

**HARNESSING AQUACULTURE AS A STRATEGY FOR POVERTY  
REDUCTION IN SOME SELECTED DISTRICTS IN THE WESTERN  
REGION OF GHANA**

**By**

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## DECLARATION

I hereby declare that this work is my own. It is towards the award of M Sc. Development Policy and Planning Degree and that to the best of my knowledge, it contains no materials previously published by another person nor material which has been accepted for the award of any other degree of the University, and that due acknowledge has been made to such text.

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## ABSTRACT

This research work investigates the role that both the private and public sectors have played to harness the development of aquaculture in the three selected districts of the Western Region, namely Juabeso, Bia and Aowin Suaman. The NDPC (2002-2005) indicates that there is a high incidence of poverty (59 percent) among food crop farmers. They further indicated that 54 percent of the populations do not have access to safe water and other basic services. The need to reduce poverty and improve the living conditions has ignited the call for diversification of agricultural activities through aquaculture.

Following literature review, reconnaissance survey was conducted to identify the difficulties to be anticipated in the area and to establish a rapport with potential respondents in the three districts. Multi-stage sampling technique was adopted and three districts where aquaculture was a major occupation were randomly selected out of five. The objective was to keep the cost of the survey low without seriously affecting the validity of the results. This was followed by questionnaire survey and interviews with those engaged in aquaculture. The data analyses revealed associated with labour shortage, land acquisition, lack of financial support and the deficiency in the number of staff with knowledge in aquaculture made the industry unattractive to farmers.

The District Assembly should facilitate the provision of financial support to the farmers through the banks. The research recommends that farmers should form Farmer Based Organizations (FBOs) in order to access loans and help each other in digging their ponds and also award hardworking fish farmers during farmers' day celebrations. There is also the need to train more staff and farmers to acquire techniques in aquaculture and research into fish species that can thrive well in the study area. In collaboration with MoFA, the District Assembly should establish hatcheries at district capitals for easy accessibility. If these measures are put in place, the small scale rural farmers would have improved their standard of living.

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Introduction for Questionnaire

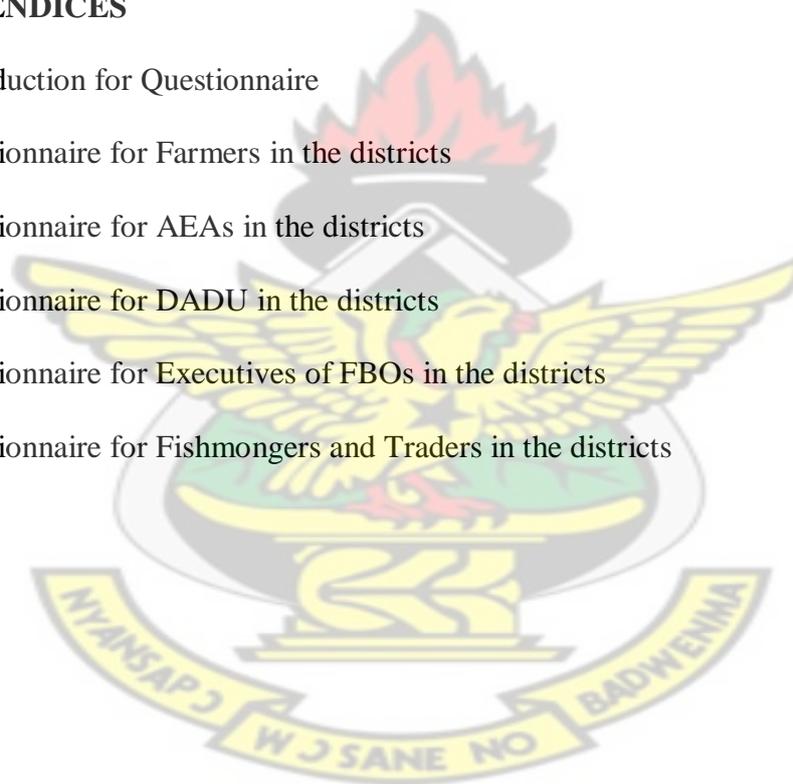
Questionnaire for Farmers in the districts

Questionnaire for AEAs in the districts

Questionnaire for DADU in the districts

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## LIST OF ABBREVIATIONS

AAGS	Accelerated Agricultural Growth Strategy
ACP	African Caribbean Pacific
AEA	Agricultural Extension Agent
AEO	Agricultural Extension Officers
AgSSIP	Agricultural Sub- Sector Improvement Project
AIDs	Acquired Immune Deficiency Syndrome
CTA	Technical Centre for Agricultural and Rural Cooperation
DADU	District Agricultural Directorate Unit
DHS	District Health Service
D o F	Directorate of Fisheries
EU	European Union
FAO	Food and Agricultural Organization
FASDEP	Food and Agricultural Sector Development Policy
FBOs	Farmer Based Organizations
FSSCBP	Fisheries Sub- Sector Capacity Building Project
GAC	Ghana Aids Commission
GHMS	Ghana Health Management Service
GHS	Ghana Health Service
GLSS	Ghana Living Standards Survey
GMHS	Ghana Maternal Health Survey
GSS	Ghana Statistical Service
GPRS	Ghana Poverty Reduction Strategy
HIV	Human Immuno-Deficiency Virus
ISSER	Institute of Social, Statistical and Economic Research
JHS	Junior High School
MDG	Millennium Development Goals
MIC	Multiple Indicator Cluster
MTADP	Medium Term Agricultural Development Programme
MoESS	Ministry of Education Science and Sport
MoFA	Ministry of Food and Agriculture

NDPC	National Development Planning Commission
NEPAD	New Partnership for Africa Development
NGOs	Non Governmental Organizations
NYEP	National Youth Employment Programme
PAMSCAD	Programme of Action to Mitigate Social Cost of Adjustment
SHS	Senior High School
UNDP	United Nations Development Programme

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## CHAPTER ONE

### AN OVERVIEW OF THE CONTRIBUTION OF AQUACULTURE TO POVERTY REDUCTION

#### 1.1 Introduction

For most developing countries, achieving food security for a rapidly growing population continues to be a major challenge. Developing countries lack strong national research capacity, robust agricultural infrastructure and suitable policy environment to boost agricultural productivity all to the disadvantage of the farm families. There was a total neglect of the agricultural sector in the period when most of these developing countries gained independence. According to Spore (2010), with the world population expected to grow to 9 billion by 2050, productivity needs to increase by about 70 percent from the current levels to meet projected demand.

Todaro, (1982:221), indicated that “in the third world, there was a general neglect of the agriculture sector during 1960-1970s resulting in its stagnation”. There is therefore the need to boost agriculture and encourage its diversification. One way for farm families to regenerate, improve and sustain their livelihoods over a long period of time is to be able to diversify their income sources. Farm diversification is the establishment of a new enterprise within the farm setting, usually agricultural and/or a non agricultural enterprise such as aquaculture. It is quite clear that, poverty could be reduced if rural farmers diversify their farming activities and venture into other areas such as aquaculture.

According to GSS (2000), poverty is found to be mainly in the rural savannah and rural forest areas and account for 60 percent of total poverty in Ghana. The people are mainly traditional small-scale producers and about six in ten small-scale farmers are poor. Welfare indicators such as school enrollments or availability of clean water supply are worse. Poor rural people have limited access to basic social services, safe water, roads that are accessible year round, and electricity and telephone services.

NDPC (2003- 2005) indicates that low productivity and poorly functioning markets for agricultural outputs are among the main causes of rural poverty. Small-scale farmers lack the technologies (such as irrigation, combine harvesters, storage facilities and inputs, such as fertilizer and improved seed) that would increase yields.

Population pressure leads to shorter fallow periods or even continuous cultivation in the densely inhabited regions, causing soil erosion and loss of fertility. Land degradation poses a long-term threat to farmers' livelihoods and incomes. Land ownership and land security are regulated by complex systems that vary widely.

According to GSS (2000), rural poverty has become a great punishment in the country making the poor people and the deprived regions to live in absolute low standard of living. It further indicated that, out of Ghana's population of 23,350,927 rural population forms 11,670,793 (49.98%) and number of rural poor are 4,574,951, that is, 39.2 percent of the rural population.

## **1.2 Problem Statement**

Poverty is endemic in Juabeso, Bia and Aowin Suaman districts (study areas) as they are mostly rural and most residents engage in small-scale traditional farming relying on obsolete farming implements. The districts are characterized by lack of essential social amenities such as well equipped hospitals to visit when they are sick; good schools for their children to have education and good roads where vehicles can ply to cart their produce to market centres. There are inadequate potable water supply, telephone and postal services.

According to MoESS (2008) number of trained teachers at the primary level for deprived districts was 37.2 percent as compared to the national figure of 59.4 percent. Illiteracy rate was 41.8 percent for the region whilst the national figure was 42.6% of the population, according to GSS (2000). Doctor to population ratio of the Western Region was 1: 33 794 in 2007 as compared to that of the national figures of 1: 13 683 (MOH 2007). Urban water supply was 68 percent as compared to that of rural water supply of 31.7 percent. The region had weak communications and infrastructure and as at 2002 the region had only 39 (73.6%) post offices in urban centres whilst the rural districts had just 14 (26.4%).

Aquaculture is seen as having the potential of making up the shortfalls in incomes through fish production. The result is that poverty would be reduced and people's standard of living would be improved.

### **1.3 Hypothesis**

Harnessing aquaculture can improve farmers' incomes and raise their standard of living. The next section focuses on research questions into aquaculture production and its contribution to reducing poverty in the Region.

### **1.4 Research Questions**

Varied strategies had been applied to tackle the issue of poverty alleviation but in all cases achievements are insignificant the reason why aquaculture must be harnessed as another strategy. The following questions if answered, researched and applied can in a way improve the living conditions of the rural farmer.

1. What is the level of poverty among farmers in the region?
2. Who are the stakeholders or institutions engaged in aquaculture?
3. What are the operations or activities that go into aquaculture?
4. Which sections of the population are involved in aquaculture in the region?
5. How does aquaculture contribute to improvement in livelihood opportunities as well as nutritional requirement in the Region?
6. What are the potentials within the sub-sector in the area of poverty reduction?
7. What are the challenges and constraints facing the sub-sector in the Western Region?

### **1.5 Objectives of the Study**

The general objective of the study is to reduce poverty through harnessing of aquaculture. There is the need to investigate the challenges confronting farmers who engage in aquaculture and how these challenges are addressed by both the public and private sectors in the Western Region.

Specific objectives include the following:

1. To investigate the extent of poverty among farmers in the Western Region.
2. To understand the operations of aquaculture including pond construction, management, harvesting and marketing.
3. To assess the contribution of aquaculture to employment amongst rural farmers.

4. To examine the potential contribution of aquaculture to poverty reduction in Western Region.
5. To assess the challenges and constraints facing the industry in the Region.
6. To inform stakeholders and make recommendations that would facilitate improvement in the sector.

### **1.6 Scope of the Research**

The focus is on poverty reduction through harnessing of aquaculture in the Western Region of Ghana. Rural farmers are the target group since they are the direct beneficiaries if aquaculture is promoted. The period would be from year 2000 to date as that year was a censal year and enough data was collated on the population of Ghana. However, references would be made to previous years where necessary.

The region is well noted for its crop bias and deep sea fishing activities which are also seasonal. As at 2005, the Western Region had rural population of 1,226,159 (63.7%) as against urban population of 698,418 (36.3%) (GSS, 2005). Rural settlements are the areas where poverty is known to be prevalent, although it is believed that most of the rural farmers are engaged in cash crops and therefore must not live in poverty.

Juabeso, Bia and Aowin-Suaman districts of the Western Region of Ghana being the study districts as shown in Figures 1.1. The districts are endowed with a lot of resources (such as forest, timber, inland valleys, and rich lands for agricultural purposes) and have suitable marginal lands for fish farming and other crops apart from cocoa.

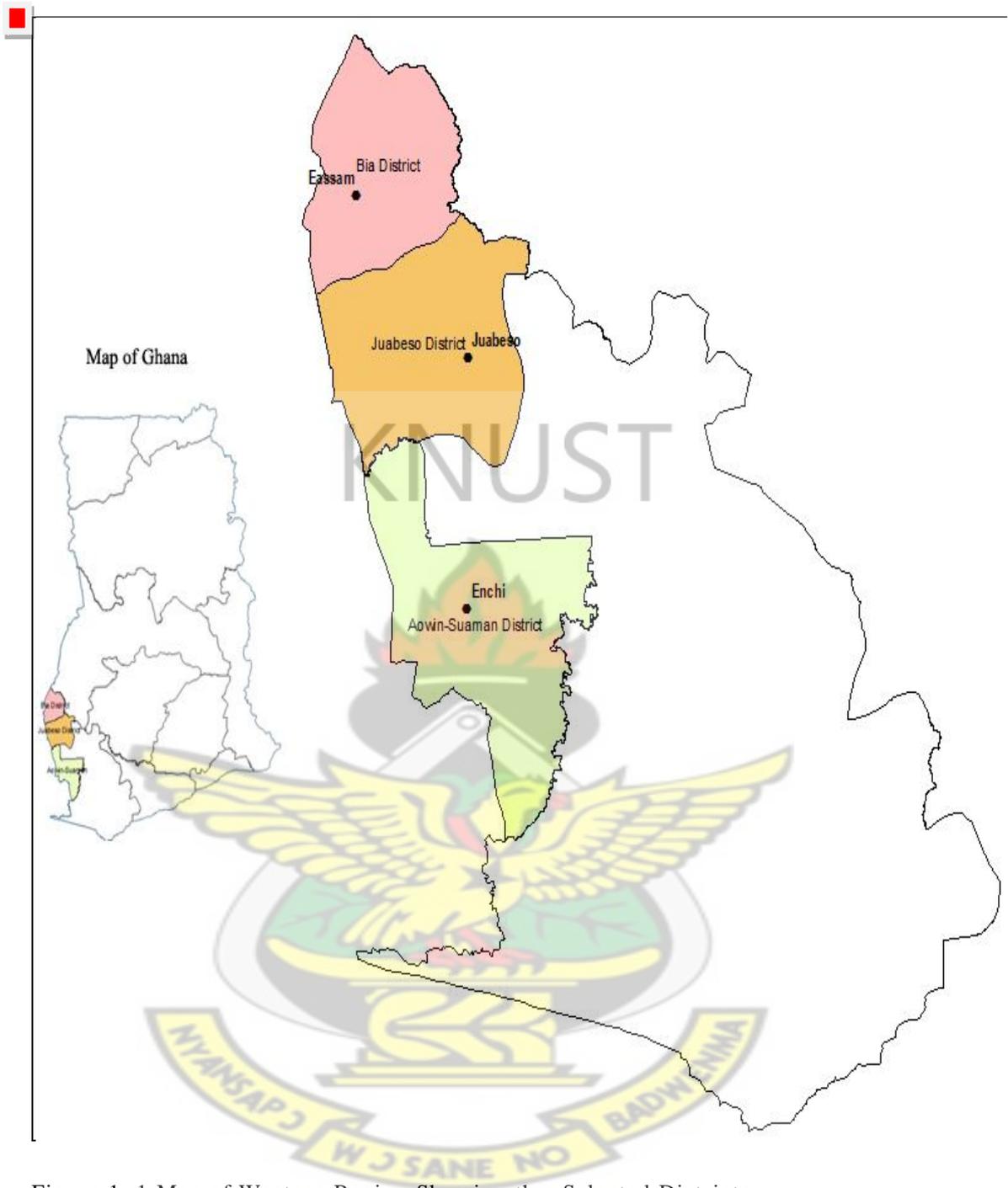


Figure 1. 1 Map of Western Region Showing the Selected Districts  
 SOURCE: (GSS 2000)

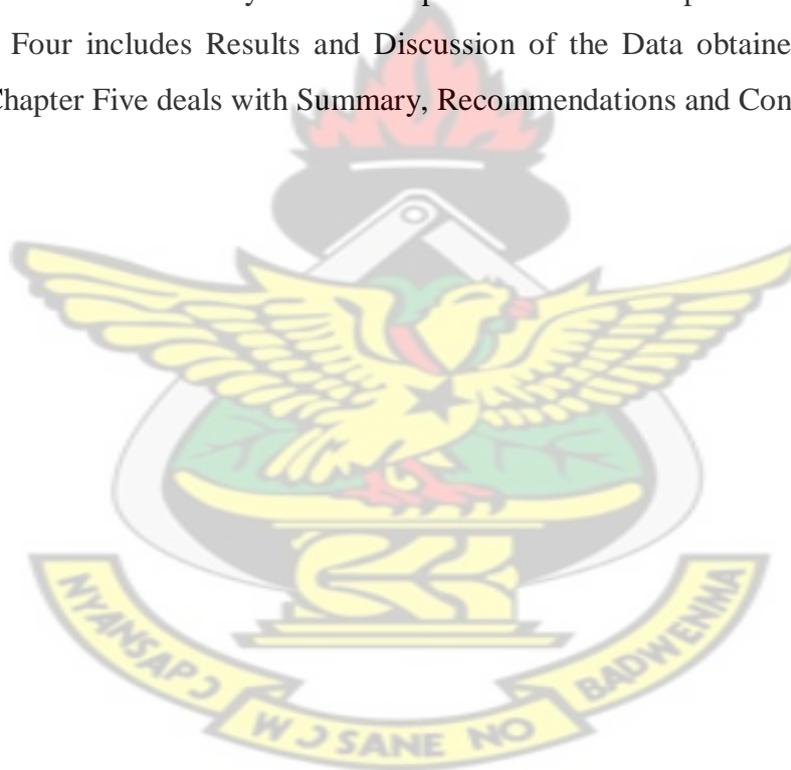
### 1.7 Justification

A review of existing literature on Ghanaian aquaculture has shown that not enough research has been conducted to assess the contribution of aquaculture to poverty reduction in Ghana. This research attempts to fill in the void by assessing its contribution on poverty reduction in Juabeso, Essam and Enchi communities in the Western Region. The Region is an ideal location as fish farming projects have been

identified. If promoted, this industry will potentially reduce the reliance on only cash crops such as cocoa, oil palm, rubber and coconut plantations which are all seasonal crops.

