *et al.*, 2003). Fish exports generate foreign exchange and revenue in the form of taxes for the government.

The small-scale fisheries sub-sector contributes enormously to income and poverty reduction at the household level in Yeji. However, knowledge of the determinants of fishers' income and the marketing margins of the major actors along the fish marketing chains, to help create strategies towards building resilience against the uncertainties arising from unstable ecosystems in fishing communities and households within the Volta Lake in Yeji, is limited or even unavailable. The aim of this paper is to provide empirical evidence upon which resilience-enhancing strategies for fisheries in Ghana at large and small-scale fisheries, within the Volta Lake in Yeji in particular, can be formulated.

The paper is organised as follows. The next section presents the research methodology under which we describe the study area and dataset, and specify the equations for computing the respective marketing margins and estimating the determinants of the fishers' income. We then present and discuss the results and end the paper by drawing conclusions and making recommendations for policy and further research.

METHODOLOGY

Study Area and Dataset

The study was conducted in Yeji, the capital of the Pru District in the Brong-Ahafo Region of Ghana (Fig. 1). The district has a total population of 129,248 of which 65,832 are men and 63,416 are women, according to the 2010 population census (GSS, 2010). Yeji is an inland fishing port located on the southern bank of the Lower White Volta River in the Bono East Region (Pru District Assembly, 2015). The topography of Yeji is generally flat with isolated hills and valleys sparsely scattered on the land surface. It is generally a low-lying terrain and the presence of the Volta Lake gives it a sloppy tilt towards the lake's basin. The vegetation of Yeji is generally the transitional type, with scattered patches of forest (Pru District Assembly, 2015).

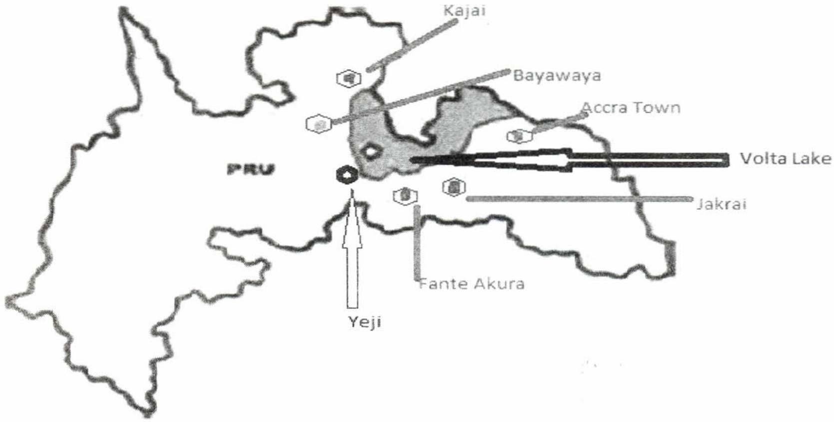

Figure 1: Pru District map showing the sampled communities
Source: Adopted and modified from ghanadistricts.com

The majority of the inhabitants of Yeji are smallholder farmers, who cultivate yam, rice, maize, cassava, groundnuts, guinea corn, beans, and vegetables (Pru District Assembly, 2015). Other major sources of livelihood in the area include fishing, fish processing and marketing, trading in general goods and services, public sector employment and artisanship.

A multistage sampling technique was used to select the sample of actors from who data was obtained for the analysis. In the first stage, purposive sampling was used to obtain six (6) most predominant fishing communities within the Yeji sub-district. The communities are Yeji, Fante Akura, Accra Town, Jakrai, Bayawaya and Kajai,. The communities were selected purposively to ensure proper targeting of the fisher folk and related actors who are the focus of the study. In the second stage, stratified random sampling approach was employed to obtain 306 respondents, comprising 51 fishers per community. The fishers were stratified into the various actor groups - fish harvesters, processors, traders and fishing gear makers. The total sample included 146 fish harvesters, 70 processors, 70 traders and 20 fishing gear makers (Table 1). To avoid interaction effects, no two actors belonged to the same household. The number of fish harvesters sampled was far higher than the other categories because they are the majority and the pivot of the fishery value chain in Yeji. The sampled number of actors in each category is roughly proportionate to the approximated total number of actors in the fish value chain in Yeji.The sampling also accounted for the residential status of actors, that is native and migrant fishers (Table 1).

