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# The Impact of Policies, Regulations and Interventions on Aquaculture Production in the Eastern Corridors of Ghana

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## ABSTRACT

The substantial annual deficit of 600,000 MT in local fish supply to meet the growing demand of Ghanaian consumers necessitates an investigation to address this gap. This study aimed to assess the challenges of aquaculture, operational costs, and profit margins, while also evaluating the impact of government interventions on fish farmers' productivity and annual profit margins in the Eastern Corridors of Ghana. Purposive sampling was employed to select respondents, and semi-structured questionnaires were administered to 30 farmers from the Volta and Eastern regions. The demographic data revealed that males (93%) constituted the majority, while 67% of the farmers were well educated. Notably, 85% reported not benefiting from government interventions and support. Among the 15% who did benefit, 40% acknowledged a positive impact on their annual fish production and profit margins, while 60% reported an insignificant impact. The total investment of GH₵107,060.00 yielded a net profit of GH₵56,741.80, which is lower compared to the national net profit, approximating only 50% of total expenses. The study identified the main fish species cultured in the region as the tilapia and catfish. Additionally, the most pressing challenges facing the sector included high fish feed prices, a lack of skilled workers, high mortality rates of stocked fish, and marginalized farmers and gender imbalances in decision-making. Therefore, it is crucial to collectively analyze and develop strategies to implement policies and regulations in the aquaculture industry to promote growth and development. In summary, while government interventions have helped promote fish culture and supply in the local market, further efforts are required to effectively implement policies and strategies that reach small-scale farmers, with consideration for stakeholder involvement in decision-making.

## INTRODUCTION

Aquaculture is the fastest growing food production sector, contributing to rural livelihoods, while relieving pressures on wild fishery resources **(FAO, 2016)**. In the year 2020, aquaculture production reached a second record high in approximately 123.3 million tonnes albeit the experiences of COVID-19 pandemic and its impact **(FAO,**

**2022)**. Approximately, 58.5 million people have been documented to be engaged directly in the fisheries and aquaculture sector in the year 2020 **(Murekezi *et al.*, 2020)**. Meanwhile, it has also been noted that an estimated number of about 600 million people have their livelihoods dependent on this sector **(Murekezi *et al.*, 2020)**.

The continual growth in the aquaculture sector has been noted globally with Africa growing by 14.5% (396,700 tonnes) in the year 2020 compared to 2019 (346,400 tonnes) **(Anderson *et al.*, 2017)**. Despite this growth, aquaculture in the sub-Saharan part of the continent was poor as in Ghana. This slow pace in the sub region despite the vast abundance of aquatic resources and higher demand for fish food includes the lack of adequate information; poor governance, lack of development capital, infrastructure, priorities and technical know-how **(Hinrichsen *et al.*, 2022)**.

Ghana is endowed with abundant natural water bodies and an unmeasurable fauna both in marine and freshwater resources, which if exploited will enhance aquaculture production. The most prevalent aquatic species cultured include the Nile tilapia (*Oreochromis niloticus*), the African catfish (*Clarias gariepinus*) and African arowana (*Heterotis niloticus*) among few others.

In the face of this abundance, there is the deficit in fishery product supply in the region of 600,000 metric tonnes (MT) **(Amenyogbe *et al.*, 2018)**. Aquaculture production is mainly dependent on freshwater and inland culture practices leaving the marine resources unexploited and also dependant on the few cultured species. This indicates that the available natural resources the country is endowed with remains underexploited and as such, there is great potential to harness enough for the aquaculture and fishery industry **(Amenyogbe *et al.*, 2018)**.

Furthermore, the fisheries sector employs about 3.0 million people (10% population) and contributes just about 3-5% to the national gross domestic product (GDP) which means; few are engaged in the fishery and aquaculture industry. However, it is anticipated that bluing and revolutionizing the aquaculture and small-scale fishery industry will help bridge this gap of unemployment rate and the engagement in low income and insecure jobs **(Fry *et al.*, 2021)**.

However, combating these challenges requires policy actions to help fish farmers understand the entire value chain, the role of regulations and research, farmers and traders' experiences in the business, and analyses of fish farm profitability. Ascertaining information on profitability of aquaculture farms, research activities, support from government, startup capital and operation cost will inform government, individuals, firms and other stakeholders willingness to enter aquaculture business which is the main focus of this study. This will also accelerate poverty reduction and enhance food security in Ghana.

The study aimed to assess existing policies and regulations on aquaculture production to enhance its contribution to food security and the attainment of the sustainable development goals (SDG) 1, 2 and 14 in Ghana. This will provide

information on indicators needed to inform key industry players on the progress of aquaculture in Ghana, taking cognizance of key policies and regulations which can attract stakeholders for its expansion and development.

## MATERIALS AND METHODS

### Area of study

The study was conducted at Volta and the Eastern Region of Ghana between January and March 2021. The study was specifically conducted covering three towns, namely Atimpoku (6.2031° N, 0.0817° E), Akosombo (6.2668° N, 0.0443° E) and Kpeve (6.6837° N, 0.3337° E) in the selected regions. These towns were selected due to their active engagement in aquaculture and their contribution to Ghana's inland fisheries. These towns have about 40 active aquaculture farms at the time of study. Agriculture is the main economic activity in the regions, and this employs about 53% of the total population of which aquaculture is part **(GSS, 2021)**.

### Sampling technique and size

Simple random sampling method was adopted to obtain information from thirty (30) active managers (10 each from the study areas) of aquaculture in Volta and the Eastern Region of Ghana of which purposive sampling was used to reach targeted respondents.

### Targeted population

A population consists of an entire group of individuals or objects with general observable characteristics **(Campion *et al.*, 1993)**. The targeted population for this study comprises aquaculture farms in Volta and the Eastern Region of Ghana. The target group was selected because they were actively engaged in aquaculture activities, which helped achieve the objectives of the study.

