

**AQUACULTURE IN GHANA; PROSPECTS, CHALLENGES,
ANTIDOTES AND FUTURE PERSPECTIVES**

BY

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**Master Thesis In International Fisheries Management
(30 points)**

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May 2008

TABLE OF CONTENTS

ABSTRACT	9
ACKNOWLEDGEMENT	10
DEDICATION	11
LIST OF TABLES AND FIGURES	12
ACRONYMS	14
CHAPTER 1	17
1.0 INTRODUCTION	17
1.1 GLOBAL OVERVIEW OF AQUACULTURE	17
1.2 OVERVIEW OF GHANAIAN AQUACULTURE	18
1.3 THE PURPOSE OF THIS PIECE OF WORK	18
CHAPTER 2	21
2.0 METHODOLOGY	21
CHAPTER 3	23
3.0 BACKGROUND: GHANA AQUACULTURE	23
3.1 GENERAL COUNTRY INFORMATION	23
3.2 SIZE AND IMPORTANCE OF THE FISHERY SECTOR	25
3.3 HISTORY OF AQUACULTURE IN GHANA	26
3.4 FORMS OF AQUACULTURE IN GHANA	29

3.5 TYPES OF AQUACULTURE	30
3.6 TECHNOLOGIES AND APPROACHES USED	30
3.7 THE INLAND SUB-SECTOR	31
3.8 RESEARCH, AND INSTITUTIONS AND GOVERNMENT SUPPORT	32
3.9 CONSTRAINTS AFFECTING THE SECTOR	33
CHAPTER 4	37
4.0 THEORETICAL ASPECT OF POVERTY	37
4.1 WHAT IS POVERTY?	37
4.2 MEASURING POVERTY AT THE GLOBAL LEVEL	37
4.3 HOUSEHOLD ECONOMIC SITUATION IN GHANA	38
4.4 LEVELS OF POVERTY	39
4.5 TYPES OF MONETARY POVERTY LINES	41
4.6 THE MONETARY POVERTY INDICATORS	41
4.7 WHY ARE PEOPLE POOR?	42
4.8 POVERTY IN FISHERIES AND THE TRAGEDY OF THE “OPEN ACCESS”	44

4.8.1 THE ENDOGENOUS ORIGIN OF POVERTY IN FISHERIES	44
4.8.2 THE EXOGENOUS ORIGIN OF POVERTY	45
4.8.3 APPROACHES TO POVERTY REDUCTION	47
4.9 FOOD SECURITY IN GHANA	48
4.9.1 POLICY DEVELOPMENTS MATRIX FOR MTP, HIPC, PRSC, MDBS	50
4.9.2 HOW AQUACULTURE IS LINKED TO FOOD AND NATIONAL SECURITY	51
CHAPTER 5	53
5.0 CHALLENGES FACING THE AQUACULTURE INDUSTRY	53
5.1 INTRODUCTION	53
5.2 SOME GENERAL PROBLEMS OF AQUACULTURE	54
5.2.1. LAND TENURE PROBLEMS	54
5.2.2 FEED PRODUCTION	55
5.2.3. LACK OF CAPITAL	56
5.2.4 MARKETING OF FISH	56
5.2.5 LACK OF INSURANCE	57
5.2.6 ISSUE OF SUSTAINABILITY	57

5.3 CONSTRAINTS WHICH ARE SPECIFIC TO AQUACULTURE	58
5.4 CONSTRAINTS WHICH ARE SPECIFIC TO CULTURE-BASED FISHERIES	59
5.5 SUMMARY	60
CHAPTER 6	61
6.0 PRESENT STRATEGIES	61
6.1 FUTURE PERSPECTIVES	61
6.2 CRITERIA FOR POVERTY REDUCTION STRATEGIES	65
6.3 GHANA POVERTY REDUCTION STRATEGY	65
6.3.1 MACRO-ECONOMIC SECTOR	65
6.3.2 PRODUCTION AND GAINFUL EMPLOYMENT	66
6.3.3 OWNERSHIP OF LAND	69
6.4 THE INSTITUTIONAL FRAMEWORK	71
6.5 RECENT DEVELOPMENTS OF THE AQUACULTURE INDUSTRY IN GHANA	71
6.6 STRATEGIES FOR THE DEVELOPMENT OF AQUACULTURE	
6.6.1 PHASE 1: ADDRESSING THE INSTITUTIONAL AND STRUCTURAL BOTTLENECKS	72
6.6.2 PHASE 2: ADDRESSING THE PRODUCTION BOTTLENECKS	75