### **1.8 Organization of the Study**

The report is divided into six chapters. Chapter One deals with an overview of the contribution of aquaculture to poverty reduction. These include hypothesis, problem statement, research questions and objectives of the study. Chapter Two analyses the dimensions of poverty and importance of aquaculture to development and poverty reduction. It also analyses types of aquaculture. Chapter Three describes the profile of the study districts and explains the methods employed to select the districts and the communities for the study. It also explains how the respondents were selected. Chapter Four includes Results and Discussion of the Data obtained from the field whilst Chapter Five deals with Summary, Recommendations and Conclusion.



## CHAPTER TWO

### IMPORTANCE OF AQUACULTURE TO DEVELOPMENT AND POVERTY REDUCTION

#### 2.1 Introduction

Aquaculture development is very crucial to economies of developing countries and as a strategy for poverty reduction. According to Muir (2005:191), “for the past twenty years, many countries the world over have intensified aquaculture development through technology to provide food. This has resulted in increasing supply of aquatic food products and employment in many developing economies”.

Aquaculture is therefore seen as a necessary form of diversification in the agricultural system and is very significant in the rural settings since it creates employment, ensures food security and raises people’s standard of living and consequently reduces poverty. This chapter intends to look at what poverty is, causes of poverty in developing countries, dimensions of poverty in Ghana and the strategies being adopted to reduce it. It would also find out what entails in aquaculture, types of aquaculture and analysis done by others in the area of its importance to development and poverty reduction. The next section tries to delve into causes of poverty in developing countries and its effect on the people.

#### 2.2 Analysis of poverty

According to World Bank, (2002), Poverty is pronounced deprivation in wellbeing. The United Nations Development Programme (1997) defines poverty as the denial of opportunities and choices most basic to human development to lead a long, healthy, creative life and to enjoy a decent standard of living, freedom, dignity, self-esteem and the respect of others. Sen (1987) defines poverty as sense of powerlessness, lacking key capabilities for inadequate income, education, or health, or security, or self-confidence and the absence of rights and freedom of speech. Considering these few definitions of poverty, it is clear that poverty is not for the benefit of humankind. Countries all over the world are trying all forms of programmes and strategies to eradicate poverty.

Poverty has been with humankind throughout history and has been accepted as 'natural and unavoidable' in traditional societies. Poverty issues became obvious when a severe famine and malnutrition in Asia and Africa occurred during the 1950s. This led to a renewed interest in the adoption of strategies of poverty alleviation. Poverty is unacceptable and an enemy of humankind. According to Sen, (1987) poverty is ambiguous and multifaceted and includes the following:

- Lack of basic needs such as food, clothing, shelter and social services.

The cost of basic needs estimates the cost of acquiring enough food for adequate nutrition, usually 2,100 Calories per person per day. People who cannot afford this quantum of calories a day are said to be poor.

- Income or consumption poverty

This kind of poverty is the situation where people's annual incomes are below what the UNDP (1997) has recommended as an acceptable minimum daily income levels for humankind. According to Chen and Ravallion (2008), the daily minimum wage is \$1.25 per day.

- Human underdevelopment

People have not developed their mental faculties to acquire knowledge or skills to enable them think and fend for themselves as independent entities.

- Social exclusion

This is a form of poverty where people are excluded from being part of the society in which they live due to reasons such as apathy, isolation and sometimes as a result of the remoteness of communities.

- Ill-being

People who live in poor environmental conditions through their own making or through no fault of theirs can lead to illnesses and chronic diseases resulting in low productivity and poverty.

- Lack of capability and functioning

People who do not upgrade themselves through education and skills acquisition may in most occasion lack capabilities of performing certain functions for themselves and their communities. Poor people often lack key capabilities; they may have inadequate income or education, or be in poor health, or feel powerless.

- **Vulnerability**  
People could be vulnerable to certain situations of which they have no or little control over. In that case there may be some weaknesses on the part of such people. They cannot easily handle most challenges themselves and this can be described as a form of poverty.
- **Livelihood unsustainability**  
People's livelihoods seem unsustainable through some negative activities such as environmental degradation, pollution and deforestation. Fertile lands that supported lives sometime back can no longer do so due to the use of unapproved ways of farming. Farmers who find themselves in such environments would definitely be affected negatively.
- **Relative deprivation**  
People are said to be poor if they are deprived of wellbeing and have no access to basic necessities because of where they live, or illiterates or are known to be strangers.

Other dimensions of poverty include the following:

- **Voicelessness and powerlessness within political systems and bureaucratic structures.**  
Another form of poverty is when decisions concerning some people are made by other people who are less concerned about the impact that the decision would have on the people. Lack of participatory democracy is a form of poverty.
- **No means of ensuring accountability from aid agencies, NGOs, government agencies.**  
Situations where people lack the ability to call for accountability of peoples stewardship is also a form of poverty.
- **Unable to participate in the definition and implementation of programs intended to reduce poverty**  
Situations where people are unable to be part of deciding on a programme meant to improve their own lives are a form of poverty.
- **Limited access to education, land, water, credit facilities, agricultural services and difficult access to markets.** People are said to be poor if they lack these essential social services.

What would be the reference point against which to measure poverty? What is meant by “adequate” and “minimum” shelter and clothing or needs, since there are variations according to the age, physical features and type of activity of each person? The sex of a person also determines his or her needs as needs are a matter of values, preferences and comparisons.

According to Haughton (1999), poverty is measured by comparing individuals' income or consumption with some defined threshold below which they are considered to be poor. This is the most conventional view of poverty which is seen largely in monetary term and is the starting point for most analyses of poverty. Another approach to measure poverty is to ask whether people are able to obtain a specific type of consumption good: such as food or shelter or health care or education? Nutritional poverty might be measured by examining whether children are stunted or wasted; and educational poverty might be measured by asking whether people are literate or how much formal schooling they have received.

The broadest approach to measure poverty is the one articulated by Sen (1987), who argues that a person cannot be considered poor if he/she is capable to function in society. Thus, poverty arises when people lack key capabilities, and so has inadequate income or education, or poor health, or insecurity, or low self-confidence, or a sense of powerlessness, or the absence of rights such as freedom of speech. Viewed in this way, poverty is a multidimensional phenomenon. For the purpose of this study the lack of basic needs such as food, clothing, shelter and social services would be more appropriate for the research. There are reasons why poverty is measured.

Ravallion (1998:133) argues that “credible measure of poverty can be powerful instrument for focusing the attention of policy makers on the living conditions of the poor.” Also measuring poverty is to target interventions. Clearly, one cannot help poor people without knowing who they are. Measuring poverty is to be able to predict the effects of, and then evaluate, policies and programs designed to help poor people. Measuring poverty also helps to evaluate institutions. Poverty could be measured in absolute and relative terms.

Absolute poverty could be described as the minimum set of resources a person needs to survive without which a person could suffer acute deprivation, hunger, premature

death and suffering. It is also about minimum intake of food as well as non-food needs (clothing, shelter, health and other social services). Absolute poverty is an intolerable situation, requiring prompt corrective action. An absolute poverty line of US\$1.25 a day by the above standards put 1.38 billion people as poor in 2005 globally according to UNDP (1997). However, the problem with these definitions is that it becomes difficult to measure some of these set standards. For example, what is minimum set of resource a person would need to be declared as not being poor since it may differ from place to place?

Relative poverty, on the other hand, is the measurement of the resources and living conditions of parts of the population in relation to others. It recognizes absolute minimum below which livelihood is not possible, reflects inequality and the relative position of households in terms of consumption and expenditure. The poverty line could be set at 50 percent of the country's mean income or consumption but revised from time to time to reflect social consensus about what constitutes poverty.

### ***2.2.1 Main determinants of poverty and reduction strategies adopted in Ghana***

Haughton et al (1999) noted that poverty can be determined through well defined characteristics such as regional, community, household and individuals situation. A region can be said to be poor due to its remoteness in terms of location. It can also be referred to as poor if that region has less infrastructure and poor access to markets and services. A region that lacks resources (such as fertile lands and minerals), experiences poor weather and environmental conditions (such as droughts and frequency of earthquakes), do not practice integrated regional governance and management as well as inequality can be declared as being poor.

More so, a community can be said to be poor if it lacks infrastructure such as piped water, access to tarred road, access to public goods and services, social structure and social capital.

Characteristics of household for it to be declared as poor or non poor include its size, dependency ratio, and gender of heads of household. A household that lacks assets such as land, tools, and other means of production is said to be poor. Proportions of adults employed, type of work-wage labour or self employed, remittances inflows all determine employment and income structure of a community. The health and educational status of household members on average also determines the state of such

house. Individual can be said to be poor or non poor by considering the persons age, education, employment and health status. The next topic attempts to look at the levels of poverty in developing countries and in the Western Region.

### ***2.2.2 Poverty in developing countries, Ghana and Western Region***

For the purpose of this study, poverty in terms of lack of basic needs (food, clothing, shelter and social services) due to low incomes would be the main focus. Developing countries are characterized by low levels of technology, industrial development and incomes and are engulfed in poverty. However, there are variations and degrees to which these figures are applicable in various countries. Some of these features include:

- Low standards of living
- High population growth rates
- Low levels of productivity
- High levels of unemployment
- High dependence on export of primary products
- Health related issues

### ***2.2.3 Low standards of living***

Sub-Sahara Africa is generally classified as a developing world where standard of living of majority of her people is generally very low. This is due to the incidence of extreme poverty that makes people to survive on only \$1 or less a day resulting in incidence of diseases, low life expectancy, inadequate and dilapidated housing, limited education, poor nutrition and high infant mortality (World Bank, 2004).

According to World Development (2004), all Sub-Saharan African countries, (with the exception of nine, that are either lower middle income or upper middle income) are low income countries as shown in Table 2.1. All the countries are developing ones, but in different stages of development. The level of income inequalities is more profound in the developing world than in the developed world since vast inequalities exist between the bottom poor and the top rich.

Table 2.1: Classification of Countries by Incomes

Low Income Countries Less Than \$735	Lower Middle Income Countries \$736- \$2935	Upper Middle Income Countries \$2936- \$9075	High Income Countries More Than \$9076
Ghana	China	Botswana	Norway
Nigeria	Algeria	Gabon	Australia
Indonesia	Namibia	Mauritius	Singapore
Georgia	South Africa	Argentina	Kuwait
Mali	Guatemala	Seychelles	Germany
Togo	Jamaica	Mexico	Canada
Cote d' Ivoire	Philippines	Saudi Arabia	Japan
Rwanda	Albania	Libya	Israel
India	Swaziland	Lebanon	Bahrain
Uzbekistan	Egypt	Croatia	Qatar

**Source:** World Development Indicators, 2004

World Bank Report (2004) indicated that, in Ghana, for instance, the percentage consumption for the lowest 10% of the population in 1997 was 3.6, whilst the highest 10% had 26.1% of national income and also Per capita income in 1999 was \$390 but dropped to \$270 in 2002. The growth rate was 4.5% and 5.2% in 2002 and 2003 respectively (ISSER, 2004).

#### ***2.2.4 High population growth rates and dependency burdens***

According to World Bank (2004), the total world population as at 2002 was 6.2 billion of which three quarters lived in the developing world. Developing countries have high national populations due to high birth rates. The average annual population growth rate from 1990 to 1998 was 1.7 percent for developing countries as a whole and 2.6 percent for Sub-Saharan Africa. The rate was only 0.6 percent for the developed world.

In Ghana, the annual population growth rate between 1990 and 1998 was 3.0 percent. As a result 44.1 percent of the population in 1998 were under 15 years, 51.2 percent were between 15 and 64 years, while 4.7 percent were 64 years and over. According to Amankwaa (2000), in Ghana because of the youthful nature of the population arising from high population growth rate the dependency ratio of 53.47 is high therefore creating a burden.

The population of the Western Region is 1,924,577, constituting about 10 percent of the total population of the country as at 2000 (GSS 2000). The region as at 2005 had rural population of 1,226,159 (63.7%) as against urban population of 698,418 (36.3%) (GSS-2005) and with a population growth rate of 3.2%, the region's population is expected to double by the year 2030. The high growth rate would result in high unemployment rate and it is expected that few people would have to work to feed majority of the population.

### ***2.2.5 Low levels of productivity***

The productivity of labour in developing countries is extremely low due to lack of technological know-how and at times managerial skills as well as diseases that make man hours get wasted due to hospitalization and sick leaves by workers. Improper care of the environment and surroundings brings about accumulation of filth resulting in the spread of diseases. According to World Bank (2001), only 29 percent of the populations of low and middle income countries had access to sanitation between 1990 and 1996. That is, more than 3 billion people in the developing world have no access to sanitation thereby increasing the prevalence of diseases.

Ghana Statistical Service (2000) has indicated that in Ghana only 42 percent of the population had access to sanitation between 1990 and 1996 while just 56 percent had access to improved water sources over the same period. Naturally, people are unable to work as productively as they are expected to if they are in poor state of health.

### ***2.2.6 High levels of unemployment***

Unemployment rate is very high in developing countries although is becoming a canker throughout the world including developed countries. People are poor if they are unemployed. Unemployment is a serious economic problem. Whilst there are thousands of unemployed people who want to work the approximate rate of unemployment is difficult to establish due to political implications.

### ***2.2.7 High dependence on export of primary products***

The majority of people in developing countries are engaged in agriculture but on small-scale basis. They rely on obsolete farming tools; apply outmoded technologies and unimproved planting materials. As a result, they produce very little. According to World Bank (2004), indeed 80 percent of the population of the developing countries is

based in the rural areas and out of this 60 percent are engaged in agriculture compared to 21 percent in the developed world. The exportable commodities such as cocoa, coffee, tea, timber are exported in its raw form without adding value by way of processing them into other products.

In Ghana, major exports are cocoa, gold and timber and in 1999, the export of cocoa beans and gold accounted for nearly 58 percent of total exports (ISSER, 2000). Unfortunately the demand for these commodities is unstable and prices vary at certain periods within the seasons. The consequences are that developing countries become poorer and the living conditions of her people deteriorates. Western region is known to be one of the leading producers of cocoa and are therefore bound to face these similar challenges.