### Research instrument

Semi-structured questionnaire was used to solicit information from 30 managers of aquaculture farms in Volta and Eastern Region. The questionnaire used was categorized into three groups: i) demography and number of years in the aquaculture business; ii) production including, species cultured, marketing strategies, types of operation, product forms; and iii) characteristics of the farmer, production cycle, group linkages and socio-economics, including credit accessibility, income generated from aquaculture, record keeping and access to extension services.

In addition, review of literatures and other studies was employed to further discuss stakeholders' access and engagements, initiated interventions and investment opportunity from government and national regulatory and legal framework for fisheries and aquaculture.

**Assessing the profitability of aquaculture farms**

As part of the revolutionary agenda, performance of aquaculture farms was determined by calculating the profit margin of their operations. The first step in the analysis of the economics of fish farming was to determine if it is possible to make money generally from this type of business activity. For this, the method called enterprise budget analysis was performed. Under this, the gross revenue, total cost, net profit or loss and rate of return on investment (RRI) was calculated.

**Gross revenue (GR)**

Gross revenue consists of receipts from total sales. It is the product of quantity harvested for sales (Q) and unit market price (P) of fish per kilogram. It was calculated as follows:

$Gross\,revenue = Quantity\,Harvested(Q)kg * Unit\,Price\,(P)$ **(Coulibaly *et al*,. 2010)**.

**Total fixed cost (TFC)**

Total fixed cost is the cost incurred in the acquisition of land and other available structures for the business.

***Total Variable Cost (TVC)***

Total variable cost consists of costs of fish seed (fingerlings/ juveniles), lime, fertilizer, fish feeds, hired labor, medication, fuel, transportation, and miscellaneous **(Coulibaly *et al.*, 2010)**.

**Total cost**

It is the addition of total fixed cost (TFC) and total variable cost (TVC). It was calcualted as follows:

$\text{Total Cost (TC)} = \text{Fixed cost (TFC)} + \text{Total Variable Cost (TVC)}$ (**Coulibaly *et al.*, 2010**).

**Net profit**

Net profit was computed by deducting total cost of production (TC) from the gross revenue (GR) $\text{Net Profit} = \text{Gross Revenue (GR)} - \text{Total Costs (TC)}$ **(Coulibaly *et al*., 2010)**.

**Rate of return on investment (RRI)**

Rate of return on investment was determined by dividing net returns by total cost of production. It was computed as follows:

$$\text{Rate of Return on Investment} = (\text{Net Returns}/\text{Total Costs}) * 100$$ **(Coulibaly *et al.*, 2010)**.

**Data analysis**

The Wilcoxon sign rank test was used to check whether the annual profit margin of fish farmers has improved at a significance level of 5%. To evaluate the most significant challenge faced by aquaculture farms identified in Ghana, Garrett's ranking technique was used. This method allows respondents to assign ranks to all challenges faced by them, and the outcome of such ranking would be converted into score value. The approach provides the change of orders of constraints and advantages into numerical scores. The prime advantage of this technique over simple frequency distribution is that the constraints are arranged based on their severity from the point of view of respondents **(Zalkuwi *et al.*, 2015)**.

## RESULTS

**Gender based demographics**

Gender-based demographics are shown in Fig. (1). Among the 30 respondents, 28 were male, representing 93%, while 2, accounting for 7%, were female. This result indicates that the majority of aquaculture farm managers are male compared to their female counterparts.

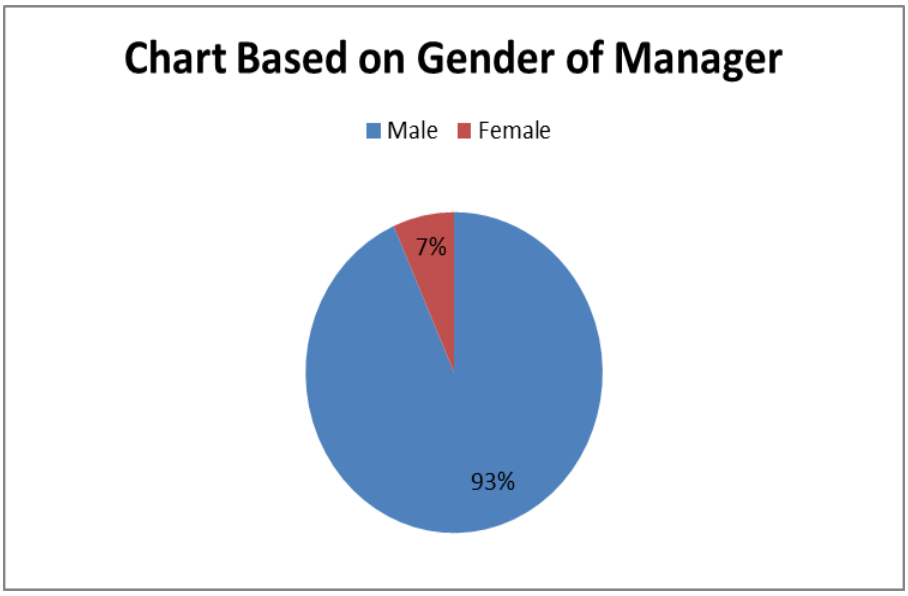


**Fig. 1.** Description showing the distribution of manager's gender

Fig. (2) shows the responses to questions regarding the owner's gender of the aquaculture businesses in the study. The results reveal that out of the 30 aquaculture

farms considered, 23 are owned by males, representing 76.67%, while 7 are owned by females, accounting for 23.33% of the respondents.

