



## **The State of Farm Raised Catfish Consumption in Ghana: A Case of the Ashanti Region**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Author HA designed the study, reviewed literature and wrote the first draft of the manuscript. Data collection, analysis and discussions were undertaken by authors HA, DY, AP, JEE and MO. Author HA undertook the final write-up. All authors read and approved the final manuscript.*

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### **ABSTRACT**

This study aimed to explore the status of farmed raised catfish consumption in Ghana focusing on the Ashanti region as a case study. Data was collected using a semi-structured questionnaire from 240 respondents from 4 out of 7 zones in the region. The method of data collection were purposive, stratification and simple random sampling. The study employed descriptive analysis as well as logistic regression for data analysis.

Twenty percent of the sampled population were men and the rest were women with age range between 22 to 84 years. The respondents were sampled from various professions while some were students. About 30% of sampled respondents had attained a high educational level (tertiary) while 36% had attained basic level. Most respondents preferred fish as a regular source of protein. A higher percentage of the respondents (73%) consumed farmed fish, mainly tilapia and catfish. Results points out that about 59% of the consumers of farmed fish consumed catfish. Furthermore, 62% of consumers of catfish had ever consumed fresh catfish. Reasons provided by those who did not eat fresh catfish are: it taste less better than captured catfish from the wild, has an unpleasant

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odour and slimy in nature, is a taboo due to religious belief, and higher price. Most respondents (63%) who patronized catfish preferred smoked catfish. About 80% of the respondents are willing to eat catfish if it is processed. The logistic regression results showed that the determinants for consumption of processed catfish are age, gender, where fish is consumed, and frequency of farmed catfish purchased. It is recommended that government should come out with policies, plans and strategies as well as incentives to enable fish farmers produce and process catfish. There should be the developing of projects out of the aquaculture development plan and other plans with emphasis on catfish production including the production and supply of quality catfish fingerlings to farmers. Since a greater percent of consumers preferred processed catfish compared to fresh, value addition to the catfish product should be encourage for higher patronage.

*Keywords: Status; farmed catfish; consumption; Ashanti region; Ghana.*

## 1. INTRODUCTION

There are a range of smaller fish farms operating in Ghana mainly producing tilapia and catfish based on extensive (stocking of small reservoirs) and semi-intensive (earthen ponds) techniques [1,2]. There are some medium scale fish farmers also into catfish production. One of the regions producing and consuming a greater percentage of catfish is the Ashanti region which is the study area. There is no available data to show the percentage of catfish produced in the region, but it is estimated by the authors that not less than 40% of what is produced for the country came from the region. The main type of catfish produced is *Clarias gariepinus*, the African catfish [1]. About equal percentage of catfish (49.6%) and tilapia (49.4%) fishes were produced in 2016 in that region showing the importance of catfish. Traders come from far and near to buy fresh, live and processed catfish for their customers. There has been a new niche market developing in the region and the national capital (Accra) which is known as 'point to kill'. In this case, the fish is kept live in water, killed and processed upon the request of the customers.

Catfish is mostly farmed in the earthen ponds or tanks by generally small-scaled and medium scale fish farmers. Most of the fish farmers are into mixed farming (tilapia and catfish) [1]. The cost/kg of catfish raised in the country for 2015 was estimated to be not less than USD\$3.00/kg (GHS4-1US\$). The production of catfish in the country is second to tilapia. In response to challenges and prospects of developing Ghana's fisheries, the Government of Ghana provided substantive support to developed technical frameworks for the effective planning, development and regulation of the fisheries and aquaculture subsectors. Some of the supports were: West African Regional Fisheries

Programme (WARFP) in Ghana (2011); the Tilapia Volta (TIVO) project was implemented to further enhance the genetic quality of tilapia and also catfish; Fisheries and Aquaculture Sector Improvement Programme (2010); Fisheries and Aquaculture Policy (2008); Aquaculture Strategic Framework and Ghana National Aquaculture Development Plan (GNAPD) supported by FAO [3,2,4]. These have been reference material for the development of aquaculture in Ghana. From the authors' point of view, much attention was paid to the production of tilapia as compared to catfish. Currently, the West African Regional Fisheries Programme in Ghana is supporting the development of a new strain of tilapia called the Akosombo strain. The Ghana National Aquaculture Development Plan is yet to be developed into projects for implementation and some key objectives to be addressed are: the development of improved strains of catfish, improvement in the genetic quality of broodstocks, feed and support to the industrial players involved in catfish production, as well as market development.

Some questions that came up in the course of study were; why the major focus on the production of tilapia compared to catfish, is it that consumers prefer tilapia to catfish, if so, what will make them diversify their preferences, are they willing to consume if value is added to catfish?