### **2.2.8 Health related issues concerning poverty in Ghana**

From Table 2.2, targets set for 2008 were exceeded for infant mortality rates. It fell from 64 per 1000 live births to 50 per 1000. Under-five mortality rate per 1000 live births also fell from 105 to 80, an indication of an improvement. According to Mkandawire (2005), about 60% of deaths in the under-five age group are attributed to malnutrition, with minerals, vitamins and protein deficiencies standing out as leading causes. In many parts of Sub-Sahara Africa, fish has been the main source of those vital nutrients, especially among the poor.

Table: 2.2 Targets for Infant Mortality Rate and Mal-nourished Children in Ghana

Year	2008 Target	2003 DHS	2006 MIC	2007 GHMS	2008 DHS
Indicator					
Infant mortality rate per 1000 live births	64	64	71	Na	50
Under – five mortality rate per 1000 live births	105	111	111	Na	80
Under – five who are mal-nourished (underweight in %)	16	22	18	Na	13.9

SOURCE: GDHS, 1988-2008; Multiple Indicator Cluster Survey (MICS), Preliminary Report

From Table 2.3, targets set for maternal mortality ratio of 172 per 100,000 live births could not be met. According to Ghana Health Service (2008) it was 200 as at 2008. It is believed that poverty is the main cause of such deaths, because people cannot afford medical expenses.

Table 2.3 Targets for Maternal Mortality ratio in Ghana

Year	2008 Target	2006	2007	2008
Indicator				
Maternal mortality ratio per 100,000 live births	172	197	224	200

SOURCE: Ghana Health Service (GHS), 2008.

### **2.2.9 HIV / AIDS infection**

It is believed that HIV infection is very high in the economically productive age group, that is, between the ages of 15-24. The risk factors and vulnerability are different for men and women as are the implications for the impact of HIV / AIDS in Ghana. There are implications for care, treatment and tackling the needs of orphans whose parents have died through AIDS. The Ghana Aids Commission (2008) has indicated that national prevalence rate of HIV/AIDS is 19 percent. This is one major cause of poverty in developing countries such as Ghana.

### **2.3. Dimensions of poverty in Ghana**

The intensity of poverty differs from one place to the other, among socio economic groups and gender disparities. The ensuing sub- section attempts to delve into these dimensions of poverty.

#### **2.3.1 Geographical disparities**

According to National Development Planning Commission (NDPC) in GPRS I (2003-2005), there are regional disparities in terms of the intensity of poverty and the worst affected are the Northern savannah regions. From Figure 2.1, five out of the 10 regions in Ghana had more than 40% of their population living in poverty in 1992 including the Western Region the three Northern Regions and Brong Ahafo, the rural forest areas. Figure 2.1 is the Poverty Profile of Regions of Ghana. Nine out of ten people in Upper East, eight out of ten in Upper West and seven out of ten in the Northern region were classified as poor in 1999.

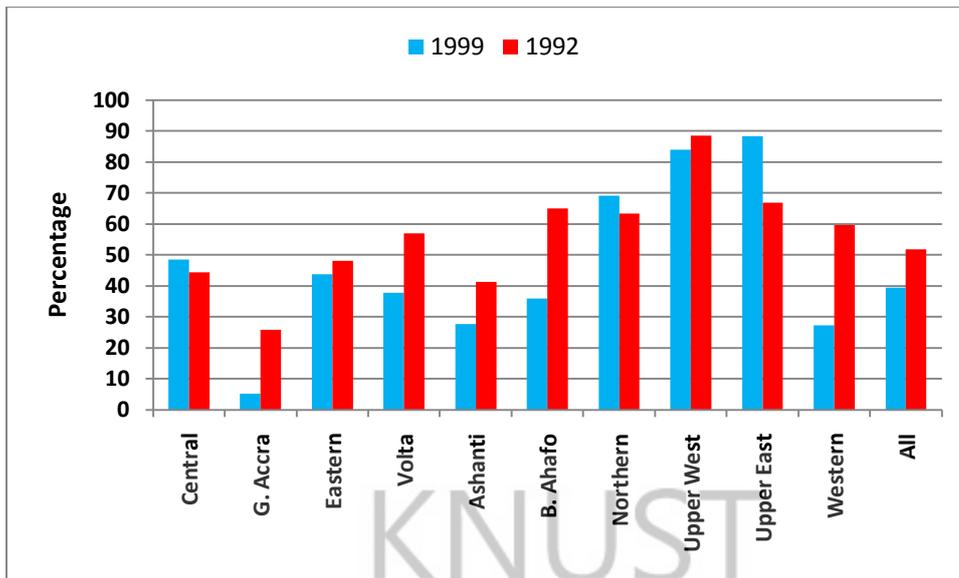


Figure 2.1 Poverty Profiles of the Regions in Ghana (SOURCE: GSS, 2000)

Table 2.4 Poverty Levels in some areas in Ghana in percentages (%)

Region	Poverty as at 1998/1999	Poverty as at 2004/2006
National	39.0	28.5
Urban Coastal	31.0	5.5
Urban Forest	18.2	6.9
Rural Coastal	45.6	24.0
Rural Forest	38.0	27.7

SOURCE: GSS (2000)

From Table 2.4 poverty levels in the rural forest region fell from 38 percent in 1998/1999 to 27.7 percent in 2004/2006, its effect was insignificant and there was the need to do more for the people by way of poverty reduction.

### 2.3.2 Poverty disparities among Socio-Economic groups

Food crop farmers are by far the poorest among other groups such as informal sector employees, non-farm self employed and export farmers NDPC in (GPRS I, 2003-2005).

Table 2.5 Poverty among Socio-Economic groups (in percentages)

Socio-Economic Group	Percentages
Employment	
Public sector	22.3
Private formal	11.3
Private informal	23.2
Export farmers	36.1
Food crop farmers	58.4
Non- farm self	28.0
Non working	20.4
All	38.3

SOURCE: GSS 2000 , (Poverty trends in 1990s, Accra)

From Table 2.5, sixty percent of the populations who are farmers are food crop farmers. There is therefore an indication of extreme poverty among these farmers and the reason why the northern savannah and the rural forest regions are the worst affected areas.

### **2.3.3 Poverty disparities by gender**

Gender is an important dimension of poverty in Ghana. Women play significant roles in rural economic activities. In rural coastal and rural forest, they are responsible for 40 percent of all household agricultural activities, and they completely dominate agricultural processing activities. Women were found to bear a disproportionate share of the burden of being poor. They are obliged to spend a great deal of time not only working in family enterprises but nurturing and rearing children, and in important household tasks such as cooking, and fetching water and firewood. On average, the GSS (1992) reports that members of rural households spend 37 minutes per day fetching water. In Rural Savannah, they are obliged to devote 48 minutes each day to this activity. This task is borne mainly by girls and women. Females in Rural Savannah spend on average 70 minutes per day collecting water.

Women bear heavy workloads. In addition to their domestic chores, they are responsible for about 60 per cent of agricultural production in Ghana. More than half the women who head households in rural areas are among the poorest 20 per cent of the population (GSS, 2000). In order to overcome their vulnerability and food insecurity, poor rural populations need help in sustainably increasing their incomes.

Good opportunities exist to link farmers to markets and to modernize agriculture. The rural private sector could play an important role in making farming a profitable business through access to financial services, farm inputs and linkages to agro processors and traders.

All these forms of poverty can be eradicated or reduced if rural farmers would diversify their farming activities and engaged seriously in aquaculture, since apart from increasing their incomes; their diets would also be improved. If families are fed on nutritious food such as fish products, problems of mal-nutrition, infant and maternal mortalities would be reduced drastically.

#### ***2.3.4 Social Dimensions of poverty***

According to GSS (2000), social indicators as 1990 showed some marginal improvement in infant and children under five mortality rates. There were decreases from 66/ 1000 and 119/1000 to 56/1000 and 108/1000 respectively from 1993 to 1998. The reasons were that the use of health facilities was very low in the savannah and the rural forest regions as compared to the Southern part and the urban forest regions of the country due to high levels of poverty in these areas. There is no doubt about the fact that poverty in any form must be eradicated and peoples standard of living be improved. The next topic tries to look at some of the strategies adopted to eradicate poverty in Ghana.

#### ***2.3.5 Poverty Reduction Strategies***

Poverty reduction has been a major challenge confronting mankind globally. Between 1996 and 2006, the world was declared as an International Decade for the Eradication of Poverty. Ghana tried to alleviate poverty in the country and therefore went through various strategies such as declaration of being a Highly Indebted Poor Country (HIPC), GPRS I and II between 2003 and 2009 as well as Ghana's Shared Growth and Development Agenda (GSGDA, 2010 to 2013) were implemented. Such strategies were to provide general infrastructure (essential social amenities) such as roads, hospitals, schools to the people. Through this, jobs could be created; communities would be opened up and linked to market centres. The result was that there would be improvement in people's standard of living. Five thematic areas were chosen with GPRS I document for special attention and later reduced to three when GPRS II was adopted. They included:

- Macroeconomic stability
- Production and gainful employment
- Human resource development and provision of basic services
- Special programmes for the vulnerability and excluded
- Good governance

The Ghana Government was expected to foster macroeconomic stability, accelerated growth led by the private sector, human resource development and good governance. Its poverty reduction strategy was focused on the vulnerable and excluded people such as poor agricultural workers – particularly migrant farm hands, traditional fishers and disabled persons – and those with the potential to become more productive, including women in the informal sector, unemployed young people, and subsistence farmers.

While the first phase of the Government's strategy emphasized programmes and projects to reduce poverty, the second focused on implementation of activities that induced growth and had the potential to support the creation of wealth. The objective was sustainable poverty reduction – an agenda for growth and prosperity. Ghana was committed to transforming its economy to achieve growth, accelerate poverty reduction and protect poor people in a decentralized, democratic environment. The Government emphasizes that it has the political will to consolidate achievements, strengthen partnerships, introduce innovations and increase policy dialogue.

The current approach is the Millennium Development Corporation or Account (MDA) which has set eight goals that are to be achieved by the year 2015 that respond to the world's main development challenges. The MDGs are drawn from the actions and targets contained in the Millennium Declaration during the UN Millennium Summit in September 2000. The goals included the following:

- Goal 1: Eradicate extreme poverty and hunger
- Goal 2: Achieve universal primary education
- Goal 3: Promote gender equality and empower women
- Goal 4: Reduce child mortality
- Goal 5: Improve maternal health
- Goal 6: Combat HIV/AIDS, malaria and other diseases
- Goal 7: Ensure environmental sustainability

## Goal 8: Develop a Global Partnership for Development

These goals pave the way forward, from that moment to the year 2015, to cut world poverty by half. With the accomplishment of these goals, billions more people can benefit from the global economy and tens of millions of lives can be saved. The next section discusses aquaculture as being one of the means of reducing poverty among rural farmers.

### **2.4 Aquaculture as a means of agricultural diversification**

Aquaculture is defined as the production, processing for marketing or/and consumption of water organisms such as fishes, crustaceans (crabs, lobsters), mollusks (snail, shellfish), algae and aquatic plants. Analyses offered by Green (2000:11), indicates that “aquaculture is the farming of aquatic organisms in fresh brackish or salt water, where a wide variety of aquatic organisms are produced through fish farming, including fishes, crustaceans (crabs, lobsters), mollusks (snail, shellfish), algae and aquatic plants”. Wilson (1995:103) defines aquaculture “as the production, processing and eating or marketing of water organisms such as fish, mollusks, crustaceans and algae”. King and Ibrahim (1985:5) defined aquaculture “as any increase in the production of aquatic organisms from a man made or modified area through some form of human intervention beyond that of merely harvesting the produce”. Balarin (1985:62) noted that “aquaculture has been applied both to the classical rearing of fish in ponds for subsistence consumption and to the extensive practice of stocking natural water bodies and reservoir”.

The definitions from above indicated that scientific principles are employed in the activities of aquaculture through human interventions to regulate and manage production. These approaches are more prevalent in the developed countries where the main reason for engaging in this venture is for commercial purposes. Unlike marine fisheries, aquaculture requires deliberate human intervention in the organisms' productivity and results in yields that exceed those from the natural environment alone. Stocking water with juvenile organisms, fertilizing the water, feeding the organisms, and maintaining water quality is common examples of such intervention. Most fish and crustacean aquaculture is undertaken in earthen ponds. These ponds are

usually equipped with water inlets and outlets that permit independent control of water addition and discharge.

Management practices range from pond fertilization, which increases the number of natural food organisms, to provision of a complete, formulated feed that supplies all nutrients necessary for growth. Animals that have reached market size are harvested from the ponds. In a complete harvest, the pond is drained and all animals are removed from the pond for processing or consumption. In a partial harvest, only a portion of the animals are removed from a full pond using fishing net.

Additional fingerlings are often stocked into the pond after a partial harvest, and the production cycle is continued. In developing countries, agriculture is identified as the engine of growth. Agriculture should therefore be seen as an activity that should forge a strong partnership among stakeholders such as government, private sector, civil society organizations and regional and international organizations. Agricultural diversification may include non-traditional crops and livestock rearing. The former include crops such as mango, pawpaw, cashew, pineapple, mushroom, and moringa cultivation for industrial use while the latter includes aquaculture (fish farming) and the production of grass cutter, snail farming, and beekeeping, rabbitry for consumption and for commercial purposes.

Non agricultural diversification includes food distribution and enterprises such as value-adding or processing and marketing of primary products in order to capture the value that is added as the product moves along the production chain until the product moves to the final market. “In Ghana, agriculture is the main stay of most of the population and an important sector that supports the economy. It employs 48% of the economically active population, contributing to Government revenue and is the main source of food for the constantly expanding urban population” (Nyanteng, 1993:69).

Globally, it was noted by Todaro (1982: 222) that “over 2.5 billion persons reside in rural areas and that almost 70 percent of the world’s poorest people are located in these areas. The inhabitants of these areas are engaged primarily in subsistence agriculture and it was recognized that if the local areas remain underdeveloped, then national development would not be sustainable”. Agriculture must therefore be developed in the rural setting by way of diversifying into other sectors such as aquaculture.

There is therefore the need to look at the areas of interests and see how they were seen by others in the field of aquaculture. The areas of interest where the literature seems to review included:

- Kinds and Types of aquaculture
- Aquaculture at Global Level, Africa, Ghana and Western Region of Ghana.
- Small scale Pond construction
- Fish feeding
- Fertilizing of ponds
- Health hazards
- Controlling of health issues in aquaculture
- Environmental impacts and sustainability

#### ***2.4.1 Kinds and types of aquaculture***

According to Avnimelech et al (1994:119), there are two kinds of fish farming: extensive fish farming and intensive fish farming. With the extensive fish farming, the organisms obtain their feed naturally based on local photosynthetic production. With intensive fish farming, the fish are fed with external food supply. With the extensive aquaculture, food supply is from natural sources, commonly zooplankton or crustaceans and mollusks whilst in the intensive aquaculture, food and oxygen is supplied. Bardach (1971) states that aquaculture includes the culturing of algae to complete domestication of fish through husbandry practices. It is sometimes difficult to distinguish between intensive management and culture. With intensive management of fish, the fish goes through different stages of rearing before it is harvest. During the harvesting all the fishes are harvested most especially when single species are raised.

#### ***2.4.2 Types of Aquaculture***

Avnimelech et al (1994: 120) noted that there are about four main types of aquaculture being practiced in countries worldwide. They include:

##### ***2.4.2.1 Integrated recycling systems***

According to Avnimelech et al (1994) large plastic fish tanks are placed in a greenhouse. A hydroponic (i.e. plants grown in water) bed is placed near, above or

between them. The fishes are fed with alga which naturally grows in the tank. The tank water is slowly circulated to the plants grown in water.

#### ***2.4.2.2 Irrigation ditch or pond systems***

Ditch or pond is dug to retain water, possibly with an above- ground irrigation system. The ponds are usually lined with clay. In small systems the fish are often fed on commercial fish food and their waste products help fertilize the fields. In larger ponds, the pond grows water plants and algae as fish food.