6.7 MEETING FUTURE DEMANDS THROUGH POND
AQUACULTURE 79

CHAPTER 7 83

7.0 CONCLUSION

86

REFERENCES

ABSTRACT

Inland and marine capture fisheries productions have more or less stabilised. Moreover, the increasing population is always putting pressure on the demand for fish which capture and marine productions alone are not able to meet. The national demand for fish is always greater than the country can supply and the gap is widening year after year. However, fish is the most important animal protein in Ghana accounting for about 82 % of protein consumption (FAO 2001). Moreover, the relatively cheaper price of fish compared to the other animal proteins means that the year-after-year short-fall in fish production will affect the protein in-take of the poorer segments of the society in the near future if nothing is done about it. For example according to Tradezone (2007:2) even though the national fish demand for 2007 was 913, 992 tonnes, the country was able to supply only 511, 836.

The development of aquaculture has been seen to be one of the best solutions to the problem. The positive side is that the geo-ecological climate of the country is generally favourable for aquaculture development. These include the vast water surfaces of the dug-outs, dams, lagoons, the Volta Lake (the largest man-made lake in the world) and other water bodies. Nonetheless, this vast potential has not been tapped due to number of bottlenecks such as the availability of quality feed among others.

Following the results of my studies and work, I therefore propose that;

1. The local agricultural products and by-products should be tested scientifically in order to formulate cheap feed for aquaculture development.
2. Integrated Agriculture-Aquaculture (IAA) should be promoted and developed since it is resource and ecologically efficient and at the same time economically beneficial to farmers.
3. The agricultural extension officers should be trained in fish farming techniques so that that they can help advice farmers more especially on issues of integrated agriculture-aquaculture.
4. Women should be encouraged and motivated to enter into aquaculture and
5. Finally, the Aquaculture Development Committee (ADC) should assist farmers in the acquisition of soft loans and land which have been major stumbling blocks to the development of aquaculture.

ACKNOWLEDGEMENT

I never had an idea how studies in another country would be like. The culture and weather posed both challenges and opportunities simultaneously. However, there is a saying that “the moon moves slowly, but at day break it crosses the sky”. My first and foremost thanks go to the Almighty God, the King of Glory, for seeing me through successfully this two-year period. Secondly, I am very grateful to the Norwegian government who offered me the quota scholarship which has given me a body of knowledge in Master of Science in International Fisheries Management which will be very useful and applicable to the situation in my home country. Moreover, my sincere gratitude goes to both the administrators and Lecturers at the Norwegian College of Fishery Science at the University of Tromsø, who have made my stay here both academically very useful and interesting, more especially, to Ane-Marie Hektoen and Kirsten Zachariassen, both being co-ordinators of the International Fisheries Management (IFM) Programme.

I am also highly indebted to Line Vråberg, counselor for international students at the student placement centre whose periodic advice, seminars and information helped me to adjust to the Norwegian society and culture with little effort not forgetting Mr. and Mrs. Adekoya whose positive contribution to my life during my stay here cannot be over-emphasised. I thank my supervisor, Professor Bjørn Hersoug, whose advice and directions helped me come out with this piece of work. Finally, I appreciate the effort, help and advice of all and sundry who directly or indirectly have contributed in one way or the other to make my two-year stay in Tromsø enjoyable and successful.

DEDICATION

This piece of work is dedicated to my parents Mr. and Mrs. Hiheglo for their advice, care and support. Their contribution to my life is beyond measure. May God richly bless them.

LIST OF TABLES AND FIGURES

Table 1: Profitability of fish farmers who provided their income and expense data	29
Table 2: Government institutions associated with aquaculture research and training.	34
Table 3: Welfare of different categories of the population in 2003 compared to the year before.	39
Table 4: Regional distribution of household economic situations in 2003 compared to the year before.	40
Table 5: Regional distribution of food needs as well as the rural and urban households	49
Table 6: Policy objectives that concerned aquaculture in the Ghana Poverty Reduction scheme.	50
Table 7: Rural-Urban Core Indicators Welfare Questionnaire Results (CWIQ) Result on Household Land ownership.	55
Table 8: Regional Distribution of the Core Indicators Welfare Questionnaire Results Result on Household Land ownership.	55
Table 9: Ghana's projected fish supply and demand up to the year 2023.	64
Table 10: Unemployment and under-employment rates of the rural and urban households for the years 1997 and 2003.	68
Table 11: Regional distribution of unemployment and under-employment rates by gender for the years 1997 and 2003.	69