Very few of catfish farmers export processed table size catfish fish to some of the European countries [5]. The domestic market demand of catfish is increasing due to increase in population, preference and the influx of foreigners including Nigerians into the country. According to FAO statistics, Nigeria is the second largest catfish producers in Africa (21%) [6] and *Clariidae* are the most popular farmed-raised and consumed fish species, as they account for up to 90% of total cultivated fish

species on commercial farms and 62% of consumption of fresh fish nationally [7,8,9].

The per capita consumption of fish in Ghana is estimated to be about 20kg for fish consumption in 2015 [1]. With the yearly increase in the population, it is expected that there will be demand for fish and fish products hence to safeguard food security, the country needs to expand and increase fish production through aquaculture including the conscious effort in the production of catfish and other new species.

This study therefore seeks to examine the status of farm raised catfish consumption in Ghana with focus on Ashanti region which produces and consume a greater percentage of the fish species. The findings will inform the industry to better attract consumers of farmed catfish; the regulators to promote the sector, enhance catfish production and encourage value addition.

## 2. AQUACULTURE AND FISH CONSUMPTION

Traditional fisheries have been supplying fish to the food market for a long time. However, unsustainable fishing practices have led to the depletion of natural fish stocks and catches. Given these circumstances, aquaculture has been the most suitable alternative, complementary to traditional fishing, to gradually satisfy the global consumer demand [10] which is expected to increase substantially in the future [11]. Aquaculture is the fastest growing animal food producing sector with a global production increasing from less than 1 million tons/year in the early 1950s to 60 million tons in 2010. In 2014, fish harvested from aquaculture amounted to about 74 million tons with an estimated first-sale value of US\$160.2 billion. Almost all fish produced from aquaculture are destined for human consumption [12]. A healthy diet has to include sufficient proteins containing all essential amino acids, essential fats (e.g. long-chain omega-3 fatty acids), vitamins and minerals. Being a rich source of these nutrients, fish can be nutritionally very important. While average per capita fish consumption may be low, even small quantities of fish can have a significant positive nutritional impact on plant-based diets, and this is the case in many Low Income Food-Deficit Countries (LIFDCs) and the least-developed countries.

Overall, world supply of fish for human consumption has kept ahead of population

growth over the past five decades at an average rate of 3.2% in a period between 1961-2013, compared with 1.6% for world population growth. World per capita apparent fish consumption increased from an average of 9.9 kg (1960s) to 14.4 kg (1990s) and 19.7 kg in 2013 and an estimate of more than 20 kg in 2015 [12]. The reasons discussed above highlights that in a market driven by the demand, a better understanding of consumer purchasing behavior towards fish products is important to developing more effective marketing and policy strategies [13].

## 3. CONSUMER PREFERENCE

A common approach used in consumer studies is that proposed by [14] who defines goods as bundles of intrinsic and extrinsic characteristics and assumes that consumers choose, amongst the available products, those with a specific combination of attributes that maximizes their utility. On the other hand, the utility level of consumers varies individually being strongly influenced by psychological, moral and cultural factors such as beliefs and traditions as well as several kinds of social, political, moral and ethical values which are likely to shape attitudes and behaviours by encouraging or discouraging some choices rather than others. Researchers have attempted, first, to identify the most relevant attributes considered by consumers in choosing fish products, and secondary, to investigate the main socio-demographic, psychological and cultural factors affecting consumers' preferences for each relevant attribute.

Consumer perception of a certain food product and its acceptance or rejection is of a multi-factorial nature [15]. According to cue utilization theory, [16], assessing the quality of products is carried out in terms of the identifying and defining the information cues that consumers use as indicators. Product information cues are traditionally classified as either intrinsic or extrinsic. Intrinsic (sensory) cues are those inherent in the product, such as taste, smell or colour [16], texture and odour are extremely important to especially evaluate the freshness of this product [17], while extrinsic cues include any external features, such as price, brand or packaging [16]. Other preconceived ideas such as attitudes or beliefs about the product are considered especially in new food stuffs [18,19,20]. This study will examine the preferences of the consumers to catfish consumption with focus on processed catfish.

## 4. METHODOLOGY

### 4.1 Study Area

The region lies in the southern half of the country and occupies 24,389 km<sup>2</sup> or 10.2 percent of the total land area of Ghana. It is the third largest region after the Northern and Brong Ahafo regions, respectively. It shares boundaries with the Western, Central, Eastern and Brong Ahafo regions. The region is endowed with a spectacular geography that includes lakes, waterfalls, scarps, forest reserves, national parks, birds and wildlife sanctuaries [21]. In terms of the economically active population employed in the region, agriculture including forestry but little fishing is their leading economic

activity (30.5%) [21]. There are a total of seven zones (according to classification from the Fisheries Commission, Ghana) that is made up of 23 districts.