#### ***2.4.2.3 Cage system***

Fish cages are placed in lakes, ponds, rivers or oceans to contain and protect fish until they can be harvested. The cages can be constructed of a wide variety of components. The fishes are fed in the cages and harvested when they reach market size.

#### ***2.4.2.4 Classic fry farming***

Trout and other sport fish are often raised from egg to fry or fingerlings and then carried to streams and released. Normally the fingerlings are raised in long shallow concrete tanks, fed with fresh stream water. The fingerlings are fed with commercial fish food pellets. The next topic would attempt to look into what aquaculture is and how it began from global level and the three study districts of the Western Region.

### **2.5. Analysis of aquaculture at Global level, in Africa and in Ghana**

According to Green (2000: 11), China, Italy and Egypt developed aquaculture more than 2,000 years ago. Other countries such as India, Japan, Philippines, Indonesia, Thailand, South Korea, Bangladesh, and Vietnam are major aquaculture producing countries. Aquaculture practiced in Europe, China, and Japan involved capturing wild fishes from rivers and putting them in ponds or other bodies of water for further growth. Green (2000: 18) indicated that, aquaculture production has grown steadily from an estimated one million metric tons (worth 2.2 billion pounds) in 1966 to 37.5 million metric tons (82.7 billion pounds) worth approximately \$56 billion in 2000. This yield, which represented about 29 percent of world fishery production, is shown in Figure 2.2. That is 29% of global aquatic production is made up of 51% fishes, 23% of mollusk (snail), 22% of algae aquatic plant and others and 4% crustaceans (crab).

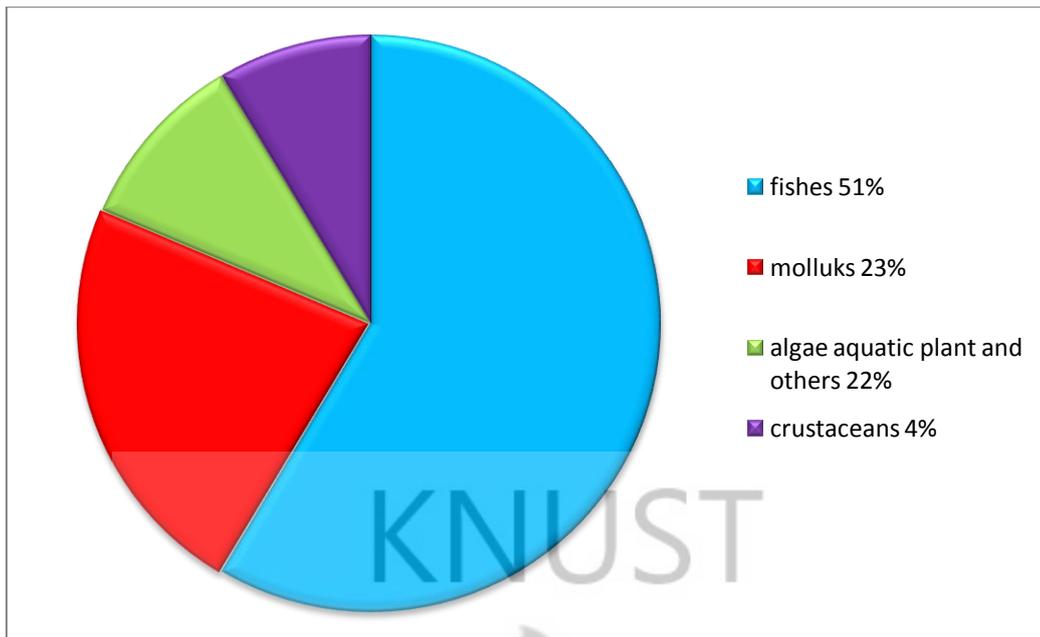


Figure 2.2. Global production of aquatic products Source: Green 2000

There is therefore an indication of extreme poverty among these farmers and the reason why the northern savannah and the rural forest regions are the worst affected areas. Green (2000:20) further showed that, while world aquaculture production has been growing at an average rate of 9.2 percent since 1970, the distribution of output is concentrated in certain countries. For example, the U.S. aquaculture production rose more than 400 percent between 1980 and 2000. The estimated value of that production is US\$ 25 million.

Table 2.6 indicates that since 1995 the percentage growth per year of finfish production is rising steadily in Africa (32.1%) although absolute figures are low. As at 1995 Africa's figures were 95394 tonnes whilst that of Asia was 13484358. However, it looks like the rise of production in Asia (8.7%), Europe (7.3%), Oceania (12.9%), the North and South Americas (8.3%) and (20%) respectively is insignificant. Africa's marine fisheries is getting depleted through unorthodox ways of harvesting, as well as the use of sophisticated trawlers for fishing and therefore the need to go into aquaculture production in order to compensate for the losses.

Table 2.6: Total Global Aquaculture Production in Tonnes (Finfish Only)

Year / Country	1995	1996	1997	1998	1999	2000	% growth / year
Asia	13484358	15306133	16 858807	17829736	19318022	20482334	8.7
Europe	881 213	943 287	1 021 647	1 095 411	1 233 821	1 253 934	7.3
South America	216053	299476	370828	396423	404725	536698	20.0
North America	349 119	387 251	440 461	456 286	511 011	519 171	8.3
Africa	95 394	112 792	118 393	176 648	266 005	384337	32.1
Oceania	15 654	19 151	17 850	21 901	24 726	28763	12.9
Total	15041791	17068090	18827 986	19976 405	21758310	23205237	9.1

Source: FAO (2002)

Table 2.7: Total Global Aquaculture Production in Tonnes (Shellfish Only).

Year / Country	1995	1996	1997	1998	1999	2000	% growth / year
Asia	8,228,922	8,511,281	8,610,777	9,180,924	10,318,376	11,168,554	6.3
Europe	694 153	717 123	712 366	820 132	823 689	768 873	2.1
South America	209 881	179 814	200 493	208 276	222 650	178 748	-3.2
North America	144 238	151 393	186 842	212 424	212 184	155 174	1.5
Africa	4899	5280	6589	6824	6933	7876	10.0
Oceania	78, 583	82,546	87,543	102, 214	104,669	100,649	5.1
Total	10 530 794	9 360 676	9 647 437	9 804 520	11 688 501	12 379 874	5.8

Source: FAO (2002)

Table 2.7 indicates that percentage growth per year of shellfish in Africa is 10 percent as at 2000, Asia is 6.3 percent, Europe is 2.1 percent and South America is -3.2 percent which depicts a fall in production.

Whereas the main reason for engaging in aquaculture in the developed countries is for commercial purposes it is not always so in the developing countries. Sometimes, ponds are made for recreation and sports in the developed countries. Aquatic organisms are produced in larger scale for both local consumption and export in the advanced countries.

As fishes are reared for commercial purposes in the developed countries, there is the need to find out the purpose and the extent of aquaculture development in the developing countries as the next section seems to depict.

### ***2.5.1 Aquaculture in Developing Countries***

Tables 2.6 and 2.7 have indicated how aquaculture is growing in Africa between 1995 and 2000 from 95,394 tonnes to 384,337 tonnes. Most farmers in developing countries go into aquaculture to support their households with food and the surplus sold for money for their upkeep. According to ACP- EU Technical Centre for Agricultural and Rural Cooperation (CTA) Practical Guide Series, NO. 1 (2007), throughout Eastern Africa pressure on land is increasing. Average farm size is decreasing as plots are sub- divided and farmers struggle to find space on their farms to grow subsistence and cash crops as well as keep livestock. As a result many farmers are now thinking of going into aquaculture because; aquaculture requires just a little space.

Odotei (1985:31) noted that South Africa went into aquaculture between 1859 and 1896 and was introduced in Kenya and Madagascar towards the end of the 20<sup>th</sup> Century. Her analyses show that the first successful production of tilapia in ponds occurred in Southern Zaire in 1946. This shows that aquaculture development in Sub Sahara Africa is relatively recent. This observation is consistent with findings by Symoens and Micha (1994) who showed that aquaculture production in 1990 only amounted to 14,700 tonnes which represent an insignificant proportion (0.5%) of world output. They further indicated that by 1990, the largest producers in Sub Saharan Africa as depicted in Table 2.7, were Nigeria, Cote d' Ivoire, Zambia, and Kenya which had more than 1,000 tonnes per year, followed by Zaire, Ghana, Tanzania, the Congo, Madagascar and Sudan, which produced between 200 and 700

tons per year. This informs us that most African countries had not been practicing aquaculture until recently.

According to Mkandawire (2005), fisheries are an important rural commerce and enterprise across the continent. It is the source of livelihood and direct income for more than 35 million Africans, majority of whom are poor and live in remote rural areas where other economic opportunities are rare. The farmers who establish aquaculture do it on subsistence bases and sometimes do not harvest their produce regularly due to the difficulties and lack of techniques in harvesting. The industry that should have grown and improve the farmers standard of living seem not to be so. It is quite clear that, most developing countries are encouraging people to engage in aquaculture development as they see some depletion of their marine fish resources. The next section which analyses aquaculture will show that the practice is only a post-independent phenomenon with very low outputs in Ghana.

### ***2.5.2 Aquaculture in Ghana***

Aquaculture is one of the activities that have been identified as a means to poverty reduction in Ghana and also the Millennium Development Account (MDAs), a poverty reduction document aimed at taking the country to middle income status by the year 2015. Countries, including Ghana are expected to halve poverty and hunger by 2015 through diversification of the agricultural sector, the reason why countries such as Ghana are advising farmers to diversify into other areas (such as mango, pepper, and etc. cultivation).

Fishing forms one of the traditional backbones in Ghana. Freshwater fish are available in the rivers and Lake Volta, but the Atlantic Ocean provides the bulk of the nation's fish supply. Research shows that fish farming started in northern Ghana during the colonial era when fishponds were built in 1953 by the former Department of Fisheries. These ponds served as hatcheries to support the culture-based reservoir fishery development programme of the colonial administration and as a way of supplementing the national demand for fish and increasing livelihood opportunities. Analyses further indicated that, after gaining independence in 1957 the national government adopted a policy to develop fishponds within all irrigation schemes in the country. State-owned irrigation facilities were to be developed, as far as it was technically possible, under a policy of converting five percent of the scheme into fish

farms. In the period between 1990 and 2004, the technology of fingerling production improved tremendously. Fingerlings have been produced from concrete tanks and earthen ponds, as was the practice in the previous years. Although fish seed was still being obtained from the rivers and reservoirs in the remote areas, private commercial entities produce fingerlings of tilapia far in excess of their requirements and were willing to sell the surplus. Currently, all-male tilapia culture is becoming widespread in the country. According to Ayinla and Denyoh (1994:8), deficiency in fish supply can only be a thing of the past if aquaculture is taken more seriously in the country.

Long term growth strategy identified under GPRS I of Ghana is based on the concept of modernization, restructuring and development of rural areas as a catalyst for the rural economy, since the country is predominantly agrarian. Emphasis in the fisheries subsector was on the development of inland fisheries under the Medium Term Agricultural Development Programme (MTADP) 1991- 2000. Fishing on the Volta Lake was to be improved alongside harnessing aquaculture throughout the country. The Ministry was to be assisted to develop hatcheries for stocking public water bodies (Lakes and irrigation dams) and ponds. Marine facilities were also to be rehabilitated. A follow up of the MTADP with the objective of establishing long term sustainability of the fisheries resources was the Fisheries Sub- Sector Capacity Building Project (FSSCBP) in 1998. This was to facilitate and promote the development of inland fisheries including aquaculture. Under the Accelerated Agricultural Growth Strategy (AAGS), on which Agricultural Sub- Sector Improvement Project (AgSSIP) was based, a national strategy was drawn to:

- Promote production for export
- Develop appropriate technology
- Develop and facilitate access to credit
- Provide infrastructure and utilities for example fingerlings
- Build human resource and institutional capacity.

The strategy covers issues on inputs, institutions and production systems. The private sector would be seen as deliverers of inputs to farmers; the institutions would cover the private sector, training, extension and formalize links among public sector institutions for aquaculture development FASDEP II (2009:36). There would be the need for the integration of fish farming into the normal farming systems. These

policies were well spelt out and had one of the best strategies but the question was whether personnel were available to implement them at all.

### 2.5.3 Aquaculture in Western Region

The data collected from FSSCBP (2000) indicated that, between 1988 and 2000, Western Region had the highest number of ponds in the country (almost 36% of the total in the country) as shown in Table 2.8. This was mainly due to the fact that the area had large tracts of marginal lands that had the potential of supporting aquaculture production. The three northern regions had the least numbers and forms about an average of 0.10 percent. This may be due to the fact that water resources in the area are scarce and type of rainfall pattern may result in the drying of the ponds.

In the Western Region of Ghana, the cash crop farmer, especially the cocoa farmer was seen as among the rich in the country before the 1983 bush fires engulfed most farmlands. However, this is no longer the case and that after the fires, the sizes of land holdings were reduced as farmlands were sub-divided among family members.

Table 2.8: Fish pond distribution in Ghana by Region

Year Region	1988	1991	1996	1997	2000	TOTAL	%
Upper East	2	3	3	3	5	16	0.17
Upperwest	3	2	2	2	3	12	0.13
Northern	2	nil	nil	nil	nil	2	0.02
Ashanti	246	278	302	302	469	1597	17.05
Brong Ahafo	54	178	178	211	327	948	10.12
Eastern	142	178	178	178	276	952	10.17
Central	7	77	162	147	228	621	6.63
Western	37	281	890	829	1285	3322	35.48
Volta	141	146	146	92	143	668	7.13
Greater Accra	650	104	133	133	206	1226	13.09
Total	1284	1247	1994	1897	2942	9364	100
Percentage	13.71	13.31	21.29	20.26	31.42	100	

Source: Asafo, C.K. (2000).

The fact that the area has abundant forest resources, inland valleys and marshy areas and marginal lands for agriculture purposes, the rural farmers in the Western Region of Ghana still live in poverty, land holdings has become very small and they have

very little to live on. Rural farmers in the Western Region have gone into aquaculture as a means to diversify their sources of income away from the core farm production systems of cultivating cash crops such as cocoa, oil palm, coconut as well as other crops like cassava, cocoyam, plantain and others.

Diversifying an existing farm enterprise to incorporate alternative enterprise is, however not a risk less venture. It often involves interest areas, development of new skills, access to new resources such as finance, market opportunities and improves one's standard of living as was done in some Asian countries (Malaysia, Indonesia and others).

Ghana stands a better chance of achieving the MDGs by attaining a middle income country status by 2015 if aquaculture production is improved and rural farmers are encouraged to go into it. Rural farmers in the Western Region of Ghana are entitled to small land holdings that are used to cultivate cash crops. These crops are seasonal and cannot meet the financial needs of these farmers, and these farmers are seen to be living in abject poverty. The overdependence of these farmers on cocoa was so great that the 1983 bushfire outbreak throughout the country really affected their livelihood. In Ghana, fisheries are grouped under different sub- sectors and the next section tries to look into these sectors.

## **2.6 Fisheries sub- sectors**

According to Odotei (1985), Fisheries Department encompasses the following sub-sectors

- The Industrial Deep Sea Fleet which stays at sea for long periods before landing their catch.
- The Inshore Vessels which are mainly wooden plank vessels with inboard motors. They range between 30 and 60 feet.
- The Artisanal Marine or Canoe Fisheries, which comprise dugout canoes of various sizes ranging between 20 and 54 feet.
- The Inland Fisheries where ponds of all kinds are developed for the purpose of rearing fishes.



Figure 2.3. A typical fish pond with inlet/outlet to control flooding of ponds in Juabeso district (Author's photo)

Figure 2.3 is a typical pond with inlets and outlets located in the Juabeso district. The direction of the flow of water shows that the water in the pond is going down and therefore the pipe is opened for water to get into the pond to prevent it from drying up. After getting the pond filled the pipes are closed to prevent flooding.



