

Original Research Article

Economics of Fish Production in Amansie-West District of Ghana: Implication for Food Security in West Africa

ABSTRACT

This study used primary data collected from 45 fish farmers in the Amansie-West District of Ghana, West Africa. Data on yield of fish and inputs used by the farmers were used to carry out the descriptive analyses for the study. The results show that yields of fish in the area are poor and well below potential yields indicated by field trials. In order to improve yields through public policy regarding extension practices and input availability where applicable, knowledge of fish production must be improved. Also, there is a need for changes to public policy to improve yields for existing ponds and identify circumstances where yields can be improved for future ponds. It is also recommended that a further research should be carried out to estimate a cost function for the fish production technology used by the fish farmers in the district to help reduce the cost of fish production. This would help to improve the returns to fish farmers; encourage more people to engage infishfarming, thereby helping to increase fish production and promote food security in the country and the West African region.

Key words: Fish production, Amansie, Ghana, West Africa, small scale farmers

1. INTRODUCTION

Aquaculture has a long history in Africa, ranging from the regional fish culture development project by FAO which covered the Central Africa countries mainly Cameroon, Congo, Gabon and the Central African Republic [1]. With most of the fish farmers operating under small scale basis, other African countries have also witnessed significant growth in fish production, for instance, Malawi recorded an increase from 5 tonnes in 1996 to 17 tonnes in national catfish production as at 2003 [2], and Egypt which contributes up to 78 percent of the total combined aquaculture production in North Africa, Near East and Sub-Saharan Africa [3, 4]. West African countries for instance, Nigeria also records considerable success in fish production with catfish farmers operating at a profit efficiency of up to 0.84 [5], while catfish production was predicted to increase by 40,000 tonnes before 2010, with the highest concentration of fish farms located in the southern region of the country [6]. Despite the potential for fish farming in Africa, many African countries including Ghana do not have a quantified long term or even mid-term national plan for their aquaculture sectors [7], making it difficult to develop production targets for the sector. Fish farming in Ghana dates back to the early 1950s, and involves different fish species, mainly the African catfish (*Clarias gariepinus*, *Heterobranchus longifilis* and *Heterobranchus isopterus*), and tilapia, mainly *Oreochromis niloticus* [8].

The estimated domestic supply of fish is about 435,000 Metric Tonnes (MT) and a demand of about 840,000 MT (FAO, 2005). The national annual deficit is about 405,000 MT, which implies the nation is able to supply only about 52% of her fish needs. Ghana however spends nearly \$100 million a year to import 200,000 MT of fish to supplement domestic production [9], due to a decline in the contribution of the fishing sector to the country's economy [10]. In general, to boost fish production to help promote food security within the country and West Africa region, it is important that fish farmers are made to share information through an improved mechanism to boost regional and international transfer of information and technology, with reference to efficient fish production [11]. It is against this background that this study was carried out to assess the economics of fish farming in the Amansie-West District of Ghana, with a view to proffering recommendations to help promote small scale farming in Ghana and the West African region. The study therefore seeks to address the following questions:

- What inputs do fish farmers in the Amansie West district use in their operations?
- How much output do they obtain on a per hectare basis through the use of the resources available to them?
- How can these problems be overcome in order to boost local production and enhance profitability of the industry?

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To be able to answer these questions the study seeks to; identify the various inputs used by the fish farmers in the Amansie West District and the costs incurred during production; obtain data on the yield and sales of the harvested fish, and proffer recommendations based on the findings.

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2. LITERATURE REVIEW

2.1 Overview of Fish Production in the Amansie-West District of Ghana

The fishery sector in Ghana plays an important role in the national economy, although there has been a decline in the contribution of the fish sector to the national economy over the years [10]. It contributes 3 % to Gross Domestic Product (GDP). Even though in percentage terms 3 % may look small, its significance cannot be over-emphasized taking into consideration the absolute number of people employed in the sector. It is also estimated that, 1.5-2 million people directly or indirectly rely on or support these fishers. These include their wives, children, close relatives, canoe carvers, input suppliers and office workers for industrial fleet [12]. Over the years, the production from capture fisheries in Ghana has peaked, even to a point of decline; on the other hand, demand for fish has been growing due to population increase. Moreover, capture fisheries alone is not enough to meet the demands of the people for fish. This has made the development of aquaculture very important to the Ghana government to serve as one of the ways to bridge the gap between demand and supply of fish and to produce in excess for exports. The Ashanti Region is among the highest producers of farmed fish but not much is known about the production of individual districts that make up the region. Amansie West is one of the leading districts in Ashanti Region in terms of aquaculture because of its high volume of production. This total volume (90.66 metric tonnes as at 2006) does not come from few farmers but many small subsistence and small scale farms which are located all over the district. The two percent (2%) increase in production from 2005 to 2006 shows that aquaculture is doing well in the district [13].