Table 12: Current status of Integrated Agriculture-Aquaculture (IAA) and its potential in some regions of the Ghana.	77
Table 13: Total number of ponds and reservoirs in 2006 on regional basis	79
Fig. 1: The contribution of the various sectors of the economy to the GDP in percentage terms as at 2006.	24
Fig. 2: The labour force by occupation which confirms that the agricultural sub-sector employed about 56 % of the people as at 2008.	25
Fig. 3: Bar graph showing Inland and Marine Fisheries production (tonnes) in Ghana from 1995 to 2004.	26
Fig. 4: A line graph showing fish production by the Inland sub-sector from 1995-2004.	32
Fig. 5: A framework to analyse how aquaculture is linked to food and nutritional security.	51
Figure 6: cumulative age of some members of four fish farmer associations interviewed in the 2003-2004 fish farmers baseline survey in Ghana	58
Fig. 7: Factors that are taken into consideration in the selection of animal protein in Ghana.	63
Fig 8: Preferences for animal protein in Ghana	63
Fig. 9: Percentage of national fish requirements satisfied from 1995 to 2000.	64
Fig. 10: Fish farmer information needs in four selected areas in the country during the baseline survey in 2003-2004.	74

ACRONYMS

AADC:	Ashaiman Aquaculture Demonstration Centre
ADB:	Agricultural Development Bank
ADC:	Aquaculture Development Committee
AGA:	Anglo-gold Ashanti
AR:	Ashanti Region
BA:	Brong-Ahafo Region
BUSAC:	Business Centre Advocacy Challenge
CIA:	Central Intelligence Agency
CBFMC:	Community-Based Fisheries Management Committee
CIDA:	Canadian International Development Agency
CR:	Central Region
CSIR:	Centre for Scientific and Industrial Research
CWIQ:	Core Welfare Indicators Questionnaire
DFID:	Department for International Development
EPA:	Environmental Protection Agency
ER:	Eastern Region
FAO:	Food and Agriculture Organisation of the United Nations
FFA:	Fish Farmer Association
GDP:	Gross Domestic Product
GIS:	Geographical Information System
GLSS:	Ghana Living Standards Survey
GNA:	Ghana News Agency
GPRS:	Ghana Poverty Reduction Scheme
GR:	Greater Accra Region
GSS:	Ghana Statistical Service
GTZ:	German Technical Cooperation
HIPC:	Highly-Indebted Poor Country
IAA:	Integrated Agriculture-Aquaculture
IAB:	Institute of Aquatic Biology
ICLAM:	International Centre for Living Aquatic Resources
IDA:	Irrigation Development Agency
ICOUR:	Irrigation Company of the Upper Region
KfW:	Kreditanstalt fur Wiederaufbau
KNUST:	Kwame Nkrumah University of Science and Technology
LAP:	Land Administration Project
LI:	Legislative instrument
MDBS:	Multi-Donor Budget Support
MOFA:	Ministry of Food and Agriculture
MPSD:	Ministry for Private Sector Development
MSE:	Medium and Small-Scale Enterprises
N:	North
NGO:	Non-Governmental Organisation
NM:	Nautical miles
NR:	Northern Region
NSB:	National Service Board
R:	Rural

RP:	Rural Poor
U:	Urban
UCC:	University of Cape Coast
UE:	Upper East Region
UG:	University of Ghana
UN	United Nations
UP:	Urban Poor
URADEP:	Upper Regional Agricultural Development Programme
UW:	Upper West Region
VR:	Volta Region
VRA:	Volta River Authority
W:	West
WR:	Western Region
WRC:	Water Research Council
WRI:	Water Research Institute

CHAPTER 1

1.0 INTRODUCTION

1.1 GLOBAL OVERVIEW OF AQUACULTURE

The contribution of aquaculture to global supplies of fish, crustaceans, molluscs and other aquatic animals cannot be over-emphasised. In 1970, aquaculture formed 3.9 % of the total global production by weight. Thirty years down the line, that is, 2000, it had increased to 27.1 %. In 2004, aquaculture formed almost a third of the global production by weight, which is 32.4 %. Moreover, according to FAO (2007), aquaculture continues to grow more rapidly than all other animal producing sectors. In comparison, whilst aquaculture has grown worldwide since 1970 at a rate of 8.8 % per year, capture fisheries and other terrestrial farmed meat production systems on the other hand, have grown at 1.2 % and 2.8 % respectively, over the same time period.

According to FAO (2000a) and Tacon (2001) in Kooiman et al., (2005), developing countries' contribution by weight increased from 73 % in 1979 to 90 % in 1998. However, this dramatic increase in production is skewed on regional basis in favour of Asia. For example, in 1998, aquaculture productions by weight according to region were as follows: Europe, about 5 %; South America, less than 2 %; Africa and Oceania, about 0.5 % each (FAO 2001a and Tacon 2001 in Kooiman et al., 2005). Moreover, according to FAO (2000a) in Kooiman et al., (2005) the numbers of fish farmers in the world increased from 7.07 million in 1998 to 7.47 million in 2000. The corresponding numbers for 1998 (and 2000) by region were: Asia, 6.67 (7.13) million; North and Central America, 191,000 (190,000); Africa 56,000 (75,000); South America, 41,000 (41,000) and Oceania 5,000 (5,000).