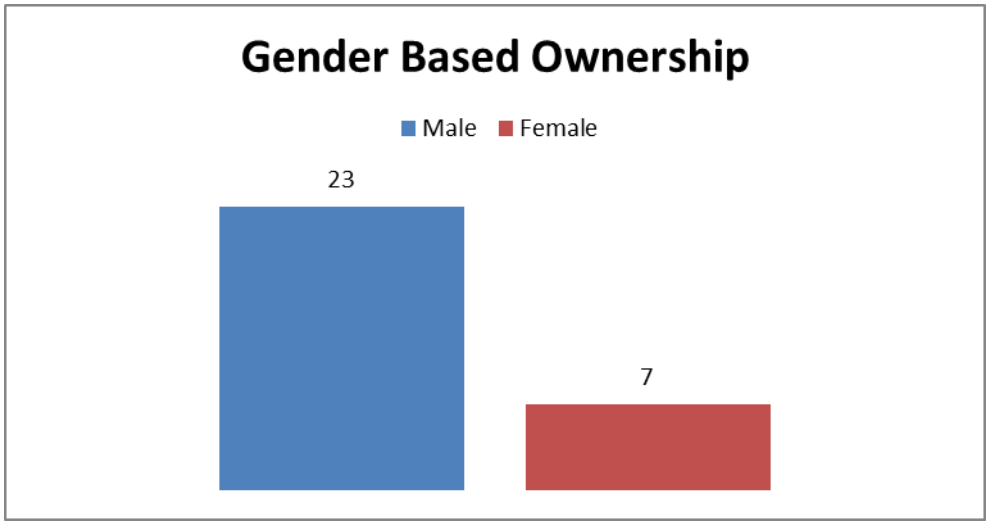


**Fig. 2.** Gender distribution of farm owners

From Table (1), the age group of managers that recorded the least frequency was 14 – 24 years with a percentage of 6.67%, indicating few managers in this age bracket. Majority of managers' fall within the age bracket of 36 – 46 years, with corresponding percentage of 50%, followed by the age group 47 years and above, which represented 30%. This implies that the majority of the managers contacted are youth informing policy makers and interested parties that the subsector has a brighter future. Note that, ages 36-46 in this study are categorized as youth.

**Table 1.** Fish farmers age distribution

| Age group of owners | Frequency | Percentage % |
|---|---|---|
| 14 – 24 | 2 | 6.67 |
| 25 – 35 | 4 | 13.33 |
| 36 – 46 | 15 | 50.0 |
| above 47 | 9 | 30 |
| Total | 30 | 100.0 |

The chart in Fig. (3) shows the educational background of aquaculture venture owners in the study area. Graphically, 13% of the owners are junior high school graduates, while 67% have completed tertiary education, and 20% have attained secondary education.

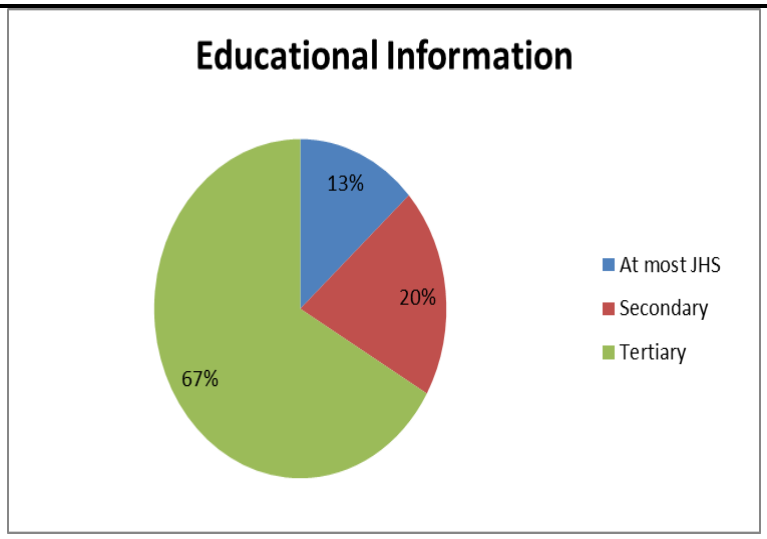


**Fig. 3.** Pictorial view of educational background of farm owners

As shown in Fig. (4), out of the 30 sites visited, 20 farmers engaged in earthen pond aquaculture, representing 66.7% of the total. Additionally, 7 farmers used floating cages, accounting for 23.3%, while only 3 employed diversified culture systems.