Table 1: Number of fishers by community and residential status in Yeji

Actors	Res. Status	Communities						
		Yeji	Fante Akura	Accra Town	Jakrai	Bayawaya	Kajai	Total
Fish Harvesters	Indigene	24	24	24	24	24	24	144
	Migrant	2	0	0	0	0	0	2
Fish Processors	Indigene	5	8	6	9	7	4	39
	Migrant	3	6	5	6	5	6	31
Traders	Indigene	3	5	5	5	7	6	31
	Migrant	8	7	7	4	5	8	39
Fish gear owners/ menders	Indigene	5	1	4	3	3	3	19
	Migrant	1	0	0	0	0	0	1
Total		**51**	**51**	**51**	**51**	**51**	**51**	**306**

Source: Field survey, 2018

Primary data was used for the analysis. The data was obtained from the targeted fishers and related-actors in the fish value chain using in-depth personal interviews and focus group discussions. Personal interviews using semi-structured questionnaires were employed in gathering information on the socio-economic characteristics of small-scale fishers and the extent to which small-scale fisheries contribute to household food security and incomes in the study area. Focus group discussions were also conducted to obtain additional information to validate the data obtained using in the in-depth interviews. Fundamentally, socio-economic data on demographic characteristics of actors, and relevant economic variables related to fish harvesting, processing, trading and fish gear making was collected.

Data analysis was carried out using two main analytical methods; the Scarbough and Kydd Model for the computation of the marketing margins of actors, and the multiple linear regression (MLR) model for estimating the effects of the factors influencing fishers' income.

carbough and Kydd Model

o determine the marketing margins resulting from the operations of the various actors along ne fish value chain, data was collected on prices at each level and transactions cost of performing different activities. Using this data, the associated marketing margins of actors was computed using the Scarbough and Kydd (1992) approach.

The approach defines marketing margins as the difference between prices at two market levels. It is most commonly used to refer to the difference between producer and consumer prices of an equivalent quantity and quality of a commodity. It may also describe price differences at other points in the value chain e.g. between producer and wholesale, or wholesale and retail prices (Scarbough and Kydd, 1992).

In this study, marketing margins accruing to the operations performed by harvesters, processors and traders were of interest. Therefore, we identified and computed the harvester, rader and processor's marketing margins. The general equation for estimating a given marketing margin is as follows:

$$Price\ margin = SP - (CP + TC) \ldots\ldots\ldots 1$$

Where; $SP = selling\ price$; $CP = cost\ price$; and $TC = transaction\ cost.$

The specific marketing margins of the three actors are computed using equations 2, 3 and 4 as specified below:

$$Harvesters'\ margin\ (HM) = HSP - (HCP + HTC) \ldots\ldots\ldots 2$$

$$Traders'\ margin\ (TM) = TSP - (TCP + TTC) \ldots\ldots\ldots 3$$

$$Processors'\ margin\ (PM) = PSP - (PCP + PTC) \ldots\ldots\ldots 4$$

$$Overall\ margin\ (OM) = CP - Pp \ldots\ldots\ldots 5$$

Where; (HSP) = Harvester's selling price; (HCP) = Harvester's cost price

(HTC) = Harvester's transaction cost; (CP) = Consumer price

(TSP) = Trader's selling price; (TCP) = Trader's cost price; (PP) = Producer price

(TTC) = Trader's transaction cost; (PSP) = Processor's selling price

(PCP) = Processor's cost price; (PTC) = Processor's transaction cost

The Multiple Linear Regression Model

The multiple Linear regression model using ordinary least squares (OLS) estimation procedure was used to estimate the factors that influence fishers' income. The model is specified as in equation 6.

$$Zi = \beta 0 + \beta 1xi + \varepsilon i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..6$$

Where Zi = the dependent variable, xi is a vector of independent variables and, $\varepsilon_i \sim N$ (0, variance σ^2) is a vector of independently and identically distributed (iid) error term with mean 0 and variance σ^2.