Amansie West has the potential for fish farming and this is found in the nature of terrain, the streams and type of soil, which are inevitable factors in aquaculture. The main local sources of fish are the streams and rivers found in the district. Yet bulk of their fish is from Kumasi where much of the fish in the market come from coastal towns like Accra, Takoradi, Tema, Elmina and Yeji.

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Cobbah[13]acknowledged that aquaculture has gained some grounds and has been progressing in Amansie West district for the last six years since its inception by the Resolute Amansie Mines Company Limited. The adoption of aquaculture in the district is shown in the widespread distribution of earthen ponds. Aquaculture is believed to have helped to mitigate the protein-deficiency of the people. It has also brought employment especially to the youth as some of the youth are employed as fish pond managers. It was alsoassertedthat there are two categories of fish farmers – individual and cooperative farmers. Most cooperative ponds are abandoned mainly because of lack of commitment and heavy reliance on the mines for resources. There is also a higher preference for individual ponds and farming is at the subsistence and small scale levels. Most of the harvested fish are sold and the rest used in the home.

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81 There is more room for improvement in the identified fish pond management practices in Amansie West. However,
82 there are numerous constraints to fish farming in the district and assistance from governmental and non-
83 governmental organizations are needed to sustain interest and improve on production. Moreover, the country's
84 department of Fisheries is unable to provide all the information and services required for efficient development and
85 management of the fisheries sector, coupled with lack of awareness of current developments in other countries in the
86 West African region which could be relevant to the Ghanaian condition[14].

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88 3. METHODOLOGY

89 This study was conducted in the Amansie West District of the Ashanti Region of Ghana, West Africa. Amansie-West is
90 a rural farming district in the Ashanti Region of Ghana, West Africa. The area was chosen because it has the highest
91 number of registered fish farmers in the Ashanti Region[13]. Another reason why the area was chosen was because
92 Amansie West is considered a very poor district with high malnutrition status in Ashanti Region which is the highest
93 producer of farmed fish in Ghana. Amansie West is one of the 21 districts in the Ashanti Region of Ghana with
94 MansoNkwanta as its capital. It was carved out of the Amansie East District in the Ashanti Region in 1989, as part of
95 the government's Decentralization Policy. The district is located in the south-western part of the Ashanti Region. It
96 shares common boundary on its western part with the Atwima District. On its northern part can be found the
97 Bosomtwe-AtwimaKwanwoma District while a regional boundary separates it from the Western Region on its southern
98 part. The district covers an area of 1,364 square kilometres[15].

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100 The district lies entirely in the rainforest belt of Ghana. It exhibits most semi-deciduous characteristics. The district is
101 very rich in forest resources, such as timber, herbs of medicinal value and fuel wood. It also abounds in different
102 species of tropical hardwood, notably Odum, Mahogany and Sapale. There are four main forest reserves in the
103 district. These are: Oda River Forest Reserve, Apamprama Forest Reserve, Gyeni River Forest Reserve and Jimira
104 Forest Reserve. The soils are mainly ultisols, acid and of low fertility. Amansie West has a population of 108,726,
105 most of whom are illiterates. It is rural and cocoa farming is the major occupation. Fish farming, a growing business in
106 the district started in 2002 and it was the initiative of the Resolute Amansie Gold Mines. The topography of the district
107 is generally undulating with an elevation of 210 meters above sea level. The most prominent feature is the range of
108 hills, which stretches across the north-western part of the district, especially around Manso-Nkwanta and Abore.
109 These hills have an elevation of between 560 m and 630 m. The district is drained in the north by the Offin and Oda
110 rivers and their tributaries such as Jeni, Pumpin and Emuna. With a monthly temperature of 26°C, the district enjoys a
111 mean annual rainfall of 160-180mm, with no strong dry season[16].