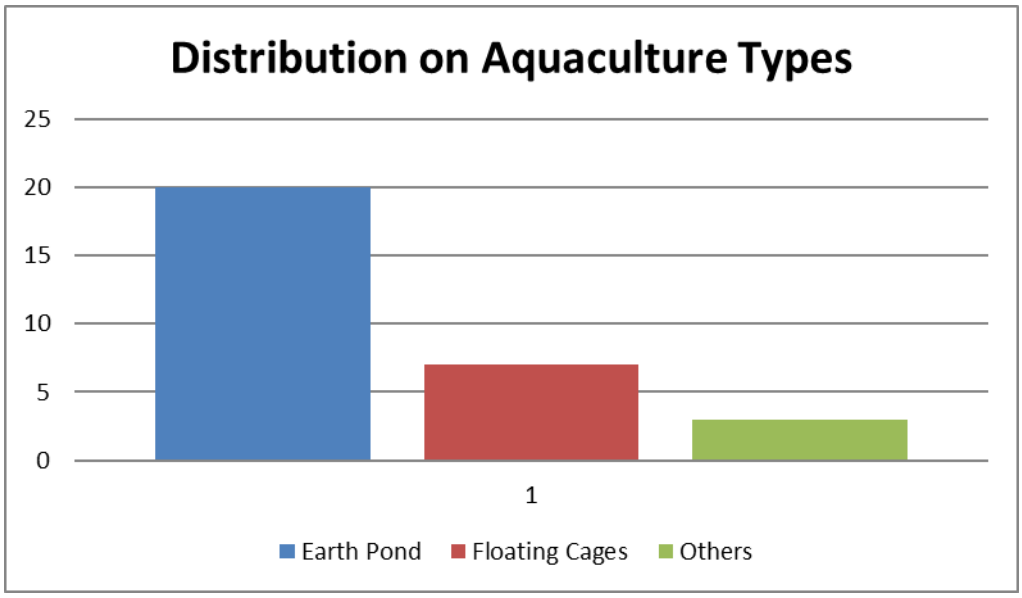


**Fig. 4.** Distribution of the types of aquaculture practices

The result displayed in Fig. (5) also reveals that, out of the 30 farmers, 20 of them use freshwater to culture their fish representing 66.67%, while 8 (26.66%) of them use brackish water and 2 (6.67%) farmers use salt water.

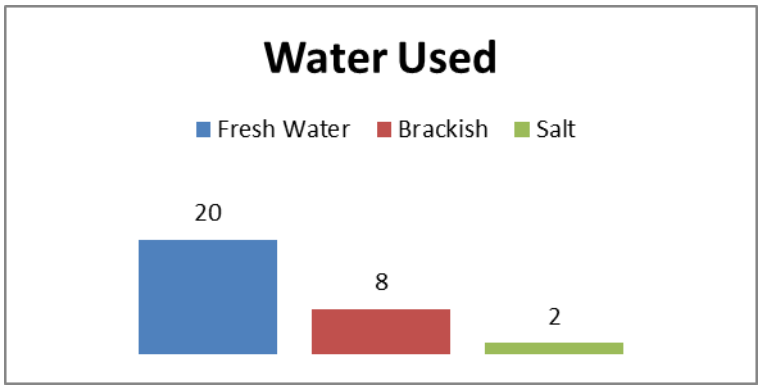


**Fig. 5.** Presentation of the water types used by fish farmers in their aquaculture

From the result in Fig. (6), 60% of the farmers have fish farms ranging from 5 to 10 pond or cages, followed by fish farms ranging from 3 to 4 pond or cages, while 7% have 1 to 2 pond or cages.

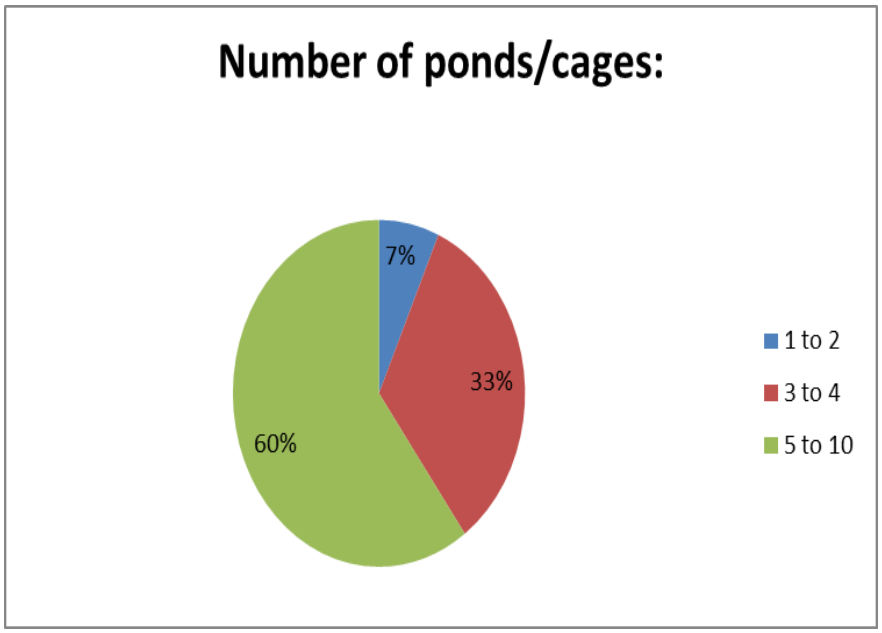


**Fig. 6.** Number of ponds/cages in their business

The various fish species farmed, as indicated in Fig. (7), show that the Nile tilapia is the most commonly cultured species, accounting for 50% of the total. While, the catfish follows at 30%. Additionally, the results reveal that *Heterotis* sp. is cultured at 13.33%, while other fish species make up 6.67%.

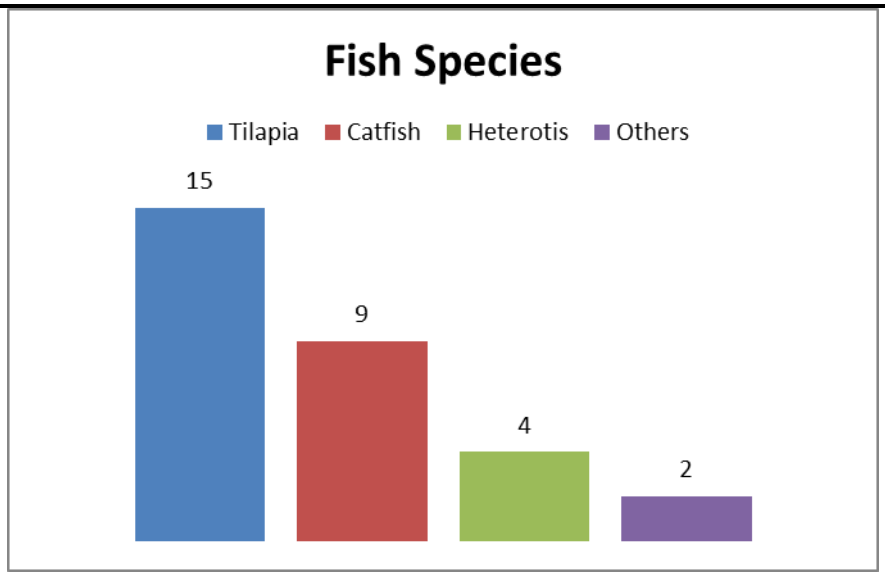


**Fig. 7.** Chart showing the farmed fish species

As indicated in the chart (Fig. 8), the fishing gear most commonly used by fish farmers for harvesting is fishing nets (such as seine nets, cast nets, and entangle nets), which account for 80%. This is followed by those who use hook and line for harvesting. In addition, the results indicate that a small number of farmers use mosquito nets for harvesting fish from their ponds.