Figure 2.4 Fish ponds located in the Aowin-Suaman district (Author's photo)

These ponds shown in Figure 2.4 are located in the Aowin-Suaman district of the Western region. Trees are planted along the ponds to provide shade however; the sun is allowed to reach the ponds to help with algae growth.

The nationwide campaign to promote aquaculture when it was recognized that it has the potential of making up the shortfalls in fish supply, was not followed up with enough support from extension delivery, adaptive research packages and finances. The shortfall of the country's fish resources were as a result of the unorthodox ways of harvesting by the local fishermen and the use of powerful trawlers in the country's territorial waters by expatriate fishermen resulting in the dwindling of our fish population. According to Daily Graphic report (29<sup>th</sup> Dec. 2009), two foreign trawlers have been arrested fishing in Ghana's Inshore Exclusive Zone (IEZ) reserved for our local fishermen and a prohibited area for industrial vessels. Fish is seen as one of the cheapest source of protein that should be readily available all the time for households. According to Asafo (1995:4), fish constitutes two-thirds of animal protein intake in

Ghana and the current national requirement is estimated at 600,000mt/year. The annual domestic production however is currently about 400,000mt/year. This made the then government in 2004 established the Ministry of Fisheries (MoF) to oversee the activities of the fishing industry in Ghana. Although being practiced on smaller scale, aquaculture was given a special attention as a way of harnessing it, most especially amongst the rural small scale farmers for the benefit of the country in general and the farmer in particular. To achieve these goals of reducing poverty by way of harnessing aquaculture would mean that, the sector should have enough staff to disseminate information on the industry to the rural farmers.

Until January 2005, the Directorate of Fisheries (DoF) was part of the Ministry of Food and Agriculture (MoFA), as one of several Directorates under the Minister of Food and Agriculture. It was part of a unified agricultural extension system. In this system, all sectors of agriculture (Crop Services, Veterinary Services, Animal Production, Plant Protection and Regulatory Services) including the Fisheries Services, were represented at the farmer contact level by a single person known as the agricultural extension agent (AEA). This AEA was expected to have the technical proficiency to direct all types of farmers on how to find solutions to their problems. Fisheries extension was very weak because training in aquaculture and fisheries was not part of the curricula of the agricultural colleges. This has resulted in the deterioration of several aquacultures related activities such as data collection and collation, site selection and supervision of pond construction (Aggrey-Fynn, 2001). As a result, Ghana's fish requirement cannot be met through its fishing activities but through imports.

### ***2.6.1 Small - scale pond construction, fish feeding and fertilizing of ponds***

According to Bardach et al (1972), the initial capital needed to build a pond has been one of the major constraints to aquaculture development. The large capital involved has prevented the industry from enjoying much of the higher profits that would otherwise be indicated by yields and operational cost. The high cost of pond construction is really a disincentive to the industry and the idea of encouraging the rural poor farmer to be engaged in aquaculture would be a mirage. Shang (1983:540), identified site selection and construction of ponds as crucial factors affecting the operating efficiency of a farm, thereby influencing initial capital investment,

operating cost and yields. In Ghana to engage in aquaculture requires a huge capital due to non availability of labour and issues on land tenure.

One of the main factors that do not encourage fish farming is that there are no feed mills that produce fish feed in the country. However it constitutes one of the most important requirements in this industry. According to Leopold (1981:8), fish feeding constitute one of the most important factors affecting production and economic results of fish farming. Feeding is considered the basic factor in terms of intensification and is used as a criterion for distinguishing between two types of culture, the intensive and extensive.

There is always the need to be wary of type of feed to be fed at every period of the fish's age as well as the quantity. Landau (1992:40) noted that, "bad food choices results in poor growth, health and reproduction. In addition, whilst under feeding results in poor growth, over feeding can cause high biological oxygen demand of pond water and diseases". Fish needs sufficient oxygen level for growth. The quantity of feed needed is less as compared to the others which means that rearing fish does not require tonnes of feed as in the case of cattle.

Lymbery (2002) noted that, many cultured fishes require no meat or fish products in their diets. Top level carnivores (e.g. salmon) depend on fish feed of which a portion is usually derived from wild caught fish. Vegetable derived proteins have successfully replaced fish meal in feeds for carnivorous fishes. Stocking water with juvenile organisms, fertilizing the water, feeding the organisms, and maintaining water quality are some of the activities that go into fish farming. Fertilizing of pond water with artificial fertilizer provides it with mixtures such as potash, phosphorus, nitrogen and other micro elements which encourage algal growth on which the fish depends. "At simple levels, in directly a photosynthetically driven system such as fertilized ponds, the aim is to stimulate productivity, harnessing normal ecosystem and nutrient transfer processes in favour of the production of desired species" (Pant et al. 2001:120). In much of current aquaculture production, yields are much lower than those attainable in well fertilized and well managed systems, in which species and biomass of production is adjusted effectively to make best use of feeding niches.

### ***2.6.2 Health hazards and controlling of health issues in aquaculture***

The main concern of aquaculture is the health of the species being cultured and also the implications of aquaculture activities for human health and wellbeing are equally important (Pillay, 1990:30). According to McLarney (2000), health hazards are greater in the tropics where there is greater prevalence of water borne diseases. Most of the disease causing organisms live in wet areas and would therefore prefer living in ponds and around them. Mosquitoes causing malaria and bilharzia causing schistosomiasis all live in water from any source, likewise pathogens such as Salmonella typhi and Shigella species causing typhoid fever and dysentery respectively in humans. There is also the risk of infection by parasites like fish lice, fungi (Saprolegnia species), intestinal worms such as nematodes or trematodes, bacteria (e.g. Yersinia species, Pseudomonas species) and protozoa (such as Dinoflagellates). Diseases of fish transmitted to humans are few and limited to some pathogenic helminthes for which fish is the intermediate host. It is very common in persons who normally eat raw fish. Important ones are tapeworms (Diphyllobothrium latum) and flukes (Clinorchis sinensis).

Lymbery (2002) noted that, because of parasite problems, some aquaculture operators frequently use strong antibiotic drugs to keep the fish alive. In some cases, these drugs have entered the environment. Additionally, the residual presence of these drugs in human food products has become controversial. Use of antibiotic in food production is thought to increase the prevalence of antibiotic resistance in human diseases.

According to Swift (1999), algal bloom may sometimes occur when temperature, nutrients supply and available sunlight are optimal for algal growth; the algae multiply their biomass exponentially, and may eventually result to an exhaustion of available nutrients and subsequently die-off. The decaying algal biomass consequently deplete the oxygen in the pond water, because it blocks out the sun and pollutes it with organic and inorganic solutes such as ammonium ions which can lead to massive loss of fish. The next topic discusses the need to control these hazards. Several recommendations have been made as to how to control health issues. According to Pillay (1990):

- Ponds must be properly constructed with adequate drainage facilities.
- Ponds should be at least 0.61 meters (2ft) deep, preferable 0.914meters (3ft).
- Animals should be prevented from grazing on embankments as their footprints are notorious breeding grounds for mosquitoes in humid tropics.
- Well stocked ponds can help control mosquito larvae and the algal vegetation that shelters them.
- Emergent and submerged vegetation should be cleared around ponds.
- Periodic drainage, drying and liming of bottom will check snail population. Where possible, stocking with snail eating fish like Haplochromis species can check the multiplication of the snail.

### ***2.6.3 Environmental impacts and sustainability***

Agricultural expansion and diversification in any form has threatened environmental sustainability and ability of ecosystems to provide critical services as well as climate change, poses major threats to agriculture in developing countries by increasing climatic variability and the risk of droughts and floods. Aquaculture production has its threats on the environment. According to Lebel et.al (2002:312) Shrimp thrives in brackish water, and large areas of mangrove forests have been destroyed to rear shrimp. In Thailand, shrimp farms have been located further upstream, adding salt to the freshwater diverted to the ponds thereby polluting the water. Salmon farming needs fishmeal to feed the salmon, which requires substantial support from ecosystems to sustain production. Aquaculture therefore has a very serious impact on the environment in terms of pollution, degradation, destruction and depletion of resources in the environment.

Ludwig et al. (1993:20) claim that situations have made it such that large scale fishing has been concentrated on few species. This has led to the species depletion and degradation and to a greater extent the depletion of an important food source. History has shown that overfishing has eroded the capacity of coastal areas to maintain viable fish populations at higher trophic levels and assimilate waste (Jackson et al. 2001:630). This capacity is now further challenged by modern aquaculture's continued growth and impact on coastal environments.

## CHAPTER THREE

### THE PROFILE OF THE REGION OF STUDY (WESTERN REGION) AND METHODOLOGY

#### 3.1 Introduction

Western Region has been blessed with a lot of resources such as rich land for agriculture, minerals of all kinds and recently oil and gas. It means that the region is very important to the country's economic development. The region's profile would therefore attempt to describe its location, climate, vegetation, social and demographic characteristics, age- sex distributions and economic characteristics among others.

#### 3.2 Physical characteristics of Western Region

The Region of study has peculiar climatic conditions as compared to all the other regions in the country and would be described in the ensuing topics.

##### 3.2.1. Location of Western Region

The region covers an area of approximately 2,391 square kilometers, which is about 10 percent of Ghana's total land area. It is located in the south-western part of Ghana, bordered by Cote d'Ivoire to the west, Central Region to the east, Ashanti and Brong Ahafo Regions to the north and to the south by 192 km stretch of coastline of the Atlantic Ocean (GSS 2000).

##### 3.2.2 Climate / Vegetation

The region lies in the Equatorial climate zone that is characterized by moderate temperatures ranging from 22°C at night fall to 34°C during the day. The average rainfall is about 1600 mm per annum (GSS 2000). The high rainfall creates high moisture culminating in high relative humidity, ranging from 70 percent to 90 percent in most parts of the region and can therefore support all year round agriculture activities. The average annual rainfall of 1600mm and the high relative humidity really favours fishing activities mostly aquaculture production as the waters never dry up.

The region has about 75% of its vegetation within the high forest zone of Ghana. It has about 24 forest reserves and parks which account for about 40% of the forest reserves in the country. Prominent amongst them are the Bia Reserve, Cape Three

points National park and the Ankasa/ Nini Suhyiem Forest and Game Reserve (GSS 2000). These forests contain tall trees with wide stumps that make pond digging very difficult as one has to remove these stumps when developing the ponds.

### **3.3. Social and Demographic Characteristics of the Region**

Western Region is among the regions where male population exceeds that of the female the reason being that the males travel from far and near to cultivate and make use of the Region's fertile lands. They also engage in "galamsey" operations which is mostly undertaken by the male population. Detailed description of the demographic characteristics would be done in the following topics.

#### **3.3.1 Population of the Region**

The population of the region is 1,924,577, constituting about 10% of the total population of the country as at 2000 (GSS 2000). With a population growth rate of 3.2%, the region's population is expected to double by the year 2030. The population is relatively young with over 40 percent within the age group 0 to 14. Females constitute about 49.2 percent of the population. The proportion of urban population is 36.3 percent and that of rural is 63.7 percent (GSS 2000). This means that most of the population is living in rural settlements and that most of the developmental programmes should be geared towards those areas. This can result in the situation where the youth would remain in their communities and contribute to agriculture development in general and aquaculture in particular by way of providing labour and taking over farming from the aged.

Statistics in Figure 3.1 shows that the Western Region has a higher population growth and is the fourth highest apart from Greater Accra, Ashanti and Eastern regions. Another contributory factor which has created pressure on rural farmlands in the Western Region was the comparatively high intercensal growth rate of 2.1 in 1960 to 3.2 in 2000 as shown in Table 3.1. The population density of 48.4 in 1984 increased to 80.5 by 2000.

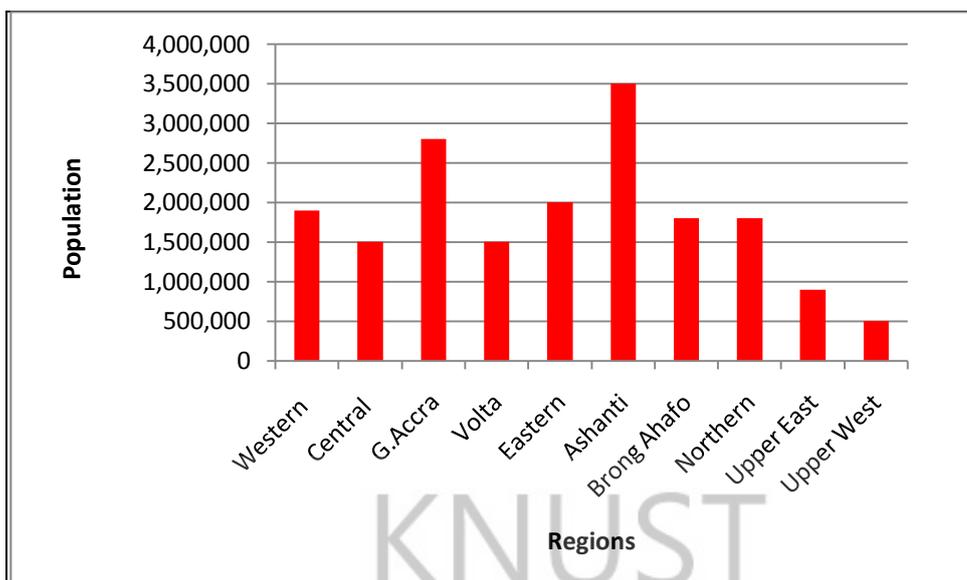


Figure: 3.1 Total Regional Population Distributions (GSS 2000)

Table 3.1 Population characteristics of the Western Region

Population Growth Indicators				Population Density	
Year	Population	Rate of Increase	Intercensal Growth Rate	Population Density (Sq. Km)	Rate of Increase
1960	626155	NA	NA	26.2	NA
1970	770087	23	2.1	32.2	23.1
1984	1157807	50.3	3.0	48.4	50.0
2000	1924577	66.2	3.2	80.5	67.7

Source: GSS, 1960, 1970, 1984 and 2000

As shown in Table 3.1, Western Region is predominantly rural as the total rural population stands at 1,226,159 and urban population was 698,418 by the year 2005. This provides some indication of higher concentration of poverty in the region. Poverty is very prevalent in the Western Region of Ghana most especially in the rural areas among the rural farmers, (although, the area seems to have abundant resources such as minerals, land, and forest).

### 3.3.2 Age- Sex Distributions of Western Region

It is observed that with a few exceptions in age 0 to 4, all the districts depict the same pattern of reducing population as age increases. The population distribution of all the

districts for both males and females follows similar patterns. The region has high population growth rate of 3.2% leading to rapid population increase. Generally, for all districts, as age increases population for both sexes decreases. Under the broad age groups of children (0- 14), working force (15- 64) and aged (65+), each district shows a different characteristic (GSS 2000). The age distribution shows that most of them fall within the youthful bracket that would need jobs in the near future and therefore the need to pay special attention to agriculture in general and aquaculture in particular as a source of employment. There is the need to encourage the youth to go into aquaculture, as this can generate employment for them. This can holistically reduce the situation where the youth are drifted to the urban centres to look for non existing jobs.

### 3.3.3 Ethnicity and Religion of Western Region

Major ethnic groups are the Ahantas, Nzemas, Wassas, Sefwis, Aowins and Fantes. There is freedom of religion. From Figure 3.2, Christianity and Islam are the two main religions with 81% and 8.5% shares respectively. About 1.5% is into Traditional African Religion, while 8.2% of the population does not follow any religion. Religion and ethnicity play an important role when it comes to agriculture. For instance a Moslem would never go into piggery just as some tribes from the north (e.g .Dagarties) would never go into snail farming, but with aquaculture, it is never so.