The empirical estimation of the model involves two steps. The first step consists of estimating the factors influencing fishers' incomes. If the decision to go into fishing is independent of factors that contribute to a fisher's income, then the standard OLS estimation, in the absence of misspecification, provides best, linear, unbiased and efficient (BLUE) estimates of the factors determining fishers' income. However, the assumption of independence cannot be the case here. This is because, *ceteris paribus*, a fisher's decision to perform given operations is determined not only by the predictor variables specified but also by his/her expectations of the associated income or net returns due to the particular operations. In this case, the standard OLS estimation procedure cannot be applied to the data. Rather, an OLS estimation procedure with inbuilt capacity to address problems of endogeneity in the data is preferred. This procedure estimates the effects of the factors determining fishers' income, whilst controlling for other important variables.

Accordingly, the following specification relating respondents' incomes to household characteristics was estimated in the first step:

$$\begin{aligned} LnZ_i = \beta_0 &+ \beta_1 Age + \beta_2 Sex + \beta_3 Experience + \beta_4 Number_{of_{Children}} \\ &+ \beta_5 Access_{to_{Credit}} + \beta_6 Access_{to_{Market}} + \beta_7 Quantity_{Consumed} \\ &+ \beta_8 Access_{to_{Fisheries}} + \beta_9 Gear\ Ownership\ (Net) \\ &+ \beta_{10}\ Gear\ Ownership\ (Boat) + \varepsilon i \ldots\ldots\ldots\ldots\ldots\ldots..7 \end{aligned}$$

Where; Z_i = Income of Fishers and $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7$ ß8 and ß9 are unknown parameter coefficients to be estimated, β_0 = intercept ε = Error term. The parameter coefficients respectively denote the effects of sex, experience, number_of_children, access_to_credit, access_to_market, quantity_consumed, access_to_fisheries, gear_ownership (net) and gear_ownership (boat) on fishers' income. The description, units of measurement and *aprioiri* expectations of the explanatory variables are presented in Table 2 below.

To control for effects of other important but unknown variables, Davidson and MacKinnon (1993) suggest an augmented regression test (Durbin–Wu–Hausman test), which is done by including the residuals of each endogenous right-hand side variable, as a function of all exogenous variables, in a regression of the original model. Hence the dependent variable (was) is regressed against the explanatory variables as:

$$z_i = c_0 + c_1x_1 + c_2x_2 + c_3x_3 + \mu_i \ldots\ldots 8$$

The residuals (**z_i_res**) from equation 8 are then obtained and included in the equation 7. The result is the augmented regression model specified as follows in 9:

$$\text{Ln} \quad Z_i = \beta_0 + \beta_1 Age + \beta_2 Sex + \beta_3 Experience + \beta_4 Number_{of_{Children}} + \beta_5 Access_{to_{Credit}} + \beta_6 Access_{to_{Market}} + \beta_7 Quantity_{Consumed} + \beta_8 Access_{to_{Fisheries}} + \beta_9 Gear\ Ownership\ (Net) + \beta_{10}\ Gear\ Ownership\ (Boat) + \beta_{11} zi_{res} + \varepsilon i \ldots\ldots 9$$

$\beta_{11} \neq 0$ implies that the OLS specification in 9 is consistent and would produce unbiased estimates.

RESULTS AND DISCUSSION

Men dominate the fisheries value chain in Yeji. Men constitute about 91% of the actors while women constitute only 9%. Household sizes of fishers range from 1 to 36 persons with an average household size of 9 members. The literacy rate amongst fishers in Yeji is a little below average. Only about 49.67% of the respondents ever attended formal school while 50.33% have never been to formal schools. It was observed that, younger fishers are more likely to have some years of formal schooling than older ones. On the average, the sampled respondents had about 18 years of experience in fishing.

The study also revealed that majority of the respondents 254 (83.55%) had no access to any form of credit whilst only 50 (16.45%) had access to credit. A majority of the respondents (78.95%) earn weekly income up to GHS 500.00 or below whilst 21.05% of the respondents earn weekly income above GHS 501.00. A majority, about 78.29% of the fishers reported consuming from 1 - 20 kg of fish per week whilst 21.71% consumed above 20 kg of fish per week.