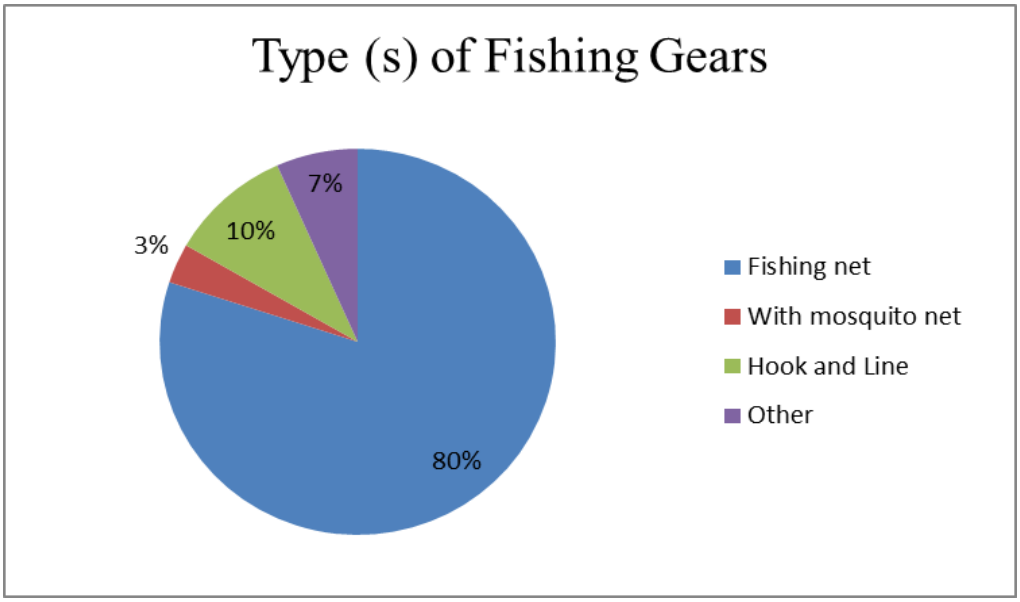


**Fig. 8.** Chart presentation of fishing gears used by fish farmers

## The main analysis

### Government interventions to expand aquaculture subsector

From Tables (2, 12) 40% of the respondents agree to receive improved fingerlings from government and 18 (60%) of them did not receive such intervention. Again, considering training session for improved fingerlings, 12 (40%) of the respondents benefited from such training from government while, 18 (60%) of them did not receive such training. Furthermore, supporting fish farmers financially by government, 5 (15%) farmers received financial support from the state whereas the majority (85%) of them did not have such support. 3 (9%) farmers attested to receiving technical support, and 27 (91%) did not receive this support.

**Table 2.** Responses from fish farmers on government intervention to expand aquaculture

| Interventions | Responses (Frequency) | | Percentage | |
|---|---|---|---|---|
| | Yes | No | Yes | No |
| Supply of improved fingerlings | 12 | 18 | 40% | 60% |
| Training sessions for improved fingerlings | 12 | 18 | 40% | 60% |
| Set up of fish disease laboratory | 6 | 24 | 20% | 80% |
| Financial support from government | 5 | 25 | 15% | 85% |
| Granting subsides on farm inputs | 6 | 24 | 20% | 80% |
| Technical support | 3 | 27 | 9% | 91% |
| Overall impact of the interventions | 12 | 18 | 40% | 60% |

### Impact of government intervention of annual fish production by farmers

To assess whether government interventions for aquaculture farmers have impacted their annual output, a questionnaire was administered for farmers to rank the effects based on categories: Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree. As shown in Table (3), 30% of farmers agreed that the supply of improved fingerlings has positively impacted their output, while 10% strongly agreed. Conversely, 30% disagreed that the supply of improved fingerlings has increased their output, and 22% strongly disagreed.Considering whether set up of fish disease laboratory has increased or not, 5% strongly agree, 15% said they agree that, this set up has helped. Respectively, 10 and 40% said they disagree and strongly disagree; whereas, 30% of the respondents were neutral.

With respect to financial support from government, the result shows that there is limited financial support from government. From data presented in Table (2), 5 and 10% of the respondents strongly agreed and agreed to benefiting from government's financial support respectively, whereas 5% were neutral. This indicated that, either they receive limited support resulting in small impact or they receive nothing at all. However, the majority, 20 and 60% disagreed and strongly disagreed, respectively, to the impact on financial support from government. On the other hand, when it comes to granting of subsides on farm inputs, 2% strongly disagreed; 18% of the respondents disagreed to that fact, while 45 and 25% strongly agreed and agreed, whilst 10% were neutral.