Following the figures given above, Africa continues to be a minor player in the global aquaculture industry even though the continent has a natural potential for aquaculture production. The production of tilapia which is even native to the continent has not experienced any significant growth. However, according to FAO (2007), the continent still has some encouraging signs. These include the black tiger shrimp (*penaues mondon*) in

Madagascar, *Eucheuma* seaweed in Tanzania and abalone (*Haliotis spp*) in South Africa. Moreover, Egypt is now the largest producer of tilapia in the world after China.

1.2 OVERVIEW OF GHANAIAN AQUACULTURE

Aquaculture started about 1950 in the Upper Region of Ghana. The upper region has now being divided in to Upper East and Upper West Regions for administrative purposes. The policy was to allocate 5 % of all irrigable lands for pond construction and it enjoyed some satisfactory level of patronage. Nonetheless, it was not very successful because of a number of reasons. These included poor site selection, ponds not being drained and farmers not having any business focus. According to the Department of Fisheries, there are a lot of constraints to the expansion of aquaculture in Ghana. These include lack of adequate supply of seed, lack of quality fish seed, lack of suitable feed and weak extension support. There are also the problems of credit and organised markets. Shortage of trained staff and less motivated practitioners are also of much concern. The question one may ask is; how are the developing countries in Asia able to make it? For example in Vietnam, according to FAO (2007), the annual percentage growth rate from 2002-2004 was 30.6 %. According to FAO (2005), aquaculture in Ghana is only Nile tilapia, *Oreochromis niloticus* and the African catfish, *Clarias gariepinus*. According to the Department of Fisheries, tilapia forms about 80 % of aquaculture production without any algae, shrimps, crabs and frogs being farmed.

1.3 THE PURPOSE OF THIS PIECE OF WORK

This piece of work is however to assess the potential of aquaculture in Ghana. It will also touch on the challenges facing the aquaculture industry and what should be done to improve the current situation. The sector needs a lot of commitment from the government and all other stakeholders to be able to pick off rapidly to realise its potential. The issue of sustainability of aquaculture is very important to look at. This is because according to the baseline survey conducted by the Department of Fisheries and Food and Agricultural Organisation's (FAO) Regional Office for Africa located in Ghana in 2003-2004, most of the fish farmers are in their 50s, 60s and 70s. The youth in their 20s and 30s are very few. If the industry is to be sustainable, the industry has to attract the youth. For aquaculture to attract the youth, it has to be able to generate income similar to or more than expected to be obtained from other sectors of the economy. Moreover, most of the farmers themselves see aquaculture as a part-time, limited investment hobby.

According to the Ghana Statistical Survey (2005), a 1 % growth in the population of the country requires a 3-4 % growth in the economy to maintain the present standard of living. However, the average annual population growth rate in Ghana between the years 1984-2000 is 2.7 %. This requires that all things being equal, the economy is supposed to grow at a rate of about 8-11 % on order to maintain the present standard of living. Nonetheless, the real Gross Domestic Product (GDP) growth rate computed from the Institute of Statistical, Social and Economic Research, ISSER (1996) over the same period gave an average of 4.53 %. This means that the population is growing faster than the economy which can have some undesirable long-term consequences. One consequence of this is that the excess of demand over the supply of fish is likely to increase with time if the production from capture fisheries does not keep pace with population growth. This makes the aquaculture industry to have a very crucial role in bridging the gap between demand and supply.

This piece of work is specifically aimed at touching at these areas;

1. Background of aquaculture in Ghana
2. Trends and Present situation
3. The profitability of aquaculture
4. Bottlenecks and problems
5. Possible policies to obtain rapid growth.

CHAPTER 2

2.0 METHODOLOGY

The data was entirely secondary mostly from the Department of Fisheries and the Institute of Statistical, Social and Economic Research (ISSER) at the University of Ghana. The idea behind the thesis is to know the constraints that prevent the successful boom of aquaculture in the country even though the country has a huge potential for aquaculture development with no particular locality or fishery as a case study area or case study. Therefore, considering the time and the resources available it was not possible to do a proper nationwide data collection. However, the Department of Fisheries had already gathered a lot of data that were very relevant to the topic to be discussed. The collection of secondary data was therefore considered the obvious choice.