### 4.2 Sampling

Data was collected from four (57%) out of the seven (7) zones with the help of the Regional Director of Fisheries and some of his staff (Table 1).

A total of 240 people were sampled for the study at random in the Districts. Twenty (20) respondents were sampled from each of the twelve (12) districts (See Table 1).

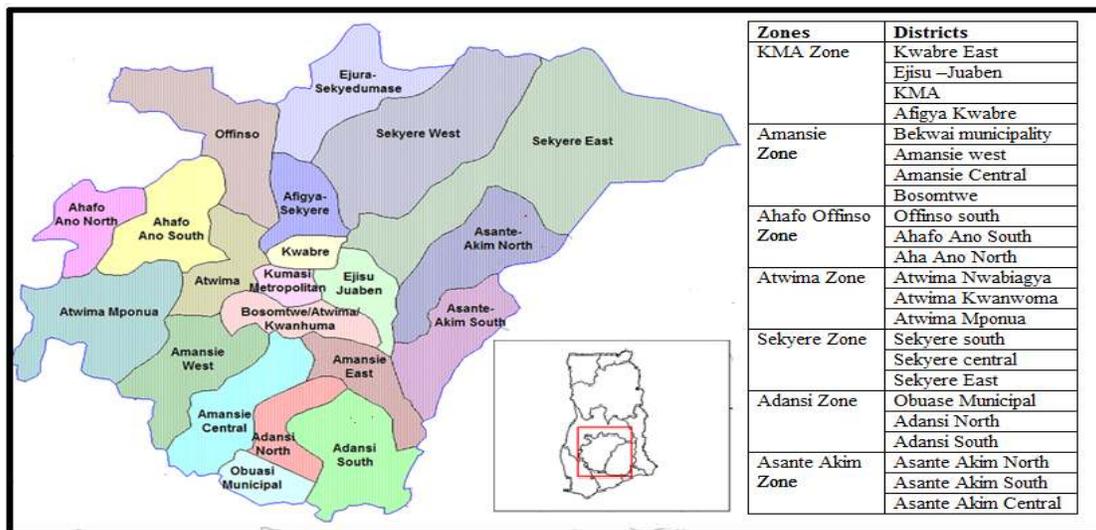


Fig. 1. Zones and districts of Ashanti region (Study area) [22]

Table 1. Study area and sample size

Zone	Total districts in zone	Number of sampled district	District sampled	Number of questionnaires
Ahafo Offinso	4	3	Offinso South, Ahafo Ano South, Ahafo Ano North	60
Atwima	3	2	Atwima Nwabiage, Atwima Mponua	40
Kumasi Metropolitan Authority	5	4	Kwabre East, Ejisu-Juaben, KMA,	80
Sekyere	4	3	Afigya Kwabere Sekyere South, Sekyere Central, Sekyere East	60
<b>Total</b>	<b>16</b>	<b>12</b>		<b>240</b>

**Table 2. Description, codes, name and A’ priori expectations of explanatory variables in the logit model**

Description	Codes/values	Name	A Priori expectation
Age	Years	Age	+
Gender	1 = male, 0 = female	Gender	±
Educational level	1 = formal, 0= no formal	Edulev	±
Household size	Number	HHS	+
Type of consumer	1 = family, 0 = otherwise	ToC	+
Frequency of fish purchased	1 = weekly, 0 = more than a week	Ffpur	+
Frequency of fish consumed	1 = weekly, 0 = more than a week	Ffcons	+
Where fish is consume	1 = home, 0 = otherwise	Locfcons	-
Ever eaten farmed fish	1 = yes, 0 = no	Etnffish	±
Taste of fresh farmed fish	1= Unpleasant taste, 0 = otherwise	Taste	-
Smell fresh farmed fish	1 = smell less better, 0 = otherwise	Smell	-
Preparation of fresh farmed catfish	1 = lack of prep skill, 0 = otherwise	Prepffish	-
Price of fresh catfish	1 = price, 0 = price not an issue	Pcatfish	-
Frequency of catfish bought	1= weekly, 0 = more than a week	Feqcatbot	+
Error term		ε	

**4.3 Data Collection Tool, Data Collection and Analysis**

A semi-structured questionnaire was designed for data collection. It is categorized into socio-economic characteristics, consumer preferences, farmed fish, and catfish consumption. Data was collected from the 14<sup>th</sup> to 20<sup>th</sup> September, 2015. The questionnaire was pretested and finalized for enumeration. Data enumerators included the Ashanti regional fisheries staff and staff from the head office. The results were presented descriptively using Statistical Packages for Social Sciences (SPSS) version 20 and regression analysis was undertaken using STATA version 11.