**Table 3.** Impact of government interventions provided to farmers on fish productivity

| Government Interventions | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Supply of improved fingerlings | 10% | 30% | 8% | 30% | 22% |
| Training sessions for improved fingerling | 10% | 30% | 8% | 30% | 22% |
| Set up of fish disease laboratory | 5% | 15% | 30% | 10% | 40% |
| Financial support from government | 5% | 10% | 5% | 20% | 60% |
| Granting subsides on farm inputs | 2% | 18% | 10% | 25% | 45% |
| Technical support | 4% | 5% | 1% | 25% | 65% |

The signed rank test revealed that the interventions provided by the government to some fish farmers in the study have significantly improved their annual profit margin ($V = 11$, $P$-value $< 0.0001$).

**Assessment of most significant challenges associated with aquaculture business**

The results from Table (4) illustrate the various challenges faced by fish farmers in the study area. The study revealed that high price of feeds recorded the highest total score of 2060, with corresponding total mean score of 68.67, followed by lack of skilled workers, which recorded total score of 2059 with total mean score of 68.63. Additionally, high mortality of stocked fish was the third to be ranked by respondents, with total score of 1926 and total mean score of 64.2. Overall, respondents ranked lack of good water for fish farming as the least problem faced by them, with a total mean score of 42.43.

**Table 4.** Ranking of the various challenges faced by fish farmers in Eastern Corridor of Ghana

| SI No. | Description | Rank given by respondents | | | | | | | Total No. of respondent |
|---|---|---|---|---|---|---|---|---|---|
| | | 1st | 2nd | 3rd | 4th | 5th | 6th | 7th | |
| 1 | Shortage of fry/fingerlings | 10 | 6 | 5 | 2 | 4 | 2 | 1 | 30 |
| 2 | High mortality of stocked fish | 15 | 5 | 2 | 1 | 4 | 2 | 1 | 30 |
| 3 | High price of feeds | 20 | 2 | 1 | 4 | 1 | 2 | 0 | 30 |
| 4 | Lack of skilled workers | 19 | 4 | 2 | 2 | 1 | 1 | 1 | 30 |
| 5 | Lack of capital/credit | 13 | 1 | 8 | 3 | 1 | 2 | 2 | 30 |
| 6 | Lack of good water for fish farming | 5 | 2 | 1 | 3 | 2 | 7 | 10 | 30 |
| 7 | Marketing problems | 7 | 5 | 2 | 6 | 1 | 5 | 4 | 30 |

## Assessing the annual profitability of aquaculture business using income statement approach

In estimating the annual profit of fish farmers in the region, the calculation was based on the averages of the annual values of the variables involved. Net profit was calculated by deducting the total expenses from total revenue. From Table (5), the total annual revenue of aqua farmers in the region is GH₵ 163,804.80, and the total cost of operation including both fixed and variable cost is GH₵ 107,060.00. From information displayed in Table (5), the annual net profit of aqua farmers in Ghana is estimated to be GH₵ 56,741.80. In addition, the rate of return for aqua farmer investing in fish farming in the region is 0.53 which suggests that exerting much more input and support can improve their activities, and thereby increasing their profits margins.

**Table 5.** Income statement showing annual profit margin of aquaculture business in Eastern and Volta regions of Ghana

| **Description** | **GH₵** | **GH₵** |
|---|---|---|
| **Total Revenue** | | **163801.80** |
| **Expenses** | | |
| Setup cost | 9840.00 | |
| Fingerlings | 2400.00 | |
| Commercial fish feed | 15300.00 | |
| Fertilizer or compost | 6000.00 | |
| Lime | 720.00 | |
| Net | 600.00 | |
| Fencing | 1800.00 | |
| Transportation cost | 5000.00 | |
| Technical services | 10000.00 | |
| Operation and maintenance | 5000.00 | |
| Hired labor | 50400.00 | |
| **Total Expenses** | | **(107060)** |
| **Net Profit** | | **56741.80** |
| **Rate of Return on Investment** | | **0.53** |

## DISCUSSION

### Demographics of respondents

The study reveals that the majority of fish farms in the study area are owned by males and the remaining are owned by females. This result conforms to the findings of Frimpong and **Anane-Taabeah (2017)**, who reported that males' own majority of fish farms in Ghana representing 90% of the total owners. Moreover, **Agbekpornu *et al.* (2019)** stated that the majority of the fish farmers in Ghana are males representing 93.3% compared to the females that formed 6.7%. This is a clear indication that the aquaculture subsector is highly dominated by males.

The majority of managers' falls within the age bracket of 36 – 46 with corresponding percentage of 50, indicating youthful presence. This is followed by the age group of 47 and above, which recorded 30% compared to the study results from **Frimpong and Anane-Taabeah (2017)**. They disclosed an age group of 40 years and above as the majority to own fish farm in Ghana. This implies that a greater percentage of those indulged in fish farming in Ghana are within the youth category, which can be classified as active labor category.

The greater percentage of the respondents are well educated, hence can read and write. This is favorably compared with the findings of **Agbekpornu *et al.* (2019)**, who documented that the majority of fish farm owner are literate. Similarly, **Frimpong and Taabeah (2017)** revealed a positive correlation between higher education and large-scale cage farms. Therefore, it can be concluded that the majority of fish farmers in Ghana have attained high level of education.

### Aquaculture production

The results from the current study revealed that the earthen pond aquaculture is the most used by farmers. This result can be attributed to the high cost of construction and equipment acquisition coupled with other financial constraints. According to **Agbekpornu *et al*. (2019)**, the main production systems are earthen pond followed by cages. The cost of owning cages is expensive compared to the cost of earthen ponds, and this is suggested to be the disparity amongst these ownerships. Cages and raceways are expensive not so much in the cost of the structures themselves but the cost of reasonable balanced feeding **(Hiheglo, 2008)**. Hence, it will be more reasonable to go for low cost systems as it can be seen from the study results. Cage system of farming presently accounts for about 2 percent of farms by number but much greater by catch output **(Asiedu *et al*., 2016)**. This clearly confirms that earthen pond aquaculture is going to be the basis of fish culture in Ghana during the next decade. Although this will be profitable, there will be inefficiency in land use and development will be lagging to increase output. Therefore, there is the need for support and other inputs, such as tax reduction and exemptions on aquatic machinery and systems and also some non-taxable loans for farmers.