Table 2: Descriptions, measurements and *a priori* expectation of the explanatory variables

Variable	Description	Measurement	*A priori* expectations
Age	Age of respondent	Years	+
Sex	Sex of respondent	Dummy: 1 = male, 0 = female	+
Experience	Number of years of fishing	Number of years (continuous)	+
Number of Children	Number of children in the household (below 18 years) who depend on the respondent for support	Number (continuous)	+/-
Access to Credit	Whether the respondent has access to credit or not	Dummy: 1 = yes, 0 = no	+/-
Access to Market	Whether the respondent has access to market or not	Dummy: 1 = yes, 0 = no	+/-
Quantity Consumed	Quantity of the fish consumed in the household	Kg	+/-
Access to fisheries	Access to the fishery resource	Dummy: 1 = yes, 0 = no	+/-
Gear Ownership (Net)	Whether the respondent owns a net or not	Dummy: 1 = yes, 0 = no	+/-
Gear Ownership (Boat)	Whether the respondent owns a boat or not	Dummy: 1 = yes, 0 = no	+/-

Table 3: A summary of descriptive socioeconomic characteristics of fishers in Yeji

Characteristics		
Sex (%)	**Male**	**Female**
	91	9
	Mean	**Range**
Household size	9	1 – 36
Daily income (GHS)	46.00	3.00 - 386
Experience (years)	15	4 – 18
	Yes	**No**
Formal schooling (%)	49.57	50.33
Credit access (%)	83.55	16.45
Weekly income (%)	**< GHS500.00**	**≥GHS500.00**
	78.95	21.05
Income distribution (%)	**< Daily Min. Wage**	**≥Daily Min. Wage**
	16	84
HH fish consumption (%)	**< 20kg/Week**	**≥20kg/Week**
	78.29	21.71

Source: Field survey, 2018

Finally, the results showed that the minimum daily income earned by fishers was GH₵ 3.00; the mean daily income earned was GH₵ 46.00, while the maximum daily income earned by fishers was found to be GH₵286.00. Comparatively the minimum wage in Ghana at the time of this study was GH₵ 8.00 per day (GoG, 2016). From the study, it was revealed that about 83.88% of the respondents earn daily income above the minimum wage whilst only 16.12% of the respondents earn daily income below the minimum wage. These descriptive characteristics have implications for discussing the main results presented in the following sections.

Gross Marketing Margins along the Fish Marketing Chain

The period of fishing was categorised into two seasons; 1) the peak season, usually from July to September, and 2) the lean season, usually from January to March. Due to the absence of fixed price of fish and the unstandardised way of determining their prices, the average price of a pan (weighing averagely 10kg) of mud fish was used in estimating the margins in both peak and lean seasons. The margins identified and estimated were harvesters' margins, processors' margins and traders' margins (Table 4).

Table 4: Gross marketing margins along the fish value chain

	Peak Season (August-December)				Lean Season (January-April)			
	Buying price (GHS)	Transaction cost (GHS)	Selling price (GHS)	Margin (GHS)	Buying price (GHS)	Transaction cost (GHS)	Selling price (GHS)	Margin (GHS)
Harvesters	-	40.00	100.00	60.00	-	55	130.00	70.00
Processors	100.00	50.00	200.00	50.00	130.00	70.00	300.00	100.00
Traders	200.00	100.00	350.00	65.00	300.00	85.00	450.00	55.00

Source: Computed from survey data, 2018

The average margins obtained by harvesters when one pan of mud fish was sold at the landing site during the peak season was GH₵60.00 and GH₵70.00 at the lean season. Also, the margins obtained by processors of an average value of one pan of mud fish were GH₵50.00 at the peak season and GH₵100.00 at the lean season. Finally, the margins obtained by traders of an average value of one pan of mudfish were found to be GH₵ 50.00 at peak season and GH₵ 65.00 at the lean season.

Comparatively, fish traders were expected to receive higher margins. However, the study revealed that across both periods, processors received higher margins than fish harvesters and fish traders. Interactions with the major players in the sub-sector revealed that the higher margins received by fish processors was as a result of the fact that the fish processors were the price determiners of fish in the small-scale fishery sub-sector in Yeji. Fish harvesters, upon accounting for their transaction cost, also received higher margins than fish traders did.

Findings based on the FGDs confirm the findings of why fish traders earn lower margins in comparison with the other actors. The reason is that traders face higher risks, namely the fish they buy from the processors were sometimes not adequately dried, and so begin to rot if not sold. As such, they were often compelled to dispose the fish off at prices commensurable to minimal margins to avoid high levels of losses. However, traders, in an attempt to make more profit, increase the price so high that the fish stays long with them. The delay in the sales of the product means incurring

extra cost of keeping the fish in a good condition, which implies an increase in the transaction cost and eventual reduction in the marketing margins earned by traders.