**4.4 Theoretical Analysis**

Regression methods have become an integral component of any data analysis concerned with describing the relationship between a response variable (outcome or dependent) and one or more explanatory variables (predictor or independent). It is often the case that the outcome variable is discrete, taking on two or more possible values. Over the last decade the logistic regression model has become, in many fields, the standard method of analysis [23]. In this case, the model is being adopted in the analysis of the willingness to consume processed farmed raised catfish. Binary

discrete phenomena usually take the form of a dichotomous indicator or dummy variable with values of 1 and 0 [24]. The dependent variable takes the value of 0 and 1 but the predicted values for regression take the form of mean proportions or probabilities conditional on the values of the independent variables.

The general multiple logistic P(X) can be written as [25]:

$$P(D = 1|X_i, \dots, X_k) = P(X) = \frac{1}{1 + e^{-(\alpha + \sum \beta_i X_i)}} = F(\alpha + \beta_i) = \text{Eqn. 1}$$

$$\text{Logit } P(X) = \alpha + \sum \beta_i X_i = \alpha + B_1 X_1 + B_2 X_2 + \dots + B_k X_k = \text{Eqn. 2}$$

Where ‘e’ denotes the natural logarithms, P(x) is the probability that an individual will like to consume processed catfish or not, βi are the coefficients of the explanatory variables (Xi) [23,24,26]. Fish consumption and preferences are affected by consumers’ geographic, social, and cultural characteristics [27,28]. It is known that food preferences are also affected by a number of sensory (taste, smell, texture etc.) and none-sensory factors (e.g. personal characteristics such as gender, age, education, marital status, income, family size among others) [29].

#### 4.5 Marginal Effect

The marginal effects of a variable 'x' on 'p' can be calculated by taking the first derivative of the function as shown in Eqn. 3.  $\beta$  denotes the marginal effect of a unit change in the explanatory variable on the probability of Willingness-To-Consume farmed raised catfish [25].

$$\frac{\partial p}{\partial x} = \left[ \frac{\partial p}{\partial F(x\beta)} \right] \left[ \frac{\partial F(x\beta)}{\partial x} \right] = f(x\beta) \cdot \beta_i = \frac{e^{-x\beta}}{(1+e^{-x\beta})^2} \cdot \beta_i \quad \text{Eqn. 3}$$

#### Empirical Model

$$y = \alpha + \beta_1 age + \beta_2 gender + \beta_3 edulev + \beta_4 HHS + \beta_5 ToC + \beta_6 ffpur + \beta_7 ffcons + \beta_8 locfcons + \beta_9 etnffish + \beta_{10} taste + \beta_{11} smell + \beta_{12} prepf fish + \beta_{13} pcatfish + \beta_{14} freqcatbot + \varepsilon_i \quad \text{Eqn.4}$$

### 5. RESULTS AND DISCUSSION

#### 5.1 Gender and Age of Respondents

Out of a total of 240 respondents sampled, 20% were males while 80% were females. Their ages ranges from 22 to 84 years with an average age of 41years and the modal age of respondents (21%) is 30 years.

#### 5.2 Household Size and Number of Household Working

The household size of the sampled respondents ranged from 1 to 16 with an average number of 6 and a standard deviation of 3 people. The modal number reported for this study is 4 persons per household. According to the 2010 Population and Housing Census [21], the average household size in the region is about 4. The household size range recorded for the study fell within what was reported in 2010 which was 1 to more than 20 for the region. The total number of persons in a household working also ranged from 1 to 10 with an average of 3 and standard deviation of 2.

#### 5.3 Profession

The following were the professions of the sampled population: catering, civil servants, local restaurants operating, dressmaking, cleaning, food vending, teaching, nursing, processing,

hairdressing, trading, farming and business. Students were also among the sampled population.

#### 5.4 Educational Level

The targeted respondents had attained various levels of education. Majority of those targeted (36%) had attained the Middle School/Junior High School followed by 20% who had had no formal education. In addition, 17% and 15% of the target population had accomplished their 1<sup>st</sup> degree and 2<sup>nd</sup> degree (Masters) respectively. Others (6%) had reached High National Diploma and Vocational levels. The 2010 Population and Housing Census in 2010 suggested that about 15% of the population in the region have never had formal education. Even though the figure reported for the study seemed higher, it is lower than the national average of 23.4% [21].

#### 5.5 Ethnicity

Majority of the targeted group for the study were Akans (56%) followed by the Northerners from the three Northern regions who formed 20% of the sampled size. The Ewes formed 13% and others such as the Brongs, Gas, and Fantis formed 11% of the sample size. The predominant ethnic group in the region are the Akans who formed about 75% of the population [21].