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112 Forty five (45) registered fish farmers formed the sample size for the study, selected from the total of seventy (70)
113 registered fish farmers in the Amansie-West District. Data on the registered farmers were obtained from the Ashanti

114 Regional Office of the Department of Fisheries. Primary data were obtained from the selected farmers through the use
115 of the semi-structured questionnaires and interviews, which included data on the socio-economic characteristics of the
116 respondents, such as sex, educational status, marital status level of education, number of dependants and main
117 occupation of fish farmers in the study area. The descriptive analyses were carried out on the socio-economic data
118 using the Student Statistical Package for Social Science (SPSS). Secondary data used for the study were collected
119 from literature relevant to the research topic, such as serials, FAO publications, books and journals. The secondary
120 data obtained showed that the fish farms in the study area were of three major size distributions: large, medium and
121 small, ranging between 0.01 and 25 hectares. To ensure that each size distribution was fairly represented in the final
122 sample of 45 registered fish farmers in the study area, the researcher categorised the registered fish farmers in the
123 district into groups based on the total area of the ponds on each farm. The categories were: small (0.01-0.10 ha),
124 medium (0.11-0.20 ha) and large (>0.20 ha). There were 39 small-sized farms, 16 medium farms and 15 large farms.
125 With the intended sample size of fifty (50) and the total population of registered fish farmers of seventy (70), and to
126 obtain a proportionate number of respondents from each stratum, the sample size was divided by the population:
127 50/70, which gave 5/7. Thus, 5/7 of the number of farmers in each stratum was chosen randomly. In other words,
128 twenty-eight (28) small-sized farms were randomly selected from the thirty-eight (38) small-sized farms, eleven (11)
129 from the sixteen (16) medium farms and eleven (11) from the fifteen (15) large-sized farms totalling fifty in all.
130 However, only forty five (45) out of the fifty (50) registered fish farmers selected gave complete information used for this
131 study.

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133 4. RESULTS AND DISCUSSION

134 4.1 Inputs used by Fish Farmers in the Amansie West District of Ghana

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135 Data used for this work were obtained from a sample of 45 fish farmers. Of this number of respondents, twenty-two
136 (22) were individuals while twenty-three (23) were cooperative societies. Data was obtained on the total area of
137 functional ponds (ha) used for the 2007/2008 production season, the number of fingerlings stocked, the quantity of
138 fertilizer used (kg), the quantity of feed used (kg) and the number of times per day that the fishes are fed daily and
139 how many months fish are fed before harvesting, and the number of hours or minutes spent working on the fish ponds
140 (man-days). The descriptive analysis of the inputs used by the fish farmers is presented in table 1.

141 Table 1: Descriptive analysis of Inputs used by Fish Farmers in the Amansie West District of Ghana

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Inputs	Range	Minimum	Maximum	Sum	Mean (N = 45)	StdDev
Total Pond area (ha)	1.2485	0.0015	1.25	7.413	0.17	0.24
Fingerlings Stocked	70925	75	71000	9331.11	13198.99	13242.68
Quantity of Feeds (Kg)	19215	1260	20475	200313	4451.40	3279.56
Labour (Man-days)	146	4	150	2096	56.58	225.97
Quantity of Fertilizer (Kg)	980	1	981	11732	260.71	210.38

142 N = Number of Observations.
143 Source: Field survey data (2009)

144

145 4.2 Total area of fish Ponds in used by Farmers in the Amansie-West District

146 As shown in table 2(appendix), the distribution of ponds in the district among the forty-five (45) respondents indicates
147 that 27(60%) of the respondents have total pond area of less than 0.10 ha. This group included both individual farmers
148 and cooperative societies. This is also the modal group in terms of total pond area stocked during the last production
149 season;anindication that most of the farmers operate on the small-scale. As may be seen from table 1 in the appendix,
150 the least total pond area was 0.0015 ha while the largest total pond area was 1.25 ha.11(24.44%) of the respondents
151 had pond areas ranging from 0.11 and 0.20 ha and 7(15.56%) owned total pond areas larger than two (2) ha (table 2).

152 Table 2: Total areas of fish ponds in the Amansie-West District

Total Pond Area (Ha)	Frequency	Percent
< 0.10	27	60.00
0.11-0.20	11	24.44
> 0.20	7	15.56
Total	45	100.00

153 Source: Field Survey (2009)

154

155 The cost of constructing the highest capital element in the establishment of a fish farm and since majority of the
156 farmers obtained their initial capital from their own savings, it is not surprising therefore that majority of them own pond
157 areas less than 0.11 ha. Discussions with some farmers during the field surveyrevealedthat land acquisition was not
158 much of a problem to them but their major setback had been the construction of the ponds. Of the farmers interviewed
159 43(95.6%)had earthen ponds dug out for raising fish while the remaining 2(4.4%) had concrete ponds, which were
160 relatively smaller in size than the dugout earthen types, as shown in table 3.