Determinants of Fishers' Income Level in Yeji

This section presents the results of the MLR Model results obtained using the second OLS estimation procedure (Table 5). Seven (7) out of the ten estimated coefficients are statistically significant at the 1%, 5% and 10% levels. Of the statistically significant estimates, all except net ownership have the expected signs. The R-square of 0.6099 shows that, the model is able to explain 60.99% of the variation in income received by actors in the fish value chain. Fundamentally, the results highlight the important role of the independent variables age, sex, experience, number of children in a household, access to the fishery resource, and fishing gear (net ownership, and boat ownership) in determining the income of fishers in Yeji. Market attributes – fishers access to credit and commodity markets do not affect their income. The quantity of fish consumed by the fisher's household, as expected, does not also affect his/her income.

Since income is a monetary measure, it was specified in its natural log form. This is to avoid a possible skewness in the income variable on the normality assumptions of the model. All the independent variables were however specified in their absolute values. For this reason, the interpretation of the effects of the predictor variables is based on their partial elasticities presented in column 4 of Table 5.

Table 5: Estimated determinants of fishers' income in Yeji

Variable	Coefficient	Standard Error	Partial Elasticities
Age	.1876***	.0643	0.2063
Sex	-.3229*	.1946	-0.2760
Experience	.0951***	.0082	0.0997
Number of Children	-.0354***	.0070	-0.0348
Access to Credit	.1975	.1340	0.2184
Access to Market	-.0653	.3123	-0.0632
Quantity Consumed in the Household	.0031	.0034	0.0031
Access to the fishery resource	.2431**	.1021	0.2752
Gear ownership (Net)	-.3723*	.2071	-0.3909
Gear ownership (Boat)	.4268**	.1977	0.5323
Constant	2.9622***	.3831	19.34

****, significant at 1% ** significant at 5% * significant at 10% Number of Obs = 267, F(10, 256) = 40.02, Prob>F = 0.0000, R-squared= 0.6099, Adj R-squared = 0.5946, Root MSE = 0.79638*

Source: Computed from field survey data, 2018.

The results show that there is a statistically significant and positive relationship between fishers' age and fishers' income at the 5% level. This means, older fishers are more likely to earn higher incomes than younger ones. Specifically, an additional year in the age of a fisher increases his/her income by about 0.2063 (21%). Older fishers are likely to be more experienced and endowed with fishing resources. This directly enables them undertake fishing

and fishing-related activities more efficiently than the younger ones. Older fishers, given their higher experience, wider networks and resource endowments, are also disposed to adopting more efficient and remunerative fish harvesting,
processing and marketing technologies than younger ones. Ultimately, older fishers tend to be more responsive in undertaking operations that result in higher income than younger ones.

The variable sex which is specified as a binary variable with male = 1 and female = 0, affects fishers' income negatively. The partial elasticity coefficient of -0.276 is statistically significant at the 10% level. This implies that female fishers are more likely to earn about 27.6% higher income than male ones. Female actors in the fish value chain are usually processors or marketers, who due the value added nature and scale of their operations, are expected to gain higher returns than male actors who are most likely to be at the fish harvester level. Another explanation is that in Sub-Saharan Africa (SSA), women are traditionally more efficient in fish processing and have better bargaining skills in marketing food commodities than men. This observation is consistent with Awo (2010) and Andrew (2005) among many other market studies in SSA.

Fishers' experience has been shown to have a positive significant effect on their income. At the 1% significance level, the results show that an increase in experience by one year is most likely to increase income by about 0.0997 (circa 10%) on fishers' earnings. Like age, experience, measured by the length of time fishers have been engaged in the industry, plausibly exposes fishers to more efficient fish harvesting and processing technologies as well as equip them with better profit seeking strategies. Moreover, fishers with higher levels of experience should tend to have a more enhanced access to more lucrative fishing resources and networks within the value chain than less experienced fishers. This observation is consistent with the view of Chilot et al. (1996) who found experience as a determining factor in technology adoption and income of farmers.