Any limitation that is associated with the way the research was conducted will automatically reflect in the outcome and conclusions that may be drawn in this piece of work. For example, the database contained more data than was used to prepare the report. Some data were also entered inconsistently (eg. maize and corn bran). Moreover, data on fish farmers' income and expenses were very few. This is may be due to the fact that the farmers did not know the basic booking-booking methods or were afraid to release financial information for fear of taxation by the Internal Revenue Service (IRS). In the baseline survey for example, one of the enumerators developed her own questionnaire out of enthusiasm and started interviewing the farmers. When the questionnaire which was originally developed to be used for the research was ready, most of the farmers did not want to be interviewed for the second time leading to the loss of information. The data were analysed using mostly excel and statplus computer programmes. This included the use of pie charts, bar graphs and line graphs and others whenever, it was found necessary. Some of the data are also in the form of table to make them readable.

CHAPTER 3

3.0 BACKGROUND: GHANA AQUACULTURE

3.1 GENERAL COUNTRY INFORMATION

Ghana was formed from the merger of Gold Coast, the former British colony and the Togo land trust territory. It was the first Sub-Saharan country to gain independence on the 6th of March, 1957. The country is located in West Africa. On the south, it is bordered by the Gulf of Guinea of the Atlantic Ocean. On the east and west, it is bordered by Togo and La Côte d'Ivoire respectively whereas the northern part of the country is bordered by Burkina Faso (CIA 2008).

The geographic co-ordinate of the country is 8 00 N, 2 00 W. The total area of the country is 239,460 sq km of which 230,940 and 8,520 sq km are made of land and water respectively. Comparatively, the land is slightly smaller than Oregon in the United States of America. It has a coastline of 539km. The country has the following maritime claims; 12 nm (nautical miles) of territorial sea, 24 nm of contiguous zone, 200 nm of exclusive economic zone and 200 nm of continental shelf (CIA 2007).

The country is endowed with a lot of natural resources. Among them are gold, timber, industrial diamonds, bauxite, manganese, and fish. Estimates in 2005 revealed that 17.54 % of the land was arable in 2003 (CIA 2007). The country is also endowed with the Lake Volta which is the largest artificial or man-made lake in the world with a size of 8,480 sq km. It was formed when the Volta River was dammed in 1965 in order to generate hydro-electricity for the country.

According to a July 2008 estimate, the population of the country will be 23,382,484 with a population growth rate of 1.92% (CIA 2008). The population has a total life expectancy at birth of 59.49 years. The country has a literacy rate of 59.49 %. This represents the percentage of the population 15 years and over who can read and write. Subsistence agriculture which is the backbone of the economy contributes about 34 % to Gross Domestic Product (GDP) and employs about 56 % of the labour force. The GDP per capita (purchasing power parity) according to 2006 estimates is US\$ 2,600 with a real growth rate of 5.7 %.

The GDP by sector is represented in figure 1 below.

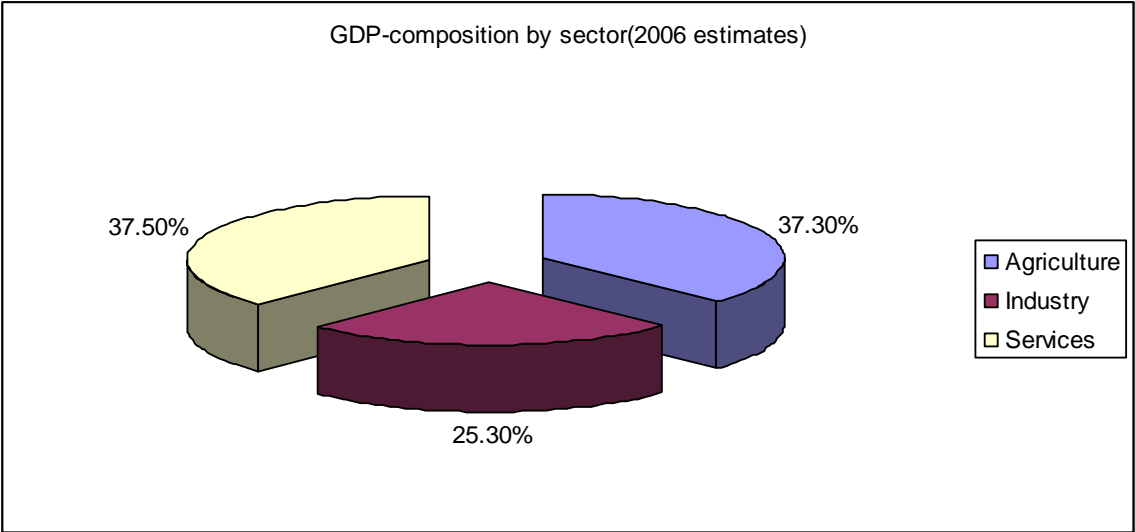


Fig. 1: The contribution of the various sectors of the economy to the GDP in percentage terms as at 2006.