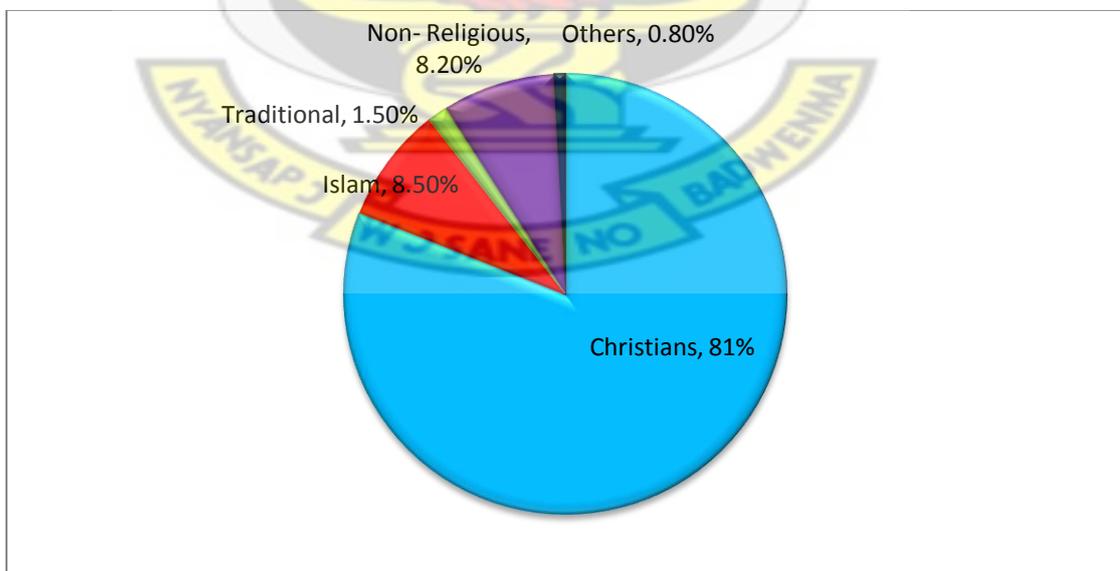


Figure 3.2: The state of Religion in the study area (GSS 2000)

### ***3.3.4 Literacy Levels of the Region***

According to the GSS (2000), the level of literacy in the region is 58.2 percent. Females form about 47.9 percent with males forming about 52.1 percent. Nearly two-thirds of those currently in school (who form 64.3%) are in the primary level whilst 21.3 percent are in the Junior Secondary School. There is more to be done with education in the region since higher levels of illiteracy does not help with development. It has been proven that people who are literate are more productive when they go into agriculture than those who are not.

### ***3.3.5 Households in the Region***

According to Ghana Statistical Service (2000), there are 410,412 households in the region, with an average of 1.6 households per house. Of these, 72 percent are headed by males as against 28 percent headed by females. The number of persons per household is 4.7 as compared to the national average of 5. In most cases, farming activities are labour intensive and would therefore require more hands. The average number of persons per household of 4.7 is therefore of special significance to agricultural development in the region as family members can work together on their farms.

## **3.4 Economic characteristics**

The region is endowed with considerable natural resources. These include rich tropical forest, wide varieties of minerals such as gold, bauxite, iron, diamonds, manganese, and the recent discovery of oil and gas. Most of these minerals are being exploited and is creating jobs for the people, however with its accompanying land degradation. Lands that were seen as marginal lands are now being used to cultivate inland valley rice, oil palm and aquaculture; the reason why main occupation in the region is agriculture which employs about 53.1% of the population. The industrial sector employs about 14.5% and the services sector 15% (GSS, 2000).

## **3.5. Profile of the districts**

The three districts of study include, Juabeso, Aowin- Suaman and Bia with their capitals as Juabeso, Enchi and Essam respectively.

## 3.6. Juabeso and Bia Districts

### 3.6.1 Location

Until recently, Juabeso and Bia, were under one administration. In 2004, Bia was carved out of the Juabeso- Bia District as shown in Figure 1.1. It is bordered on the north by Bia District, Sefwi Wiawso and Asunafo Districts to the east, Aowin - Suaman District to the south and to the West by La Cote D' Ivoire. It covers a surface area of 4,496 square kilometers that is, both Juabeso and Bia Districts (GSS, 2000).

### 3.6.2. Climate

The Districts lie within the semi-equatorial climatic zone characterized by double maxima rainfall with mean annual rainfall of 1250-2000mm. the vegetation cover is made up of the semi- deciduous forest type (GSS 2000). The environment is very good for agriculture and supports tree and root crops as well as aquaculture.

### 3.6.3 Population

The population growth rate is about 3.7 percent, which is higher than that of the national average of 3.0 percent. The district is basically rural in nature with about 79.6 percent of the population living in rural settlements. Juabeso, in spite of being the capital is largely rural and has not grown appreciably in size for the past 20 years (GSS, 2000). Other communities of importance include Bodi, Amoaya, Kwasiakrom, Asempanaye, Ahibenso and Bonsu Nkwanta. In 1970, Juabeso community had a population of 1,132, which increased to 1,199 in 1984 and further to 3,639 in year 2000 (GSS 2000) as shown in Table 3.2.

Table 3.2: Population Growth of the Study Communities

Year \ Community	1970	1984	2000	Total
Juabeso	1132	1199	3639	5 970
Enchi	4382	6010	9270	19 662
Essam	1102	1898	5019	8 019
Total	6616	9107	17928	33 651

Source: Ghana Statistical Service, 2000.

About 13.8% of the population in Juabeso- Bia are migrants from Brong Ahafo, with which the district shares a common boundary. Juabeso- Bia district had a total population of 245,035 (GSS 2000).

Bia district shares borders with Dormaa Municipal in the North, Asunafo North Municipal to the East (all in Brong Ahafo Region), Juabeso District to the South Eastern border and La Cote d'Ivoire to the West. It has its capital as Essam. According to Ghana Statistical Service (2000) Essam had a population of 1,102 in 1970, increased to 1,898 in 1984 and in 2000 reached 5,019 as shown in Table 3.2. Other communities of importance so far as aquaculture are concerned included Debiso, Oseikojokrom, Fosukrom, Ellioukrom Adabokrom and Kaase.

### **3.7 Economic Activities in Juabeso and Bia districts**

Agriculture being the dominant occupation in the district employs about 58 percent of the population (GSS 2000). Tree crop farming such as cocoa, coffee, oil palm and black pepper are the main crops. Food crops cultivated included cassava, cocoyam, plantain and yam. The availability of marginal lands has encouraged the engagement of farmers in aquaculture. The dominant farming system is the subsistence farming where simple tools, such as cutlass, hoe, mattock, axe, etc, are used. Few of the farmers raise livestock such as cattle, sheep, goats, pigs, rabbitry, and poultry (such as fowls and ducks). Juabeso has attracted migrant farmers because of their rich soils suitable for agriculture the reason why the population has been increasing in the district.

### **3.8 Aowin- Suaman District**

Aowin- Suaman is the most sparsely settled district in the Region, with a density of 38.5 persons per square kilometre with most of their localities being rural and not easily accessible. The dependency ratio which is the ratio of persons less than 15 years of age plus persons aged 65 and older to adults aged 15–64 years for the districts is very high. The regional average is 88.3. This means that every adult person in the productive age group has to support at least one dependent (GSS, 2000).

#### **3.8.1 Location**

According to GSS (2000) the district lies in the Mid-Western part of the Western Region of Ghana and exactly between latitude five degrees (5°) twenty–five minutes

(25) and six degrees (6°) fourteen minutes (□14) North and longitude two degrees (2°) thirty minutes (30) and three degrees (3°) five minutes (5) West. It shares boundaries to the north with Juabeso, to the south with Jomoro District, to the east with Wassa Amenfi and to the west with the Republic of La Cote D'Ivoire. The total area of the district is 2,717 square kilometers, which constitutes about 12 percent of the region's area of 23,921 square kilometers.

### ***3.8.2 Population***

The district has a population of about 119,113 (GSS 2000). Enchi is the district capital with other settlements being Dadieso, Boinso, New Yakasi, Jema and Asemkrom. Enchi community had a population of 4,382 in 1970 increased to 6,010 in 1984 and reached 9,270 in 2000 as shown in Table 3.2. The population increase is due to migration of tenant farmers due to rich nature of the land for farming.

### ***3.8.3 Literacy levels of Aowin- Suaman district***

The district is seen as one with the highest levels of illiteracy (about 57.7%) (GSS, 2000). The population distribution is influenced by factors such as vegetation, type of economic activity, infrastructure and cultural, political and administrative policies. The district has vast marginal land for aquaculture development and the reason why about 467 persons of her population are engaged in aquaculture. The three study districts have the potential of producing enough fish to feed the region. This is because the area has all what it takes to engage in aquaculture. The ensuing section tries to delve into the procedure for preliminary selection of the Districts.

## **3.9 Preliminary Selection of the districts**

Inadequate resources could not permit total coverage of the whole region for the research. Therefore, there was the need to choose few districts where aquaculture activities were very high.

### ***3.9.1 Introduction***

This work utilized secondary data sources and included those from the Ministry of Food and Agriculture directorate and other institutions, relevant textbooks, journals, newsletters, publications, technical reports, periodicals and websites/ internet. Having identified the Western Region as the focus of the study, the next stage was to identify the areas with the highest concentration of fish farming activities. Preliminary investigation with officials of MOFA, leaders of FBOs, opinion leaders, narrowed the

focus of the research to the north-western part of the region where most of the ponds were located. There were in all, seven districts (The region is made up of 17 districts) that form the north western portion of the region.

Further literature indicated that out of the seven districts, five districts had the highest number of farmers who were mostly engaged in aquaculture. The districts included Bia, Juabeso, Sefwi Wiawso, Bibiani- Anhwiaso- Bekwai, Aowin- Suaman; the study was therefore limited to these five areas shown in Figure 1.1. These districts are located in the North Western portion of the Western Region and share boundary with La Cote D' Ivoire.

### ***3.9.2 Preliminary Field Investigation***

A field investigation and reconnaissance tour was conducted to identify the difficulties to be anticipated, size and the rough estimate of cost for the study as small budget does not permit costly surveys, and to establish some rapport for future interviews and surveys. This was achieved through informal talks with respondents, Chiefs of the communities, heads of Department of MOFA, leaders of Farmer Based Organizations and NGOs working in the area. Opportunities were also taken for wayside stops and discussions to get familiarize with the physical conditions of the area and farming activities that go on there. The investigation has proved that the North Western portion is blessed with large tracts of marginal lands that are good for aquaculture development. These marginal lands are lands that were marshy and waterlogged and could not be used for many crop cultivation.

### ***3.9.3 Selection of the Districts and Communities***

Three districts were randomly selected and included Juabeso, Aowin- Suaman and Bia. The objective was to keep the cost of the survey low without seriously affecting the validity of the results. The next challenge was to identify individual communities within the sub-region who were mostly engaged in aquaculture. According to data from MOFA, as at 2006, about 1,000 farmers were into aquaculture in those three districts. The number is huge and it is still believed it would increase. Therefore there was the need to look into what goes into aquaculture in these districts.

From Table 3.3, about 45.7 percent of fish farmers were in Juabeso and constituted the largest number of farmers in the district. This is because the district has large land

size for aquaculture development. Fish products were also imported into the district from other areas and farmers had to take advantage to produce locally and supply in order to make money.

From Table 3.3, the district capital of Aowin–Suaman, Enchi, had 47.1% of the total number of fish farmers in the district. The district is blessed with lands suitable for aquaculture and as all available lands have been cultivated and planted with cocoa and other crops, farmers decided to go into aquaculture. The intention is to make an extra income. Essam- Debiso, the capital for Bia had 50.6 percent of farmers engaged in aquaculture.

Community each with the highest number of farmers was chosen from each district.

- Juabeso District: Juabeso community had 200 farmers
- Aowin – Suaman: District: Enchi community had 220 farmers
- Bia District: Essam had 180 farmers

Table 3.3: Number of Fish Farmers in study area

Communities in Juabeso District	No. of Farmers	%	Communities in Aowin-Suaman	No. of Farmers	%	Communities in Bia District	No. of Farmers	%
Juabeso	200	45.7	Enchi	220	47.1	Essam	180	50.6
Bodi	87	19.9	Dadieso	102	21.8	Debiso	80	22.5
Amoaya	60	13.7	Boinso	67	14.3	Adabokrom	40	11.2
Kwasikrom	44	10.0	New Yakasi	50	10.7	Oseikojokrom	30	8.4
Asempanaye	30	6.8	Jema	20	4.3	Fosukrom	12	3.4
Ahibenso	12	2.7	Asemkrom	8	1.7	Ellioukrom	9	2.5
Bonsu-Nkwanta	5	1.14	-	-	-	Kaase	5	1.4
Total	438	100	Total	467	100	Total	356	100

SOURCE: MOFA 2006 Annual Report

### 3.9.4 Selection of Respondents

Reconnaissance contacts with the Agricultural Extension Officers (AEOs) gave a general idea of existence of about 1,200 farmers, most of who were known to reside in the rural communities in the study districts. The total numbers of fish farmers were

estimated at 200 for Juabeso community, 220 for Enchi community, and 180 for Essam community. Since they were all farmers, they were considered as a homogeneous group. According to Minerva (1994), a sample size of 10% of the total population can be considered as representativeness of the total number of target populations. This gives a sample size of 60 farmers being interviewed during the data collection exercise. Proportional division of 60 farmers amongst the three districts resulted to 22, 20 and 18 respondents being interviewed in Enchi, Juabeso and Essam communities respectively.

### ***3.9.5 Detailed Sample Selection***

Respondents were tagged with numbers on the list of farmers engaged in aquaculture obtained from MOFA's Farmers Registration Forms and a systematic random sampling method was applied to select the respondents. Every other tenth farmer on the list was selected for the study. That is, as the tenth farmer was picked, the next farmer selected was the twentieth farmer on the list; the next was the thirtieth and it followed in that order. The technique made it possible to include all categories of farmers.

### ***3.9.6. Data collection Techniques***

The primary data was collected through the administration of questionnaires and interviews with the farmers and other actors and institutions. Interviews were administered in the communities where the farmers were located. Informal discussion in smaller groups and observation also complemented the gathered data. To collect other qualitative and quantitative data, semi-structured interviews were carried out with MOFA staff, Fishmongers, FBOs.

Data collected included:

- the production activities;
- quantum of harvest within a season (i.e. two seasons per year);
- whether there was ready market for their catches;
- amount of money they received for a season; and
- Benefits and inputs they received from other sources.

All the three District Agricultural Directors were given questionnaire that enabled the extraction of more information, such as:

- The list of fish farmers;
- The number of staff with aquaculture background;
- The role of the AEA in terms of aquaculture production; and
- The techniques they are to disseminate to farmers and list of other important information.

The three AEAs in those communities were also given questionnaire to fill for the study. A list of FBOs was also taken from the offices of Ministry of Food and Agriculture and three executives of FBOs from each of the selected communities was randomly picked and interviewed. There were visits to the markets of the various communities on their market days where the fish mongers/ traders and processors who were willing to participate were interviewed till the number required for each district was attained (five traders for each market). However, efforts were made to balance selection according to sizes of markets, since they were all gathered around the same area.

In general, questions were of two types: pre-coded in which a number of alternatives were presented and open-ended in which no choices were offered and the respondent's response was noted in its own terms. It was observed that the pre-coded questions were easy to collate because the information was restricted and channeled whilst open-ended questions were difficult to collate but permitted access to more information. About eight weeks was used for the data collection and this was done in November and December 2009. A pre-test of the question was done in Bonsu Nkwanta, one of the communities in Juabeso district with conditions similar to those in the survey area. This actually paved way to ascertain people's responses to the style and content of the questions which led to identify those which were misleading. The misleading questions were consequently rectified or avoided.