161

162 Table 3: Types of ponds Used by Fish Farmers in Amansie-West District

Pond type	Frequency	Percent
Concrete	2	4.4
Earthen	43	95.6
Total	45	100

163 Source: Computed from Field Survey (2009)

164

165

166 4.3 Number of Fingerlings used by fish farmers in the Amansie-West District

167 Table 4 presents the descriptive statistics for the number of fingerlings stocked by the farmers. The results show that
168 the minimum quantity of fingerlings stocked by the fish farmers in the Amansie-West District was 75 pieces. The
169 quantity of fingerlings stocked is relative to the total size of the fish pond. Actually, according to the agricultural
170 extension agent (pers.commun) who assisted in this work, the stocking rate per pond is 5 fingerlings per m². Apart
171 from three (3) farmers who, for their last production season obtained their seed fish from friends' ponds and the Tropo
172 Farms in the Eastern Region of Ghana, the remaining 42 respondents constituting 93.33% of the total sample
173 obtained theirs from the Department of Fisheries in Kumasi. Seed fish obtained from the ministries are raised for three
174 months by the ministry and fed on groundnut husk and rice bran. The average price paid for each fingerling was
175 GH¢0.02 and farmers paid between GH¢ 50 and GH¢ 70 to order and have their ponds stocked by experts. The two
176 major species of fish cultured were tilapia and mudfish. Sixty-nine percent (69%) of the respondents cultured both
177 species, 22.22% cultured not only tilapia and catfish, but also snakehead while 6.67% of the respondents cultured
178 only tilapia and 2.22% cultured only catfish.

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Table 4: Descriptive Statistics for number of fingerlings stocked

	N	Range	Minimum	Maximum	Mean	Std. Deviation
Number of fingerlings stocked	45	70,925	75	71,000	9,331.11	13,198.79

Source: Field Survey (2009)

4.4 Feeds and feeding regimes

It was discovered that fish farmers in the Amansie-West District fed their fishes with rice bran, corn husks, groundnut husks, and to a lesser degree, pawpaw and kitchen waste and left-over food. The majority of the farmers (77.78%) fed their fish with rice bran and groundnut husks, to provide them with carbohydrates and proteins respectively. These feed materials were and are obtained from Kumasi. These are the feeds used because according to the farmers they were advised by agricultural extension agents from the Ministry of Fisheries (MOF) to do so because they were affordable and also nutritious. About 18% of the fish farmers also utilized RAANAN feed, which is a formulated feed recently introduced onto the market, which the MOF is promoting among the fish farmers because it is so nutritious and fortified with other nutrients that it is able to increase the growth rate of the fishes making the reach the market size faster. The remaining 4.1% used some corn husks, pawpaw and kitchen wastes and leftovers.

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For the feeding regime only one (1) farmer (2.22%), fed his fishes once daily for twelve months. Five (5) farmers (11.11%), fed their fishes three times daily for the production season which lasted between nine (9) and twelve (12) months. Eighty- seven percent (87%) of the fish farmers fed their fish twice daily over the entire production season. Typically, farmers fed the fingerlings 4kg, the out growers 6kg and the finishers 9kg daily for 3, 3 and 6 months respectively. Cobbah[13]reported that groundnut pericarp (husk) is used by almost all the farmers but in combination with cereals or pawpaw leaves or both. The feed is however not compounded but a mixture of the food components. Eightypercent (80%) of the farmers fed their fishes twice daily, 10% fed once daily and another 10% did not have a regular feeding regime. They all fed by hand. This finding was consistent with that observed during this research. This implies that a year after Cobbah's work in 2008, fish farmers in the district still practiced the same technology of feeding their fishes.

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4.5 Labour (man-days)

Almost all the fish farmers were cocoa farmers at the time of this research and so the fish ponds served as secondary occupation to them. Owing to this they did not spend much time working around the fish ponds except to feed the fishes and periodically weed around the ponds. The least time spent by a respondent at the fish pond is 15 minutes per day, which translates into 4 man-days per season. On the other hand some farmers spent between 5 and 7.5 hours per day at the pond. This group of fish farmers had their ponds situated either on their farms or at their backyards where they easily got access to the ponds.