It could be seen from the chart that the importance of agriculture to the national economy cannot be over-emphasised. The country had a labour force of 10.87 million according to 2006 estimates (CIA 2007). The labour force by occupation is represented by the figure 2.



Fig. 2: The labour force by occupation which confirms that the agricultural sub- sector employed about 56 % of the people as at 2008.

3.2 SIZE AND IMPORTANCE OF THE FISHERY SECTOR

The fishery sector in Ghana plays a major important role in the national economy. It contributes 3 % to Gross Domestic Product (GDP). Even though in percentage terms 3 % may look small, its significance cannot be over-emphasised taking into consideration the absolute number of people employed in the sector. According to Mensah et al (2003) in FAO (2000-2008), about 150,000 people are said to be engaged in marine fisheries. It is also estimated that, 1.5-2 million people directly or indirectly rely on or support these fishers. These include their wives, children, close relatives, canoe carvers, input suppliers and office workers for industrial fleet (Ibid in FAO 2000-2008). The importance of the fishery sector is related to employment, livelihood support, poverty reduction, food security and foreign exchange. From gender perspectives, the fishery sector is very important. It employs a lot of women. The men are engaged in the main fishing activity whereas the women are involved with the on-shore post-harvest activities which involve processing, storage and trading (FAO 2000-2008).

Over the years, the production from capture fisheries has more or less been stabilised. On the other hand, demand for fish has been growing due to population increase. Moreover, capture fisheries alone is not enough to meet the demands of the people for fish. This has made the

development of aquaculture very important to the Ghana government to serve as one of the strategies to bridge the gap between demand and supply of fish and to produce in excess for exports. The stabilisation of marine fisheries production over the years and the need for aquaculture to bridge the gap in the face of increasing population and demand for fish is seen in figure 3.

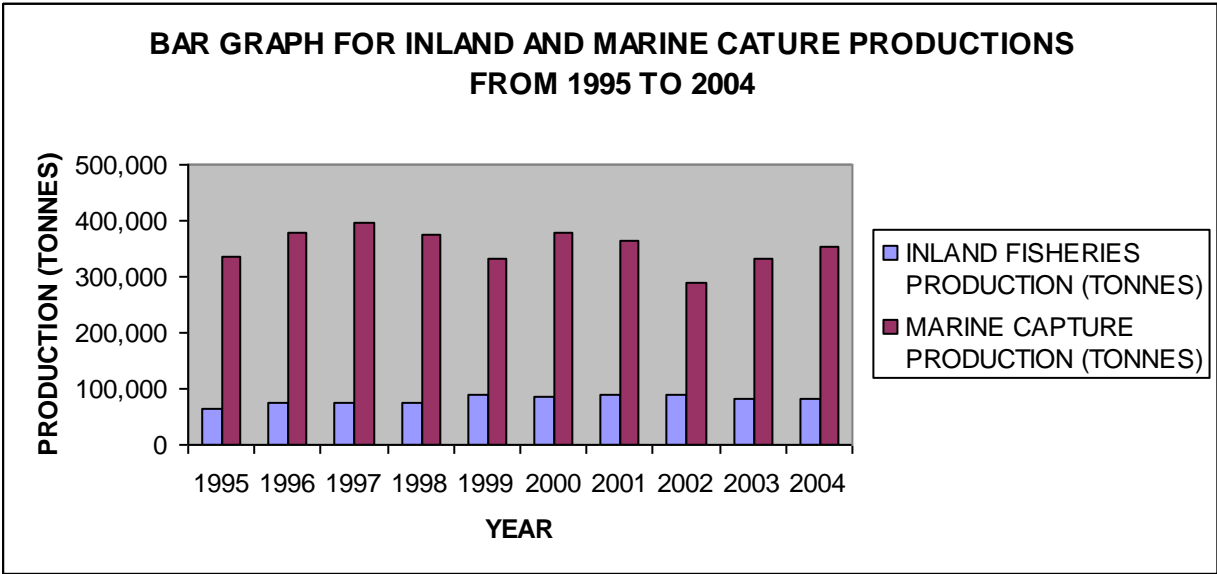


Fig. 3: Bar graph showing Inland and Marine Fisheries production (tonnes) in Ghana from 1995 to 2004. Inland fisheries here refer to production from the Volta Lake, reservoirs and dams and ponds. This shows clearly that marine fisheries production has more or less stabilised. Data used to plot the graph was received from the Department of Fisheries, Ghana.