#### 5.6 Consumers' Fish Consumption Habit

##### 5.6.1 Type of consumers and last time fish was purchased

The respondents were interviewed to disclose the type of consumers they were. Results showed that there were 82% of the consumers sampled from the family and the rest being individuals (non-family). In terms of the family (196), most were females (82%) while 18% were males. Those from the non-family were made up of 72% females and 28% were males.

The respondents were interviewed about the last time they had bought fish (Table 3). About half of them (47.9%) indicated that they had bought fish within the week while 42.5% had bought it the day the interview was undertaken. Most respondent purchased fish in the course of the week (90.4%).

**Table 3. Last time fish was purchased**

	<b>Frequency</b>	<b>Percent</b>
Today (day of interview)	102	42.5
Within the week	115	47.9
More than a week ago	6	2.5
About a month	12	5.0
More than a month ago	5	2.1
Total	240	100.0

**5.6.2 How often fish is bought by type of consumers**

Respondents buy fish at different periods (Table 4). About half of them (48.5%) bought fish daily to consume while 30.1% bought fish more than once a week. Results show that a higher percentage of respondents who are family members and individuals bought fish daily followed by those who bought more than once in a week. It implies that most respondents (78.6%) consume fish within the week. All consumers believed that it is healthy to consume fish. This confirms the findings of a study which indicated that consumers linked regular consumption of fish to health and nutritional benefits [30].

Studies have shown that fish and seafood are widely perceived by consumers as healthy foods with a number of specific health and nutritional benefits mainly associated with the high content in proteins and Omega-3 fatty acids with low fatty content [31].

**5.6.3 Frequency of fish bought and frequency of fish consumed**

The relationship between frequency of purchase of fish and frequency of fish consumption is summarized in Table 5. These results show a significant relation at 1% level ( $p < 0.01$ ). There is a positive relation between buying and consumption of catfish. Majority of respondents who buy fish weekly consumed fish weekly (Table 5).

**5.6.4 Type of fish consumed**

When the respondents were interviewed about the type of fish they consumed, they indicated that they consume fresh fish from the capture (marine and freshwater) and freshwater farmed fish. Some of the marine captured fish included tuna species, red fish, anchovies, mackerel, herrings, cassava fish, and sardinella. The fresh

water capture include mainly tilapia, *Chrysichthys* (Brollo), *Synodontis* and *Cynothrissa* among others. The farmed fish are mainly tilapia and catfish. Some consumers consumed *heterotis* as well. The respondents chose the type of fish consumed based on its price, ease of processing, smell, taste, accessibility and availability among others.

**5.6.5 Form in which fish is bought**

Fish products can be purchased in different forms such as smoked, frozen, salted, chilled/fresh, live, and grilled. The respondents were interviewed about the form in which they buy their fish. The commonly purchased form of fish is the smoked fish (77%) followed by frozen/chilled (37.5%) and then fresh (31.7%) (Table 6). The nature of responses applies to individuals as well as families. The high percentage of smoked fish preference could be due to its longer shelf life, better taste, and usage (type of meal).

Also, the cost incurred in storing fresh/chilled fish in a freezer is high due to high electricity bills hence most will like to buy smoked fish. The country had been faced with frequent power outages or fluctuation leading to fish spoilage.

**5.6.6 How often fish is consumed and where fish is consumed**

From the results, a good number of the respondents ate fish daily (63.3%) followed by those (26.7%) who consume fish more than once in a week. In addition, 9.2% of the respondents consume fish weekly while 0.8% consume once in a month. Results conclude that most respondents consume fish weekly (99.2%). Furthermore, the results show that most respondents consumed fish from only homes (92.9%), 1.3% consumed from only local joints and restaurants, and 5.9% from homes and local joints (“Chop bars”) and restaurants. Studies have shown that consumption of fish by households can be influenced by some members or households head who love and eat fish. Hence if the household head or pressure person does not eat fish, or consume less themselves, considering the person responsible in the house for cooking and not willing to prepare fish meals, they may negatively affect the level of fish consumption of their family [31,32]. In this case the results suggest that such families patronize fish as one of the protein sources in their diets.

**Table 4. Type of consumer and how frequent fish is bought**

		How often do you buy fish				Total	
		Daily	More than once a week	Weekly	More than once a month		
Type of consumer	Family	95(48.5%)	57 (29.1%)	33 (16.8%)	5 (2.6%)	6 (3.1%)	196 (100.0%)
	Individual	21(48.8%)	15 (34.9%)	6 (14.0%)	0 (0.0%)	1 (2.3%)	43 (100.0%)
<b>Total</b>		<b>116 (48.5%)</b>	<b>72 (30.1%)</b>	<b>39 (16.3%)</b>	<b>5 (2.1%)</b>	<b>7 (2.9%)</b>	<b>239 (100.0%)</b>