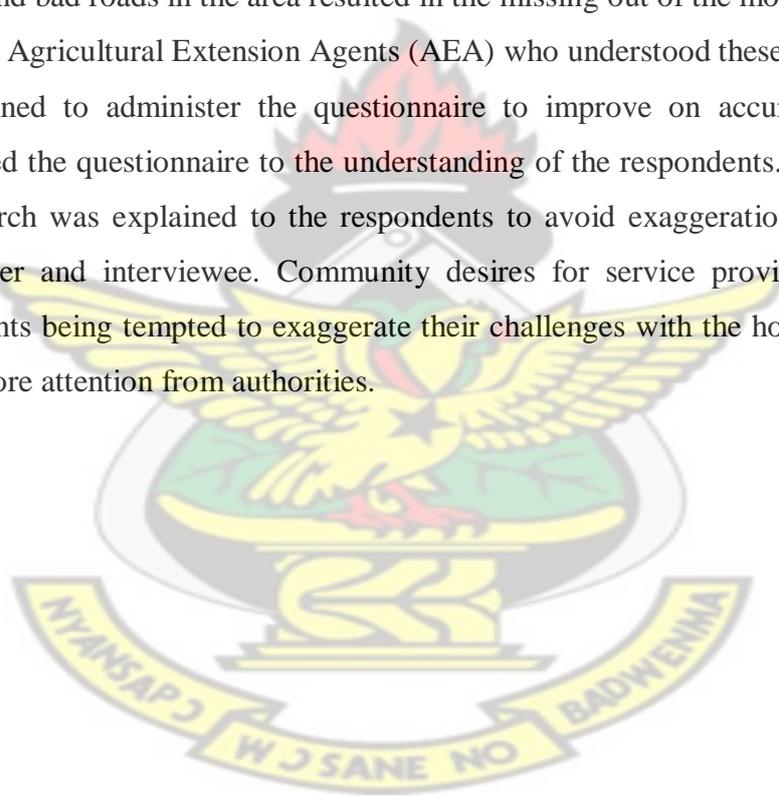
### ***3.9.7. Analyses of the Data***

The processing and analyses of the data took the form of statistical methods where the results were tabulated. From this, a series of brief conclusions were drawn and explicitly related to the survey findings. Percentages of the various livelihood

variables, production activities, for the categories and various strategies were analyzed. On this basis, logical recommendations were made for the farmers in the selected districts. In all, eighty- one respondents were interviewed in that same year.

### ***3.9.8 Limitations of the Study***

The main limitation of the study was the language barrier of most of the people which did not permit easy interaction during the administration of questionnaire. Their common dialect they frequently spoke were Sefwi and Bulsa, although few of them could speak some little Twi. The high rate of illiteracy also made the interpretation of the questionnaire a little bit difficult. Information “get lost” between interviewer and interviewee because interpreters would have to be used. Travel limitations as a result of poor and bad roads in the area resulted in the missing out of the more remote areas. The local Agricultural Extension Agents (AEA) who understood these local languages were trained to administer the questionnaire to improve on accuracy. They also interpreted the questionnaire to the understanding of the respondents. The purpose of the research was explained to the respondents to avoid exaggeration from both the interviewer and interviewee. Community desires for service provision resulted in respondents being tempted to exaggerate their challenges with the hope that it would attract more attention from authorities.



## CHAPTER FOUR

### RESULTS AND DISCUSSION

#### 4.1 Introduction

The main variables that were analyzed included age and sex group of farmers, their religious and educational background. Other variables included operations of aquaculture including pond construction, management, harvesting and marketing location of ponds, pond sizes, year of establishing ponds, types of fish reared, land acquisition and techniques being practiced by farmers. Quantum of their harvest, benefits, and job creation through aquaculture were analyzed. Finally, the challenges and constraints facing the industry in the selected districts were assessed so as to inform stakeholders and make recommendations that would facilitate improvement in the sector.

#### 4.2 Age and sex groups engaged in aquaculture

With reference to Table 4.1, the survey showed that 58.3 percent of the respondents in the study areas were within the productive age of 30-59 and only 13.3 percent were above sixty years. Respondents below 29 years formed 28.3 percent. This shows that the industry has a future as the youth are getting more involved and therefore a special attention should be placed on its development.

Table 4.1: Age Group of farmers in selected communities

District	Community	Age Groups in Aquaculture.			Total
		15-29	30-59	60+	
Juabeso	Juabeso	5	13	2	20
Aowin Suaman	Enchi	7	12	3	22
Bia	Essam	5	10	3	18
Frequency	-	17	35	8	60
Percentage	-	28.3	58.3	13.3	100

Source: Field Survey, 2010

There is the need to find out the role gender plays in terms of aquaculture development. With reference to Table 4.2, the research found out that 91.7 percent of the respondents involved were males as against 8.3 percent females. Females who indulge in aquaculture were given names such as “iron lady”, “man–woman”, “alomo

gyata”. Besides, most family lands are in the hands of the males and that they control its uses. The farmers perceived the industry as a preserve for men and that the females were for the sales of the catches, the reason why only 8.3 percent females were into aquaculture. From Table 4.2, Enchi had the highest number of females in aquaculture (80%), Essam had 20% whilst Juabeso had no female farmer at all. Although the females were few, ponds that belonged to them were found out to be well kept with proper husbandry practices than most of the men. The weeds around the ponds had been cleared, their waters looked clean and greenish, which indicates that waters, had been fertilized. Gender and religion play special roles in the Ghanaian society and has influence on their socio- economic activities.

Table4.2: Sex groups of respondents engaged in aquaculture

Sex Group	Male	Female	Total
Community			
Juabeso	20	nil	20
Enchi	18	4	22
Essam	17	1	18
Frequency	55	5	60
Percentage	91.7	8.3	100

Source: Field Survey, 2010

### 4.3 The influence of Religion on aquaculture

There is therefore the need to find out the role and influence that religion plays in terms of those activities as in some countries religion does not permit one to go into certain farm activities, for example Islam and piggery production.

Table 4.3 showed that religion had no serious influence on the industry as compared to other industries such as piggery and Islam. From Table 4.3, Christians who were engaged in aquaculture were found to be in majority in all the three communities (about 67%).

Table 4.3: Religion and Aquaculture

Religion Community	Christians	Muslims	Traditional	Others	Total
Juabeso	10	4	5	1	20
Enchi	15	3	2	2	22
Essam	15	3	nil	nil	18
Frequency	40	10	7	3	60
Percentage	66.6	16.7	11.7	5	100

Source: Field Survey, 2010

It is presumed to be a reflection on the general situation of religion in the country where Christians are in the majority. Aquaculture can therefore be encouraged in all parts of the Western Region, including other Muslim inhabited areas without any hindrance as 16.7 percent of the respondents were Muslims. The levels of education of respondents were analyzed to find out whether it has any influence on aquaculture.

#### 4.4 Educational levels of Respondents

From Table 4.4, respondents with elementary education were 25 percent; those with JHS were 33.3 percent and those with SHS and above were 30 percent. In all, 88 percent of the respondents had a form of education. The fact that respondents could read and write means they could make use of printed materials on aquaculture. Printing materials could be made available for them since this could enhance and broaden their scope in the area of aquaculture.

Table 4.4: Educational levels of Respondents

Educational Level Community	Elementary	JHS/ Middle	SHS / Above	Others or Illiterates	Total
Juabeso	3	9	4	4	20
Enchi	9	5	6	2	22
Essam	3	6	8	1	18
Frequency	15	20	18	7	60
Percentage	25	33.3	30	11.7	100

Source: Field Survey, 2010.

The research showed that, most of the farmers who were illiterates had higher number of households whilst those with higher education had smaller household sizes. The

reasons could be that those with higher education were aware of family planning issues and have also adopted the core family systems other than the extended family systems.

Table 4.5: Household sizes of respondents

Household Community Sizes	Size < 2	Size < 5	Size < 8	Total
Juabeso	3	15	2	20
Enchi	7	11	4	22
Essam	3	14	1	18
Frequency	13	40	7	60
Percentage	21.7	66.7	11.6	100

Source: Field Survey, 2010

From Table 4.5, about 66.7 percent of those interviewed had household sizes of between 3 and 5 which are closer to that of the nation's average figure of 4.7 whilst those with household sizes of above six were about 11.6 percent. Larger household sizes would mean that there would be competition for land. Family members would be scrambling for land at everywhere that family lands are available. Larger family sizes could also provide adequate labour for their farming activities. The next topic would seek to look at pond locations and reasons why they are closer to or far from their settlements.

#### 4.5 Location of ponds and pond sizes

It is obvious that respondents would visit ponds that are closer to their settlements more often than those that are far from their settlements. The higher the frequency of visits the more the ponds could be attended to. About thirty-nine forming 65 percent of respondents had their ponds situated above 10 minutes walk from their communities. Just about two of the respondents had their ponds close to their communities and only nine of them could not indicate the distances as seen in Table 4.6. This may be due to the fact that in most cases, marginal lands are used for aquaculture and farmers would move to wherever these lands are found and site their ponds. It is the location of these marginal lands that determine the location of these farms and their sizes would either be determined by the size of the plots available.

Table 4.6: Distances of Ponds from communities

Distances Of Ponds / Community	< 5 Minutes Walk	<10 Minutes Walk	>10 Minutes Walk	Don't Know Distance	Total
Juabeso	nil	4	9	7	20
Enchi	2	3	17	nil	22
Essam	nil	3	13	2	18
Frequency	2	10	39	9	60
Percentage	3.3	16.7	65	15	100

**Source:** Field Survey, 2010.

Table 4.7: Pond sizes

Pond Sizes / Community	10 X 20ft	20 X 40ft	>20 X40ft	Round Sizes	Unknown Sizes	Total
Juabeso	8	2	1	5	4	20
Enchi	12	8	2	nil	nil	22
Essam	8	2	1	3	4	18
Frequency	28	12	4	8	8	60
Percentage	46.6	20	6.7	13.3	13.3	100

**Source:** Field Survey, 2010.

Large ponds are normally for commercial purposes whilst smaller ponds are for subsistence. Larger ponds are likely to produce more fishes than smaller ones as larger ponds can contain more fishes. Although some of the respondents did not know the sizes of their ponds, about 47 percent of them had pond sizes of about 10ft by 20ft and were for subsistence purposes. Respondents were compelled to go by these sizes because of the sizes of the marginal lands available. From Table 4.7, about 7 percent of the respondents in Enchi had large ponds sizes of above 20 by 40 that are purposely meant for commerce. The next topic would look at the number of years that people have engaged in fish farming and try to examine the types of fish reared and reasons for such fishes.

#### **4.6 Year of establishment of ponds and types of fishes reared**

From Table 4.8, there were only three of the respondents engaged in aquaculture in Enchi since 1997. By 2000, the industry has expanded throughout the region and 13.3 percent of the respondents were already engaged in aquaculture. By 2002, 30 percent of respondents have gone into aquaculture. This was due to the fact that a lot of information had gone round for farmers to go into aquaculture. As at 2002, 30 percent

of respondents had ventured in aquaculture and all of them, were for commercial purposes. The number of farmers in Enchi increased from three in 1997 to nine in 2002. However, due to lack of information on correct husbandry practices and infrequent visits by AEAs, the number dwindled. Juabeso, as at 2000 had two of the respondents engaged in aquaculture but increased to nine as at 2003. Essam and its catchment area rather had two of the respondents as at 2000 but went up to seven as at 2001. This could be attributed to the fact that those who have already started were achieving success.

Table 4.8: Year of establishment of ponds

Community \ Year	1997	2000	2001	2002	2003	Total
Juabeso	nil	2	4	5	9	20
Enchi	3	4	5	9	1	22
Essam	nil	2	7	4	5	18
Frequency	3	8	16	18	15	60
Percentage	5	13.3	26.7	30	25	100

**Source:** Field Survey, 2010

All the respondents had stocks of mudfish, tilapia, redfish or mudfish and tilapia combine. These were the available fingerlings on the market and the most easily accessible one was Tilapia. About 66.7 percent were rearing tilapia as seen in Table 4.9. Essam had the highest percentage of respondents rearing tilapia (94%) followed by Enchi (54.5%) and then Juabeso (55%). These were the species available. Hundred percent (100%) of the respondents had their supplies from other farmers and that they got their feed supplies from the open market and do not even know any feed producer in the districts. Types of feed given to the fishes included corn chaff, wheat brand, green leaves such as “kontomire” and taro leaves. Lack of feed producers in the study area retards their activities and do not permit them to expand as they find it difficult to feed the fishes

Table 4.9: Types of fish reared

Types of Fish Community	Mudfish	%	Tilapia	%	Red fish	%	Mudfish/ Tilapia	%	Total
Juabeso	2	10	11	55	1	5	6	30	20
Enchi	7	31.8	12	54.5	2	0.09	1	4.5	22
Essam	1	5.6	17	94	nil	0	nil	0	18
Percentage	16.7		66.7		8.3		8.3		100

Source: Field Survey, 2010.

#### 4.7 Land acquisition and pond construction

In the Western Region, traditionally, land is recorded as a property for a group or communal ancestors to be used by the present generation and pass it on to the next generation. One has to be a member of that kinship and individuals are suppose to inherit rights over such land on the bases of kinship, that is membership of the community without prejudice to communal ownerships. This system of land ownership in our part of the world makes land very scarce commodity and consequently a disincentive to our development. Individuals who may not belong to such kinship enter into tenancy agreement either by hiring the land for a period, share cropping after harvesting or outright purchase.

From Table 4.10, 75 percent of respondents around Juabeso had their ponds on family lands since many of respondents were natives of the area, whilst 10 percent hired land and 15 percent did outright purchase. Respondents in Enchi had their ponds on lands they purchased, 36.4 percent had ponds on family lands and only 4.5 percent have ponds on hired lands. Thirty-nine percent of respondents from Essam had ponds on family lands another 38.9 percent hired land for the ponds whilst 22.2 percent purchased land for their ponds.

Table 4.10: Land acquisition

Land Acquisition Communities	Family Links	%	Hiring	%	Purchase	%	Total
Juabeso	15	75	2	10	3	15	20
Enchi	8	36.4	1	4.5	13	59	22
Essam	7	38.9	7	38.9	4	22.2	18
Frequency	30	nil	10	nil	20	nil	60
Percentage	50	nil	16.7	nil	33.3	nil	100

Source: Field Survey, 2010

After acquiring the land the respondents would need to develop it and apply methods to harness the industry. Lack of labour in the study districts is a big hindrance to agriculture development. This has resulted in the rise of cost of labour. However, from Table 4.11, 90 percent of the respondents interviewed hired labour to dig their ponds although very costly. About 3.3 percent used personal labour and about 7 percent used the “nnoboa” system. The “nnoboa” system is a situation where group of farmers come together to dig for one farmer at a time. It is common in Juabeso and Essam but uncommon in Enchi. This may be due to the fact that most of the respondents in Enchi were tenant farmers. Much of the respondents’ expenses go into hiring of labour and because of this they make less profit.

Table 4.11: Pond construction

Type Of Labour	Personal Labour	%	Hired Labour	%	“Nnoboa”	%	Total
Community							
Juabeso	nil	nil	18	90	2	10	20
Enchi	nil	nil	22	100	nil	nil	22
Essam	2	9.0	14	77.8	2	11.1	18
Frequency	2	3.33	54	90	4	6.67	60
Percentage	3.33		90		6.67		100

Source: Field Survey, 2010.

Issues of land, labour, and finance are some of the challenges that farmers face and the next section tries to delve into some of these challenges and come out with solutions.

#### 4.8. Modern techniques employed by respondents

Modern techniques employed in farming increases production and therefore influence the farmer's income because when production improves incomes also improve. Modern techniques bring about efficiency, diligence, and innovations to the farmer. All the respondents apply manure as fertilizer in the ponds. From Table 4.12, 50 percent employ timely harvesting whilst 31.7 apply correct husbandry practices such as clearing of weeds, protecting the edges of ponds. The respondents had heard of liming of ponds and treatment of the fishes at certain point in time but have never practiced it before and have never seen it being done. Seventy-five percent of the respondents had information on these techniques through other colleague farmers and only 15 percent heard the techniques from AEAs. Seventy- five percent of them saw AEAs visiting them but the visits are not regular whilst 25 percent received regular visits from the AEAs. Techniques like liming of ponds, proper stocking, and fish treatment were news to them as none of the respondents had ever heard of them before and so it is never practiced on their farms. In the developed countries fishes are given antibiotics when found out to be sick. The next section tries to analyze some of these challenges.

Table 4.12: Improved techniques employed by respondents

Communities Techniques	Juabeso	%	Enchi	%	Essam	%	Frequency	%
Fertilization	20	100	22	100	18	100	60	100
Correct Husbandry	3	15	12	54.5	4	22.2	19	31.7
Timely Harvesting	8	40	15	68.1	7	38.9	30	50

SOURCE: Field Survey, 2010.