4.6 Quantity of Fertilizer used by Fish farmers in Amansie-West District

212 The farmers fertilized their ponds at the initial stage of the fish farm and also at the onset of every culture period. Lime
213 was also applied to the bottom of the ponds together with manure before the filling the ponds with water. Organic
214 fertilizer, mostly poultry droppings and compost were used in ponds. The poultry droppings are placed in small heaps
215 in the pond. The quantity of fertilizing material used is based on the farmer's own discretion. As may be seen from the
216 table 1, the minimum quantity of fertilizer used by the farmers in the district was 15 kg whilst the maximum used was
217 981 kg. The wide variation in fertilizer usage was partly due to the relative sizes of ponds and also the accessibility of
218 fertilizers.

219 4.7 Yield and sales of fish in the Amansie-West District

220 Table 5 presents the quantity of fish harvested by fish farmers in the Amansie- West District for the 2008/2009
221 production season. The data obtained for the total quantity of fish harvested was for all the species cultured. Data
222 collected did not disaggregate output by these species. The yield reported in table 5 shows that the yield of fish was
223 positively skewed because majority of the farmers obtained less than a tonne during their last harvest except for one
224 commercial farm which obtained 12.2 metric tonnes of fish. Considering the range of 12.15 metric tonnes therefore
225 indicates that there is the potential for the small and medium scale fish farmers to increase their production capacity if
226 they could be assisted to construct more ponds by making it possible for them to obtain credit from the banks with
227 flexible terms, since many of them already have land readily available for fish cultivation. Twodays before a farmer
228 harvests, a gong is beaten in the town and neighbouring towns to alert the people. The harvested fish is sold to the
229 local people and the neighbouring towns soon after they are harvested, in the fresh state, except for two farms which
230 sold their fish to wholesalers in Kumasi. As at the time of this research on the average a kilogram of tilapia was sold
231 for GH¢2.50 (\$1.14) while a kilogram of catfish went for GH¢3.00 (\$ 1.37).

232

233 Table 5: Quantity of fish harvested by fish farmers in the Amansie- West District

Yield	N	Range	Minimum	Maximum	Sum	Mean
Total Quantity Of Fish Harvested (kg)	45	12,150	50	12,200	34738	771.96

234 N = Number of observations

235 Source: Field Survey (2009)

236

237 5. CONCLUSION

238 With the growing population increase in the West Africa region coupled with issues of food security in the Sub-
239 Saharan Africa, improvement in fish production in Ghana will have positive impact in fish production in the region by
240 helping to make more fish available for people in the country and consumers in other Africa countries. At present,
241 Ghana competes with other West African consumers for the insufficient fish available in the market. This study was
242 limited to a single district by interviewing 45 fish farmers in the Amansie West District of the Ashanti Region of Ghana.
243 This was motivated by the fact that aggregated data could exclude very vital details peculiar to individual districts or
244 firms. The aim was to find out at the micro level, the types and quantities of inputs utilized by fish farmers in their
245 production and to also relate this to the yield obtained and to also consider the challenges faced by farmers in their
246 operations.

247 The results obtained from this study indicated that there is a wide variation among fish farmers even at the district
248 level, and that fish ponds in the district were almost entirely earthen dug out ponds. The wide variation in the inputs
249 used resulted in the corresponding variation in the output. The implication of these findings is that a general
250 intervention for all farmers at a national or even regional level may not adequately address the needs of all farmers,

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251 hence the need to conduct series of district-level researches to be able to come up with a much more comprehensive
252 and all-encompassing policy for improving and sustaining subsistence aquaculture.

253 Per the results of this analysis we recommend changes to public policy to improve yields for existing ponds and to
254 identify circumstances where yields can be improved for future ponds. These include focusing attention more on total
255 pond area, feed and number of fingerlings, subsidizing, improved feed, such as *RAANAN* and *ProAqua* to ensure that
256 fishes reach market size in time, locating retailing centres for feed at vantage points within the district to cut down the
257 cost of transportation to and from Kumasi and redoubling efforts to construct more fish ponds for the farmers since
258 total pond area was found to be strongly correlated with yields. Finally, it is also recommended that a further research
259 should be carried out to estimate a cost function for the fish production technology used by the fish farmers in the
260 district to help reduce the cost of fish production. This would help to improve the returns to fish farmers; encourage
261 more people to engage in fish farming, thereby helping to increase fish production and promote food security in the
262 country and the West African region.

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