**Table 5. Cross tabulation between frequency of fish purchase and fish consumption**

		Frequency of consumption of fish		Total
		More than a week	Weekly	
Frequency of buying fish	Otherwise	11 (84.6%)	2 (15.4%)	13 (100.0%)
	Weekly	55 (24.2%)	172 (75.8%)	227 (100.0%)
<b>Total</b>		<b>66 (27.5%)</b>	<b>174 (72.5%)</b>	<b>240 (100.0%)</b>

*Pearson Chi-Square value = 22.489, df=1, (p=0.000)*

**Table 6. Form in which fish is bought**

	Frequency	%*
Smoked	181	75.4
Frozen/chilled	90	37.5
Fresh	76	31.7
Salted	70	29.2
Live	4	1.7
Grilled	6	2.5

\* Multiple responses

**5.6.7 Sources of protein and preferences**

The respondents were asked to indicate their regular sources of protein and order of preferences. From Table 7, most respondents ranked fish as their most preferred choice followed by meat. It implies that most respondents prefer to eat fish as compared to the other protein sources. Results shows that a good number of the respondents (68.4%) mostly prefer fish, 40% prefer meat (beef), and 41% prefer chicken meat as their regular source of protein.

Even though bush meat is a delicacy and consumed in large quantity in the region, it is

expensive hence not eaten regularly by the sampled respondents. Recent event in West Africa about the meat harbouring Ebola virus has affected peoples' desire to consume bush meat. Other animal protein sources are eggs and pork.

**5.7 Consumers Consumption Habit of Farmed Catfish**

When the respondents were asked if they had ever eaten farmed fish before, 70.8% answered affirmatively, 26.3% said no and 2.9% did not respond. The type of farmed fish eaten by the respondents are mainly catfish and tilapia since the region produces mainly these two fishes. In terms of gender, about 71% females out of 192 female respondents and 80% males out of 45 male respondents had eaten farmed fish before. The study further shows that of the 170 respondents who consumed farmed fish, 30 (17.6%) consumed only catfish, 70 (41.2%) consumed only tilapia and 70 (41.2%) consumed both tilapia and catfish.

**Table 7. Types of protein source and preference**

	Most preferred	Preferred	Less preferred	Least preferred	Total
Meat (Beef)	55 (26.3%)	84 (40.2%)	46 (22.0%)	24 (11.5%)	209 (100.0%)
Poultry	15 (6.9%)	89 (41.0%)	103 (47.5%)	10 (4.6%)	217 (100.0%)
Bush meat	20 (20.4%)	8 (3.3%)	23 (23.5%)	47 (48.0%)	98 (100.0%)
Fish	154 (68.4%)	37 (16.4%)	23 (10.2%)	12 (4.9%)	225 (100.0%)
Other	2 (10.0%)	-	3 (15.0%)	15 (75.0%)	20 (100.0%)

Also, the results indicate that in terms of fresh water fish, 69% of respondents have preference for lake fish (capture) and 31% for farmed fish. Numerous studies carried out in different countries [33,34,35] showed that wild fish is perceived as being superior to farmed fish by the majority of consumers in terms of taste, safety, healthiness and nutritional value. Yet consumer choice between wild and farmed fish seemed to be strongly affected by beliefs resulting from stereotypes, emotional sensations and incorrect information [36].

### **5.7.1 Consumption of fresh farmed catfish**

Also when those who ate farmed catfish (100) were asked if they consume fresh farmed catfish, about 63 respondents (63%) answered affirmatively while 37% said no. All the male respondents (13) consumed fresh catfish while 57.5% of the 87 female respondents consumed fresh catfish. The reasons given by those who did not eat fresh catfish (37%) were:

- i. **It taste different as compared to the captured:** The wild catfish has a unique taste that makes it appealing to the consumer as compared to the farmed catfish.
- ii. **It has an unpleasant odour when fresh and it's slimy:** The respondents were of the view that it has an unpleasant odour and if it is not prepared well, it might not be easy to eat it. It is also slimy when fresh hence one needs a skill in preparing it. The preparation of fish, particularly fresh fish, often requires high degree of "self-efficacy" which refers to how competent a person feels in doing what is necessary to manage a specific situation, and thus reduce uncertainty [37]. In the case of fish preparation, self-efficacy depends on the levels of knowledge, experience, expertise and self-confidence, firstly, in evaluating the quality of products at the place of purchase and, successively, in cooking them at home. It is expected that low levels of self-efficacy in managing the entire fish preparation process may affect fish consumption negatively. [14] suggested that individuals may be averse to consuming fish because of a perceived difficulty in buying, preparing and cooking, the belief that it is expensive, or the unpleasant physical properties of some varieties of fish, such as small bones and the smell.
- iii. **Is a taboo:** Some respondents due to their religion do not eat catfish because it has no scale on the body.
- iv. **The price is high due to the large size:** The farmers produce most of their catfish fishes to the size more than 1kg. This size correspond to higher price which is too expensive to such consumers hence they do not patronize the fresh fish. The cost of a kilogram of catfish ranged from GHS10.00 (US\$2.5) to GHS15.00 (US\$3.75). [38] in their studies on attitudes towards seafood and patterns of consumption in an Australian coastal town found out that 42% of respondents agreed that cheaper prices would encourage higher fish consumption. This study confirmed the findings of [39].