#### 4.9. Challenges and constraints that Respondents encounter

All the respondents encounter some challenges and constraints that tend to hinder their activities. From the field studies (Table 4.13), the most pressing challenges were invasion of predators, invasion of thieves who steal the produce, flooding of ponds after heavy rains and difficulties with land acquisition. The other constraints were lack of labour, difficulty in treating fish when they begin to die, lack of fingerlings and lack of inputs (such as nets, feed). All the sixty respondents expressed their

displeasure. The next most pressing issues were lack of AEAs with the technical knowhow on aquaculture. In all, 94 percent of the respondents faced these challenges. 50 percent of the respondents saw some of their challenges as invasion of thieves and issues of land acquisition. Respondents would have wished to increase their ponds but difficulties in land acquisition due to litigations hampered their efforts. About 20 percent of the respondents found it difficult to acquire fingerlings to stock their ponds and 80 percent of respondents had their ponds getting flooded every year and they lose all their fishes. These were serious challenges and constraints that were militating against their work and therefore needed immediate attention. Although, the respondents faced these challenges they receive benefits such as improved nutrition and income, the reason why they were still in business. The next topic tries to find out the sort of benefits the respondents receive.

Table 4. 13: Challenges those respondents encounter

Communities	Juabeso	Enchi	Essam	Frequency	%
Lack of labour	20	22	18	60	100
Land acquisition	5	14	11	30	50
Lack of fishing nets	18	20	17	55	93.6
Lack of feed	20	20	15	55	93.6
Flooding of Ponds	3	nil	2	5	8.3
Lack of AEAs with aquaculture background	20	22	13	55	93.6
Invasion of Predators	20	22	18	60	100
Difficulty in treating fish	20	22	18	60	100
Difficulty in acquiring fingerlings	5	nil	5	10	19.9
Invasion of thieves	14	6	10	30	50

Source: Field Survey, 2010.

#### 4.10 Benefits accruing from aquaculture

The main reason why farmers engaged in aquaculture was to earn extra income to improve their living standards and also to improve their diets. From Table 5.14, all the sixty respondents agreed that their diets had improved tremendously. Anytime they harvested for sale they made sure they reserved some for the family use and that it saved them a lot of money.

Table 4.14: Benefits accruing from aquaculture

Communities \ Benefits	Improved Diets	Pay Sch. Fees	Purchase Household Items	Frequency
Juabeso	20	2	4	26
Enchi	22	10	10	42
Essam	18	3	1	22
Total	60	15	15	90
Percentage	100	25	25	150

Source: Field Survey, 2010.

25 percent of them were able to pay their children's school fees and another 25 percent were able to purchase household items (such as television, fridge, and gas cookers) for their use. The next section is to evaluate the quantum of harvest within a season.

#### 4.11 Quantum of harvest within a season

Although the respondents found it difficult to harvest, when they did it benefited them a lot. From Table 4.15, 25 percent used fishing nets and the remaining seventy-five drained the water from the ponds and then harvest. About 8 percent of the respondents were able to harvest about seven pan loads and a pan load fetched them between Eighty Ghana Cedis and One Hundred Ghana Cedis. The literate ones who could do a little bit of calculation sold theirs for about Three Ghana Cedis per kilogram. This has made it possible for them to look after their children and buy home appliances for their use. The living standards of respondents have improved and employment has been created. The next section seems to find out how many of the respondents have gained and created employment for others through aquaculture.

Table 4.15: Quantum of harvest within a season

Quantum of Harvest	One Pan Load	%	Two Pan Loads	%	Three Pan Loads	%	Four Pan Loads	%	>Than Four Pan Loads	%	Total
Community											
Juabeso	2	10	4	20	5	25	6	30	3	15	20
Enchi	4	18	5	22.7	4	18	7	31.8	2	9	22
Essam	4	22.2	1	100	11	61	2	11.1	nil	nil	18
Total	10		10		20		15		5		60
Percentage	16.7		16.7		33.3		25		8.3		100

Source: Field Survey, 2010.

#### 4.12 Employment Creation

Respondents had intentions of expanding their activities in aquaculture as a means of creating jobs for themselves and others and through this improve their living conditions. However, respondents could engage few hands to work on their ponds. From Table 4.16, six of the respondents, that is, 10 percent have employed six labourers to work on their ponds and wages ranging between GH¢30.00 and GH¢60.00 were paid out to them at the end of every month. Five respondents have employed one labourer each to take care of their ponds for them in Enchi and each is paid an amount of GH¢60.00.

Labour in Enchi seems to be scarce as compared to the other areas. One respondent in Essam has employed one labourer and paid GH¢30.00 at the end of the month, but none of the respondents in Juabeso had ever engaged a labourer. They rather relied solely on household members. The roles of these labourers were to manage the ponds, act as security men, helped in husbandry and harvesting. About 90 percent of respondents relied on family members to perform certain functions such as feeding of fishes, husbandry practices, management and other duties that may crop up. The respondents have responsibility of paying wages and therefore would have to work harder. The next section looks at marketing and distribution of their produce that generates revenue for them in order to be able to fulfill their obligations.

Table 5.16: Employment creation

Community \ Employment Creation	No. Employed	Wages paid	Family Hands	Total
Juabeso	nil	nil	20	20
Enchi	5	60.00	17	22
Essam	1	30.00	17	18
Frequency	6	nil	54	60
Percentage	10	nil	90	100

Source: Field Survey, 2010

### 4.13 Marketing and distribution

It is always important to have outlets for distribution and marketing of their produce. This could be through middlemen, through consumers or processed for storage. In the developed countries, produce are packaged and exported to other countries, but it is not so in developing countries. From Table 4.17, about 67 percent of the respondents sold directly to consumers whilst about 33 percent sold their produce through middlemen and that there was always ready market for their produce. Fifty percent of respondents in Juabeso sold to middlemen and only 20 percent sold to consumers in Enchi. Respondents in Enchi normally sold to consumers, about 81.8 percent and 66.7 percent of respondents in Essam sold to consumers. According to respondents, they make much profit if they sell directly to consumers.

Table 4.17: Marketing and distribution of fish

Marketing \ Community	To Middlemen	%	To Consumers	%	Total
Juabeso	10	50	10	50	20
Enchi	4	20	18	81.8	22
Essam	6	30	12	66.7	18
Frequency	20	nil	40	nil	60
Percentage	33.3	nil	66.7	nil	100

Source: Field Survey, 2010.

#### 4.14 Staff strength and their qualifications in the three districts

There is the need to have enough staff with aquaculture background in all the three districts with total population of over 33,000. Availability of these staff would make it possible for dissemination of information to respondents. From Table 4.18, the three study districts were made up of 69 MOFA staff members comprising 4 females and 65 males. Out of this number 33 were with aquaculture background and were expected to disseminate information on aquaculture to the farmers. 92 percent of the staff were AEAs, who are products of Agricultural Colleges, whilst about 11 percent were degree holders.

Table 4.18: Educational levels of Staff

Community	Juabeso	Enchi	Essam	%	Total
Secondary	3	2	1	10	6
Agric. College	22	17	16	91.7	55
Diploma	nil	1	nil	1.7	1
Degree	3	2	2	11.7	7
Total	28	22	19	115	69

Source: Field Survey, 2010

The staff strength in the three study districts were as follows: Juabeso had two females; a degree holder and an AEA, Enchi had one female who was an AEA whilst Essam had one female who was also a degree holder. They normally played the role of Women in Agriculture Development (WIAD) and took the women farmers through the cultivation of food crops that are used to prepare nutritious foods. They go further to train women on how to process fish. In fact, they see to the welfare of the woman from kitchen to the field. There is therefore the need for more staff to be trained with aquaculture background to help in this direction.

With reference to Table 4.19, only 4 representing 12.1 percent have had regular training in aquaculture. About 29 representing 33.3 percent had in-service training and 54.5 percent had short courses in aquaculture. It seems impossible for the four staff members to serve all these number of farmers. They are just too few to handle all these farmers, the reason why information on aquaculture is not reaching the farmers as expected.

Table 4.19: Training in aquaculture

Type of training for staff	Regular	In- Service	Short Courses	Total
Staff with training in Community				
Juabeso	2	2	5	9
Enchi	nil	8	10	18
Essam	2	1	3	6
Frequency	4	11	18	33
Percentage	12.1	33.3	54.5	100

Source: Field Survey, 2010.

The District Agricultural Directorate Unit (DADU) of all the districts supports the AEAs with logistics such as motor bikes, rain coats, and wellington boots. They also provide information on aquaculture and sources of fingerlings. DADU extend technologies such as pond construction, stocking, feeding, harvesting and processing of fish to the respondents through their AEAs.

The district directors confirmed the presence of gangs that do the digging of ponds. However, all the three districts had only four of such gangs. DADU indicated that there was a strong cooperation between them and the district assemblies as aquaculture forms part of the Youth in Agriculture component of the National Youth Employment Programme (NYEP). Although, the component is not yet implemented they hope the youth would be trained in due course.

Some of the challenges and constraints confronting DADU were that of start-up capital for farmers, availability of fishing nets for harvesting, as well as storage facilities. The districts also lack Desk Officers for aquaculture activities. They also need funds to train pond construction gangs, funds for staff training and insufficient literature on aquaculture.

#### **4.15 Technologies transferred by AEAs**

According to AEAs, technologies are transferred through meetings with farmers, demonstration farms, farm visits, field days and media discussions. From Table 4.20, all the respondents have never heard of the application of antibiotics in fish, likewise liming of the ponds before stocking especially when the ponds are turning acidic. Considering all the communities Enchi had the highest number of farmers who had

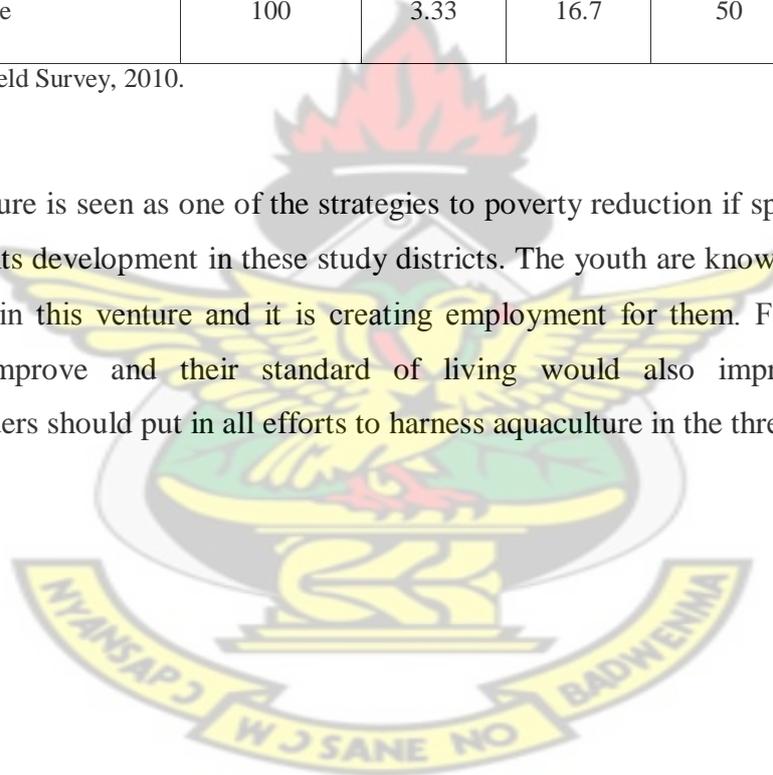
received a lot of technologies. At least, every respondent was aware of pond fertilization and of course animal manure application. However, there was the need for improvement and therefore respondents had the following recommendations to make in the ensuing section.

Table 4.20: Technologies transferred by the AEAs

Technology Community	Fertili- zation	Liming	Proper Stocking	Timely Harvesting	Husbandry Practices
Juabeso	20	nil	nil	9	4
Enchi	22	2	8	15	20
Essam	18	nil	2	6	10
Frequency	60	2	10	30	34
Percentage	100	3.33	16.7	50	56.7

**Source:** Field Survey, 2010.

Aquaculture is seen as one of the strategies to poverty reduction if special attention is given to its development in these study districts. The youth are known to be seriously engaged in this venture and it is creating employment for them. Farmer's incomes would improve and their standard of living would also improve. Therefore, stakeholders should put in all efforts to harness aquaculture in the three study districts.



## CHAPTER FIVE

### SUMMARY, RECOMMENDATIONS AND CONCLUSION

#### 5.1 Introduction

This chapter summarizes the major findings, challenges, constraints and benefits, and has made recommendation and conclusions. in order to address issues of major concern that came out from the analyses.

#### 5.2 Major Findings

The major findings based on the analyses made included the following:

- More of the youth (between age 15 and 59) were engaged in aquaculture (86.6% of respondents).
- Religion has no influence on fish farming (66.6% are Christians whilst Moslems are 16.7 %) in all the three communities as compared to other projects such as piggery and snail farming in a Moslem community.
- Females engaged in aquaculture were few (8.3%) as against males (91.7%), however, ponds that belonged to them were found out to be well kept with proper husbandry practices than most of the males.
- 88.3 percent of the respondents had some level of education, whilst 11.7 percent were illiterates.
- Location of marginal lands determines the location of these ponds.
- By 1997, only 3 of the respondents were engaged in aquaculture in Enchi. By 2000, the industry has expanded throughout the selected districts.
- Tilapia was the common fish being reared in all the three communities whilst mudfish was the least.
- 75 percent of respondents in Juabeso had free access to land, 59 percent from Enchi purchased the land and 38.9 percent hired the land for use.
- 6.67 percent employed the “nnoboa” system; 13.33 percent used their own strength whilst 90 percent used hired labour to prepare their ponds.

### **5.3 Some challenges and Constraints:**

- Invasion of predators and thieves;
- Lack of labour;
- Difficulty in treating fish when they begin to die;
- Lack of fingerlings;
- Lack of inputs (such as nets, feed); and
- Flooding of ponds after heavy rains.
- Officer Farmer ratio is 1: 91,037 for the study area.

### **5.4 Benefits**

- 10 percent of respondents have employed six labourers and pay wages ranging between GH¢30.00 and GH¢60.00 every month. Five respondents have employed one labourer each in Enchi and each is paid an amount of GH¢60.00 every month.
- 25 percent of respondents were able to pay their children's school fees
- Another 25 percent were able to purchase household items (such as television, fridge, and gas cookers) for their use.
- All the sixty respondents agreed that their diets had improved tremendously
- Respondents maximize their profits if they sell directly to consumers

### **5.5 Recommendations**

- The need to research into breeds of fishes that can thrive in those areas.
- Provision of financial support to farmers who are engaged in aquaculture in the districts.
- District Assemblies in these areas should negotiate with land owners to prevent land litigations among farmers.
- Awarding of best fish farmers as a means of boosting morale in the districts during Farmers Day celebrations

- Training and posting of more Agriculture Extension Officers (AEO) with aquaculture background to the districts to assist farmers.
- MOFA to assist in the formation of groups to construct ponds for farmers in the study districts
- Farmers to be advised to join FBOs in all the study districts for easy identification.
- MOFA / DA to establish hatcheries in study district to provide fingerlings to farmers
- Supply of inputs (feed, nets, pumping machines, etc.) through FBOs for onward supply to farmers in the districts.
- Motivation of the few AEAs in the study districts to give off their best.
- Policy direction should be specific and rope in more of the youth to go into fish farming in those districts.

## **5.6 Conclusion**

Aquaculture is seen as a necessary form of diversification in the agricultural system and is very significant in the rural settings since it does create employment, ensures food security and raises people's standard of living and consequently reduces poverty. Findings have been made and challenges and constraints identified. It would be necessary for stake holders to join hands and put in all efforts to improve the industry. The farmers in study districts would improve their income levels and export fish to the other neighbouring districts. Their diets would be improved and most especially benefit the children in these areas.

Therefore a mechanism should be in place to make available the required capital, inputs and arrangements for the terms of payment to enable more farmers to be engaged in aquaculture.

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