The majority (66.67%) of farmers using freshwater as the main source of water for aquaculture production was not much of a surprise. This has already been recorded in various studies and reports about Ghana's aquaculture, where the majority of farming takes place in the freshwater environment **(Cobbina, 2010; Amenyogbe *et al.*, 2018; Agbekpornu *et al.*, 2019)**.

The results from this study indicate that the tilapia (*Oreochromis niloticus*) is the dominant fish species (50%) cultured by farmers, followed by *Heterotis arowana* and others. This confirms reports by other researchers **(FAO, 2016; Agbekpornu *et al.*, 2019; Amenyogbe *et al.*, 2018)** who documented that the tilapia is the main cultured species in Ghana. The geography and climatic conditions of the region support and allow for the culture of this species and most importantly, they are indigenous and easier to farm which influences their culture.

This study reveals fish net as fishing gear mostly used by fish farmers. Comparing findings from **He *et al.* (2021)** with results from this study, it is clearly shown that gears dominantly used by fish farmers is the net followed by hook and line. This is because using such fishing net makes it easier to harvest the fish.

**Impact of government intervention of annual fish production by farmers**

As part of government intervention to promote development in aquaculture, a flagship program was introduced between 2014 and 2017 to increase domestic fish production, support aquaculture businesses, implement value-added technologies, zone inland water bodies for aquaculture, and create jobs for the youth **(Mapfumo, 2022)**. To achieve these targets, the government rolled out various plans and programs, including the supply of improved fingerlings, training sessions, the establishment of a fish disease laboratory, financial support, subsidies on farm inputs, and technical assistance for fish farmers.

However, findings from this study indicate that the majority of fish farmers reported not benefiting from these interventions, suggesting that the support did not reach them. Many farmers strongly disagreed that these interventions had a significant impact on their annual fish production, further confirming a lack of government support. Conversely, those who did receive assistance experienced improvements in their annual fish production and profit margins.

In summary, while the government implemented these plans and programs, the execution did not effectively reach the intended beneficiaries, and the interventions may not have been sufficient or well-monitored. This inefficiency could be attributed to a lack of extension officers, inadequate infrastructure, limited financial resources, and low stakeholder engagement. As a result, insufficient consultations and other factors may have contributed to the shortfalls in implementation.

**Challenges associated with aquaculture business**

One of the motives behind this study was to assess challenges faced by fish farmers in their course of operation. The results revealed cost of commercial feed as the most significant challenge as indicated in work by the researchers **(Ayisi *et al.*, 2016)**. The high cost of fish feed in Ghana is mostly responsible for the high costs of aquaculture production which is also a global issue **(Amenyogbe *et al*., 2018)**. Feed cost is 70% of the total production costs **(Hiheglo, 2008, Apraku *et al*., 2019; Amenyogbe *et al*., 2018)**, and the imported feeds are mostly about 30 percent costlier than the locally-manufactured feeds **(Rurangwa, 2015)**.

Lack of skilled labor was ranked as the second most challenging in their line of activities. **Aseidu *et al*. (2016)** attributed lack of technical know-how and unskilled labor to the massive under development and negligible contribution of the sector to the overall fish production and economic development in the country.

**Further observations and literature discussions**

**Youth access and engagement**

Risk management and investment were the two main areas of participation which the youth verbally discussed when questioned. This is in line with the study affirmed by Consultative Group on International Agricultural Research (CGIAR) that reported that youth participation in aquaculture and its business is dependent on access to resources which cut down losses **(Fry *et al*., 2021)**. They further noted that packages in the form of access to financial assets, digital marketing development and trainings, power and transport facilities availability will facilitate and lure the youth to engage in aquaculture practices and services.

**Stakeholder engagement**

It is noteworthy mentioning that interventions were given more to mostly established and large-scale farmers and decision making was largely in their hands. This leaves the poor and small-scale farmers handicapped and marginalized which does not enhance nor improve their activities and output. Moreover, the findings by **Fry *et al*. (2021)** in Myanmar's case conforms to this.

**Financial constraints on goods and services**

According to the Chamber of Aquaculture Ghana report, the increase in prices of the tilapia and catfish during the first half of 2022 was attributed to several factors, including high prices of feed constituents, import duties, high energy costs, and currency depreciation against major international currencies. In their analysis, the cost of tilapia rose to GH¢0.747 for fish weighing between 700 and 900 grams, while the price of the

catfish increased to GH¢2.960 per kilogram compared to the previous year, 2021 **(COA, 2022)**.

**Initiated interventions and investment opportunities from the government**

The government has, however, initiated several support schemes to accelerate the development of the aquaculture industry. These interventions include;

- The provision of free extension services which is mainly carried out by the Fisheries Directorate. However, this intervention faces challenges such as vehicle unavailability for field extension officers to reach remote parts of the country and also undocumented farms. The shortfall of this can also be inadequate personnel to carry out the activities required to push forward this initiative. Thus, increasing the number of extension officers will make this a realization.
- Few Pilot Aquaculture and Demonstration centers have been established to train farmers on new farming technologies and start-up capital given to newly trained farmer. Over a hundred thousand new farmers have been trained from this program. The established centers also are tasked to produce several thousands of high-quality fry and fingerlings to supply farmers. These products are supplied to famers at reduced cost compared to the open market as this acts as subsidiary products.