3.3 HISTORY OF AQUACULTURE IN GHANA

Culture-based fisheries have its roots in the water conservation program which the government started in the 1940's in the northern regions of Ghana (MaCpherson and Agyenim-Boaten 1991:3). These are the Upper and Northern Regions. The Upper Region was later divided into the Upper East and Upper West for easy administration because of the large size. These regions of the country have long periods of drought which had effects on the humans and the livestock. In order to solve this problem, the government embarked on a program to have more dug-outs and dams to conserve water. These dug-outs not only served as water for humans and livestock but also provided water for the irrigation of cash crops and fish culture.

In the late 1940's the government began fisheries development efforts in the northern areas. The Fisheries Department stocked some of the water bodies whilst others were stocked naturally. Moreover, some of the local people were trained in fishing techniques and the programme continued for over 30 years. Before then such lands were owned by the community and managed by the chiefs and the herdsmen on behalf of the community. When the Fisheries Department was established in 1946, management was supposed to pass into the hands of the government. But some of the local communities were not willing to give up control of the lands to the government. This hampered the take-off of some projects because it was not possible to implement sound policies and developments without the co-operation of the very people who were expected to be the direct and major beneficiaries (MaCpherson and Agyenim-Boaten 1991:4)

The southern sectors of the country were far more economically advanced and still are compared to the northern sectors after independence. Therefore, the project was a strategy to bridge the gap between the north and south. However, from the communities' standpoint, the water bodies were for domestic consumption, livestock and crops and hence any benefit which would have been accrued due to fish culture would have been considered as incidental instead of primary or main benefit.

According information from the Department of Fisheries, aquaculture started about 1950 in the Upper Regions. Fingerlings were produced to stock reservoirs and the policy was to allocate 5 % of all irrigable lands for pond construction. Even though there was a mass entry, in the early 1980s, the poor selection of sites, poor quality of fingerlings and production without any business focus among others led to the failure of the whole initiative. In the early 1980's the government embarked on a massive campaign to convince the public to establish pond fish culture (MaCpherson and Agyenim-Boateng 1990:6). The main goal of the government for doing that was the development of culture- based fisheries in freshwater environments due to the huge potential that the country has for this industry which has been under-exploited for years. The campaign was effective and more people responded especially in Kumasi and Accra which are the two biggest cities in the country.

But, after a research was conducted in later years to examine the state of the ponds, it was discovered that a lot of the ponds were out of production but even for those that can be considered to be active, a small proportion was getting economic returns on their investments.

Additionally, about 23 % of the ponds had been abandoned and even for those in operation, they were operating below their potential (MaCpherson and Agyenim-Boateng 1990:6). The reason for the failure was that the government did not support its campaign with advice and extension services. In addition the government did not have the ability either to support a new industry. Moreover, there was no exchange of information between the countries in the sub-region about new fisheries techniques and developments.

The fisheries department had 16 sites with a total area of 35 ha. These were either for hatcheries grow-outs or as demonstration ponds for the fish farmers to learn new fishing techniques. However, only four of them are operational to date. In addition to these four, other four facilities exist. These belong to the irrigation company of the Upper Regions, Kwame Nkrumah University of Science and Technology (KNUST), the Volta River Authority (VRA) and Institute of Aquatic Biology (IAB). Collectively, these other four are operational with a total area of 14 ha. Moreover, other privately existing ponds exist most of which were constructed from 1982-1984 with loans from the Agricultural Development Bank (ADB). There was a high failure rate because little technical assistance was offered to the farmers. In total, it is estimated that about 125 ha of operational ponds exist with an estimated stocking rate of 15,000 fish / ha and one culture cycle requiring about 1.9 million fingerlings assuming that ponds are harvested once a year (Prein and Ofori 1996:2). In 2005, the total fish production estimates was 1,153.915 tonnes. This can be broken down as 388.54 tonnes from reservoirs ($150 \text{ kg} \times 2,590.27 \text{ ha}$), 346.875 tonnes from ponds ($1.5 \text{ tonnes} \times 231.25$) and 418.5 tonnes from private commercial farms. However, the data for the private commercial fish farms do not include Newco farms because they were not available (Department of Fisheries). In general, aquaculture in Ghana can be considered to be highly profitable. In the 2003-2004 baseline survey when the average net income from members of three fish farmer association gave a net income of 77.4 % which can be seen in table 1.

Table 1: Profitability of fish farmers who provided their income and expense data. Source (FAO 2005:24).