## **5.8 Consumer Purchasing Behavior**

### **5.8.1 Form in which catfish is bought**

According to the respondents, they bought the farmed fish in various forms. A good number of them mostly bought smoked catfish (63%) followed by 26% who buy the fresh catfish fish. Additionally, 10% and 3% buy chilled and grilled catfish while 2% bought catfish in the live and also dried form. The taste by Ghanaians for processed catfish is also increasing with increase in population and preferences. The authors interviewed some market women who sold fish including raised processed catfish in some major markets in the regional capital of Ashanti region (Kumasi) and the National capital, Accra. The market women were of the view that there is an increase in market demand for processed catfish (wild and farmed) in the domestic markets. They indicated that catfish caught from the wild (capture) is on the decline (quantity and size) hence the need to make up for the gap by increasing farmed raised catfish.

### **5.8.2 Source of buying catfish and frequency of farmed catfish bought**

Catfish is bought from various sales point as suggested by the respondents. Most of the respondents (56.1%) buy their fish from the open market. Equal percentage (17.8%) also bought from cold stores and fish mongers/retailers/hawkers.

Other respondents buy from fish market (4.7%), supermarket (1.9%) and food or fish joints

**Table 8. Frequency of farmed catfish bought**

	<b>Frequency</b>	<b>Valid Percent</b>
More than once a week	48	48.0
Once a week	23	23.0
More than once a month	5	5.0
Monthly	11	11.0
Once a while	13	13.0
Total	100	100.0

**Table 9. Quantity and price of fish bought/month**

	<b>Min</b>	<b>Max</b>	<b>Mean</b>	<b>Std. Dev.</b>
How many purchase (kg) per month?	0.50	18.00	4.45	4.00
Amount of money spent on catfish? (US\$)	1.00	45.00	12.26	10.68

*Exchange rate GHC4= US\$1*

(1.9%). It was revealed that farmed catfish found in the coldstore were imported illegally from China [40] Imported catfish cost US\$0.85 as compared to the production cost of a kilo of catfish in the region which is about US\$4.00. This therefore calls for measures to safeguard the industry.

Table 8 describes the frequency of the purchase of catfish. The study revealed that a good number of the respondents bought and consumed catfish more than once a week followed by once a week. This implies that about 71% of the respondents purchased catfish within the week.

Table 9 summarizes the quantity of catfish bought by respondents and the value. The weight of catfish purchased ranges from 0.50 kg to 18 kg per month with an average of 4 kg and standard deviation of 4 kg. The modal weight is 2 kg catfish with price of US\$5.00. The price per kilo ranges between US\$2.5.00 to US\$3.75.

**5.9 Willingness to Consume Processed Catfish**

Furthermore, when all respondents were asked if they would consume catfish given that it is processed, about 87% said yes and 13% said otherwise. This is made up of 90% female and 75% male. The high percentage of females willing to consume processed catfish will encourage the consumption of catfish in homes since most women take decisions of what protein source to eat at home.

**6. LOGISTIC REGRESSION RESULT**

Table 10 depicts the result of a logistic regression analysis with the dependent variable being 1 for willingness to consume processed farmed catfish and 0 otherwise. In examining the goodness of fit, the results show that the p-value (<0.01) for the LR chi-square statistic implies that at least one or all of the variables in the model is important for predicting the probability of willingness to consume processed farmed catfish. The test for parameters suggest that each of the effect in the model is significant at the 1% level. Out of a total of 10 variable (excluding other variables in the model to come out with the best fit), four (4) were statistically significant at 1%, 5% and 10%. The results shows that age, gender, where fish is consumed and frequency of catfish purchased are significant at 10%, 10%, 5% and 1% respectively.