The number of children in a fisher's household had a negatively significant effect on his/her income from fishing. The coefficient of -0.0354 is significant at the 1% level and the partial elasticity of -0.0348 implies that for every additional child in the fisher's household, his/ her income is likely to reduce by about 3.5%. It is obvious that fisher households with more children spend more in the provision of childcare than fisher households with fewer children. The higher expenditure in childcare in terms of food, health and education however implies reduced availability of capital for reinvesting in their operations in the fish value chain. Especially having younger children in the fisher's household also implies more time may be used in caring for the children and hence less time for undertaking fishing activities. This may reduce the output and productivity of fisher's operations.

The income effect of the nature of fishers' access to the fishery resource (the Volta Lake) is positive and statistically significant at the 5% level. The variable is a dummy variable with a value of 1 denoting that the fisher has free access and 0 denoting lack of free access. The elasticity coefficient of 0.2752 implies that fishers with free access to the lake have 27.5% chance of earning more than fishers without free access to the lake earn. This is expected since fishers without free access to the lake incur additional costs in the form paying levies in kind or cash weekly and annually to the custodians of the land in Yeji for the rights to conduct their operations.

Turning to fishing gear ownership, the results suggest that fishing net ownership with a coefficient of -0.3909, which is statistically significant at the 10% level, negatively affects income. This finding implies that fishers who own nets had about 39.1% lower incomes than those who do not own nets. This finding does not meet our *aprioiri* expectations and is hard to explain, more so that net ownership has the strongest, negative effect on fishers' income. One should expect fishing net owners to earn more since they do not have to regularly pay rent for the nets they use. A plausible explanation may be that fishers who do not own their nets may put in extra effort and time on their operations with a determination to catch more fish, earn much and to be able pay their rents. In so doing, it is likely they may ultimately earn more than those with their own nets did.

Lastly, boat ownership, which is also a dummy variable with a value of 1 denoting fisher owns a boat and 0 denoting fisher does not own a boat, has a positive and statistically significant effect on income at the 5% level. The partial elasticity coefficient of 0.5323 suggest that fishers with boats earn about 53% higher income than fishers who do not. This variable also appears to have the strongest, positive effect on fishers' income. This finding, unlike net ownership, is expected and meets *aprioiri* expectations. Ownership of a boat means lower operations costs since fishers with their own boats do not have to pay rent to use this gear. Alternatively, boat owners may hire their gear out to those without boats and receive rents when they are not in operation.

CONCLUSION

The analysis aimed at providing an important insight on how the small-scale fisheries industry in Yeji can contribute to improving household incomes, food security and poverty alleviation. To achieve this aim, we computed the marketing margins of fish harvesters, traders and processors within the value chain of small-scale inland fisheries and estimated the determinants of small-scale fishers' income. The findings show that even though the three actors in the value chain earn considerable marketing margins on their operations, fish processors whose activities link fish harvesters and marketers earn the highest average margin across peak and lean fishing seasons.

Results of the MLR Model demonstrate that age, sex, experience, number of children in a household, access to the fishery resource, and ownership of fishing gear (net and boat) are important determinants of fishers' income in Yeji. Boat ownership has the highest positive effect on fishers' income, while net ownership has the strongest but negative effect of fishers' income. Fishers' with their own boats are more likely to earn about 53.2% more than fishers without their own boats; whereas fishers with their own nets are shown to be more likely to earn 39.1% less than the earnings of fishers without nets of their own. Market access attributes viz. fishers' access to credit and fish produce markets as well as the quantity of fish consumed by fisher households; do not however significantly affect fishers' income. Additional qualitative results show that Yeji's small-scale fishery industry contributes to food availability and diversified livelihood in the study area.

To improve equity within the value chain of inland fisheries in Yeji, lowering the transactions costs, a connotation of risk between fish harvesters and processors on the one hand, and processors and traders on the other is a *sin qua non*. Boosting the incomes and ultimately wellbeing of fishers in Yeji, also requires the implementation of strategies that support the significant determinants of fishers' income. Providing fishing boats especially to fishers will have positively immense effect on fisher's income. Government agencies, fishers associations and NGOs working in the small-scale fisheries industry should recognise the critical role of the major determinants of fishers' income and adopt measures that will either enhance the quantum, availability and even quality of these determinants as the case may be. Further research should seek to determine why important fishing gear like nets significantly affect fishers' income adversely.

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