  Although this initiative has yielded good results, it can be improved upon to obtain an efficient implementation. More centers can be built and distributed evenly in the country for easy access to local farmers and other interested personnel. This also might go beyond just training and but financial set-up to aid beneficiaries to start their own business to make this initiative a practicable one.
- Study tours are also organized for staff of the Fishery Directorate and farmers in both local and foreign countries to acquire new knowledge on new trends in farming. To make this a success, it can be suggested that trainees are made to train other farmers and interested personnel to enable dissemination of knowledge acquired easily. Moreover, this can be done by zoning and creating groups under each.
- Young entrepreneurs and construction workers are also trained on pond construction to enable reduce the cost of mechanical construction. This is necessary in rural and remote areas where mechanical aid devices are beyond reach and serves as an avenue for employment. This can help farmers to improve on the systems they construct. This study confirms that, majority of systems are old type earthen ponds which needs improvement.
- A US$53 million program was launched in the year 2017 to develop aquaculture in the Northern belt.
- A tune of US$53.8 million was presented by the International Development Association (IDA) of the World Bank and Global Environment Facility (GEF) to promote the implementation and fulfilment of the objectives of the West Africa

Regional Fisheries Program (WARFP) to restock dams and dug-outs in the Northern belt of Ghana **(Hiheglo, 2008; Cobbina, 2010; Firm Advisory, 2018)**.

**National regulatory and legal framework for fisheries and aquaculture in Ghana**

Fisheries policies in Ghana were first developed in the 1950s to promote culture-based fisheries on a subsistence level as a means to alleviate poverty in the northern belt. Since then, various sectoral policies have been established, with a major focus on the development and promotion of aquaculture practices **(Osew, 2004)**.

The 2007 Fisheries Regulation serves as the primary support act for aquaculture, stemming from the Fisheries Act of 2002 (L.I. 625 of 2002). This regulation addresses aquaculture inputs such as the transfer of live fish, certification of seed production, and responsible practices. Additionally, the Environmental Protection Agency Act 1994 (Act 490) regulates aquaculture practices to prevent environmental damage, requiring mandatory EPA assessments for land-based aquaculture as outlined in Regulation 3 of Schedule 2. Fish cage culture is specifically regulated under Schedule 30 (Regulation 3). The Food and Drugs Authority also oversees the quality of fishery products sold in the market **(Environmental Protection Agency Act, 1994; 1999; Ghana Fisheries Act, 2005)**.

Currently, a draft fisheries policy document is recognized as the only comprehensive policy on aquaculture **(MOFI, 2008)**. This document outlines various strategies for achieving sustainable development in the aquaculture industry, addressing issues such as seed production, feed development, financing, technical resources, institutional partnerships, individual engagement, and extension services. Most of these strategies have been adopted and incorporated into the goals of the Fisheries Directorate.

To incentivize fish farmers, a five-year tax exemption period is provided, during which income is not taxable. Additionally, there are no duty charges on farming inputs, but a 15% tax is levied on imported seafood to promote the industry **(Osew, 2004; Ghana Fisheries Act, 2005)**.

## CONCLUSION

In conclusion, this study highlights that the challenges faced by aquaculture farmers persist, as noted in various research efforts. Furthermore, government interventions and policy implementations have not been effectively executed or strengthened, which is crucial for attracting investors and engaging various stakeholders. While individuals slightly above the youth demographic are beginning to integrate into this business, there is potential for significant growth if appropriate regulations, policies, and interventions are enacted.

Currently, the limited variety of fish species cultured—primarily tilapia, the catfish, and Heterotis—leaves considerable room for improvement, suggesting that underexploited species could be introduced to enhance the aquatic product value chain.

Additionally, the low participation of women in farming is concerning, as their involvement is vital for inclusive development in the industry.

The study also reveals that a significant portion of the country's natural resources remains untapped, particularly in marine and brackish waters, as well as natural feed ingredients and technology. The need for recognition of diverse livelihoods, along with addressing equity in access to resources across generations and groups, remains unaddressed.

These factors are critical for the development of aquaculture in Ghana and warrant attention from key stakeholders and the government. Addressing these issues could help bridge the gap in unemployment, enhance food security, and reduce poverty along the value chain.

**Recommendations**

The following recommendations were made based on the findings from the study. From the study, it is recommended that appropriate measures and strategies should be taken to ensure that various interventions go down to all fish farmers. Moreover, few gaps on the regulations should also be addressed and efficiently implemented. Such policies which need attention from this study lacks some important economic aspects such as; the right to private ownership, the cost involve in the negligence of damaging the environment in the EPA Act.

The banning policy on importing farmed fish is although good, but drives the prices of produce in the market which affects consumers where world market prices will be lower and as such, do not promote poverty alleviation.

Legitimizing and integrating the youth in meaningful decision making and participation. Create a formal pathway and form organizations for the youth and women to engage.

The government also must intensify research and studies on other fish species to enable the culture of diverse species as not only tilapia and catfish can be cultured. Encouraging the culture of genetically modified fish species should also be encouraged because, the market sizes of the Ghanaian fishes are smaller in the international market which affect sales.

Fish feed production in Ghana is currently monopolized in Ghana. The largest feed mill is the Raanan Feed (Indian Company) which supplies 70% of its total production. On the other hand, opting to import the feed incurs about 30% increment due to port duties and other charges. This then opens the market for other investors on feed mills in strategical locations.

The insufficient supply of fingerlings hinders the progress of fish farming and limits the efficiency in production output. Although, private hatcheries are on the increase, annual fingerling supply deficit stands at 50 million. This leaves the gap for

investors to establish reliable hatcheries to produce enough fry and fingerlings of good quality and for good returns.

Basic training and education are required across the entire value-chain. This will help instill some skills and disseminate information on new farming technologies and methods, stocking, harvesting, cage and pond maintenance and many more. This also presents the opportunity for institution to fill the gap on education and communication.

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