The marginal effect of age indicates that a 1% increase in the age of respondent will lead to 0.003% decrease in the probability that the respondent will consume farmed processed catfish. This contradicts the findings of [41] who indicated that age is positively related to eating seafood. This could be due to the fact that the youth may desire for processed catfish as a result of its easy usage. Also, female who tend to manage and take decision at home about what is to be consumed in the house tend to have positive relation with the consumption of processed catfish. Male do not mostly make decision in what food is cooked at home. The result shows that a 1% increase in the number of males making decisions about what to eat in the

**Table 10. Logistic regression result for willingness to consume processed farmed catfish (Dep. var.)**

<b>Logistic regression</b>		Number of obs. = 220 LR chi <sup>2</sup> (12) = 47.95 Prob>chi <sup>2</sup> = 0.00			
Log likelihood = -67.265933		Pseudo R <sup>2</sup> = 0.2628			
<b>Consumption of processed fish</b>	<b>Coef.</b>	<b>Std. Err.</b>	<b>Z</b>	<b>P&gt;z</b>	<b>dy/dx</b>
<b>Age</b>	<b>-0.036</b>	<b>0.020</b>	<b>-1.81</b>	<b>0.070*</b>	<b>-0.003</b>
Educational level	-0.246	0.751	-0.33	0.743	-0.017
<b>Gender</b>	<b>-0.905</b>	<b>0.491</b>	<b>-1.84</b>	<b>0.065*</b>	<b>-0.087</b>
Householdsize	0.098	0.100	0.97	0.331	0.007
Type of consumers	-0.487	0.608	-0.8	0.423	-0.032
Taste	0.288	1.244	0.23	0.817	0.022
Lack of preparation skill of catfish	0.582	1.197	0.49	0.627	0.044
<b>Where fish is consumed</b>	<b>1.808</b>	<b>0.882</b>	<b>2.05</b>	<b>0.040**</b>	<b>0.254</b>
Ever eaten farmed fish before	-0.322	0.612	-0.53	0.599	0.023
<b>Frequency of catfish purchased</b>	<b>2.589</b>	<b>0.793</b>	<b>3.26</b>	<b>0.001***</b>	<b>0.181</b>
Constant	1.478	1.668	0.89	0.375	-

\*\*\*\*\* denote 1%, 5% and 10% level of significance

house will precipitate 0.087% decrease of consumption of processed farmed catfish at homes. Furthermore, where catfish is consumed can also influence its consumption. A good number of the respondents eat processed farmed catfish from home as compared to other locations. This could be so because the data collected was biased towards family members and most people interviewed consumed farmed catfish at home. A percent increase in the number of respondents eating from home will precipitate 0.254% increase in processed catfish consumption.

Finally, the frequency of the purchase of catfish can also affect the consumption of the process farmed catfish. A good number of the respondents purchase and consume catfish and fish in general within the week. Since the cost of preserving fish is high using freezers, most respondents will prefer to purchase processed catfish especially the smoked catfish rather than buying the fresh one. It implies that from the results, a 1% increase in the frequency of purchase of catfish, will lead to 0.18% increase in the consumption of processed farmed catfish. The other variables were not statistically significant even at the 10% level.

## 7. CONCLUSION AND RECOMMENDATIONS

The study employs a survey method to examine the status of farmed raised catfish consumption

in Ghana focusing on the Ashanti region as a case study. A good number of the respondents sampled for the study are educated and most respondents were sampled from the families. Results show that most of the respondents prefer fish as a main source of protein. Most purchased and consumed fish within the week. Respondents patronized captured (marine and fresh water) and cultured (tilapia, catfish and heterotis) fish. It was revealed that a greater number of the respondents prefer buying smoked fish. The results indicates that a greater number of the respondents consumed fish from homes only.

The outcomes of the analysis shows that a greater percent of the respondents had eaten farmed fish before and these are mainly tilapia and catfish. The results further points out that a little above half of those who consumed farmed fish consumed catfish. This response applies to both gender. There are various reasons some respondents do not eat fresh farmed catfish. These are: captured fish taste better, catfish has an unpleasant odour and is slimy, is a taboo not to eat scale less fish, high price and lack of skill for its preparation. Most respondents who patronize catfish prefer the smoked and mostly purchased from the open market. The study concluded that about half of the respondents who consumed farmed catfish purchased it more than once a week. It is also revealed from the study that a higher percentage of respondents will consume catfish when processed. This include a

higher percentage of women. The logistic results show that the determinant for consumption of processed catfish in this study are age, gender, where fish is consumed (location), and frequency of farmed catfish purchased. It is therefore recommended that the fish farmers be assisted by government to produce catfish by creating enabling environment. Some of these will be, developing and implementing policies through relevant ministries and agencies specifically targeting catfish production. There should be the developing of projects out of the aquaculture development plan and other plans focusing on catfish production including the production and supply of quality catfish fingerlings to farmers. Since it was revealed from the study that greater percent of consumers' preferred processed catfish compared to fresh and are willing to consume it, value addition to the catfish product should be encouraged for higher patronage thereby contributing to food security. Results of this study could play a significant role when the relevant institutions are planning and promoting the development of aquaculture in the country by making use of the interests of consumer needs.

## DISCLAIMER

Views and opinions expressed in this paper are those of the authors and do not reflect the official policy or position of the associated institutions.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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