Explanation	Sefwi	Dunkwa	Wassa West	Grand Total	% of Total Income
No. Fish Farmers Responding	15	6	13	34	
No. Fish Ponds	20	8	14	42	
Total Income	80,052,500	1,076,800	83,0709,000	164,838,300	100.0 %
Labour Costs	1,856,360	1,635,000	1,181,900	4,673,260	2.8 %
Stocking Costs	3,565,500	290,250	6,790,000	10,645,750	6.5 %
Fertilizer and Nutrients	248,000	0	2,044,000	2,292,000	1.4 %
Cost of Feed	1,975,000	348,000	3,635,980	5,958,980	3.6 %
Other Costs	850,000	0	5,608,000	6,458,000	3.9 %
Total Expenses	9,882,860	2,293,250	25,005,880	37,181,990	22.6 %
Net Income	70,169,640	-1,216,450	58,703,120	127,656,30	77.4 %

The reasons for the establishment of aquaculture in Ghana are many. Among these are to offset the deficit in national fish production, for domestic consumption, export and employment generation. In 2004 alone, the food fish production deficit was 50 %. As at now, no farmed fish are exported. Aquaculture in Ghana consists of the growing or culture of aquatic organisms in pens, cages and culture-based fisheries in reservoirs and dug-outs in the north. About 60 % of the reservoirs are found in the northern parts of the country. There are a lot of sites which are also suitable for the production. Aquaculture in Ghana is mainly tilapia (80 %) and catfish with no shrimps, algae, crabs nor frogs being cultured at the moment (Department of Fisheries).

3.4 FORMS OF AQUACULTURE IN GHANA

In a wider sense, three forms of aquaculture traditionally exist in Ghana. These are *acadjas* or brush-parks in lagoons and reservoirs; *hatsis* (fish holes) and *whedos* (mini-dams) in coastal lagoons; and *afani* or freshwater clams (*Egeria radiata*) in the lower Volta, where young clams are collected and “planted” in “owned” areas of the river (Prein and Ofori 1996:1).

Modern forms of aquaculture were introduced some 40 years ago. Initial attempts were made to culture fish in ponds and to date this type of aquaculture is the most common in Ghana. For this type of pond, the bottom and sides are built with concrete. However, in terms of their management, they are not tanks or raceways. In terms of species, there are three main cultured, namely; tilapia, catfish and *Heterotis*. Three introductions have been made in terms of species. These are *Oreochromis macrochir*, common and silver carp, and the tiger prawn (*Penaeus monodon*). Development efforts have been mainly focused on freshwater as the medium of culture. Some experimental work has been conducted in brackish water on *Penaeus monodon*. However, no experiments have been performed directly on marine and offshore environments (Prein and Ofori 1996:1).

3.5 TYPES OF AQUACULTURE

Regarding the type of culture, there are ponds, pens, cages or raceways. Cages and raceways are expensive not so much in the cost of the structures themselves but the cost of reasonable balanced feeding. When it comes to pens, the cost of feeding is not very expensive especially for a plankton feeder like *O. niloticus*. The main concern about the pens is that it has not got a very good environment for its introduction. This is due basically to two reasons. First, the water levels of potential pen sites, example reservoirs and the Volta Lake fluctuate very much over the year. In such a case, the pens have to be built so high that even if the water recedes, the incentive to remove the pens may not even be there. Secondly, when capture fishermen are also fishing at the pen sites or close to the place, they can afford to sell their tilapia and/or catfish at lower prices which the fish farmers cannot compete with (Wijkstrom and Vincke 1991:4). This clearly confirms that pond aquaculture is going to be the basis of fish culture in Ghana during the next decade. However, one advantage of cages or pens is that it permits the use of water by other users because of the high opportunity cost of water. The only challenge now is to find a solution to the problem of fluctuation water levels. It has been suggested that a technology which can be developed to stimulate a dense plankton bloom by using for example cow manure will be very suitable.

3.6 TECHNOLOGIES AND APPROACHES USED

In terms of technology in the freshwater, extensive and semi intensive forms are mainly used with only one case of intensive culture which exists for the culture of tilapia in net cages. The extensive system comprises of dams, dug-outs and small reservoirs and are fished out and stocked regularly. This type of technology has a potential for development in the northern

regions of Ghana. Rich-fish culture falls under this category. This rice-fish culture has been attempted in the Upper East and West regions of Ghana. The second system is semi-intensive. This is the most commonly practiced. Fish are constructed in earthen ponds. The pond can either stand alone or be part of an integrated aquaculture system. Most of the times, it is monoculture of tilapia or sometimes the polyculture of tilapia and catfish (Prein and Ofori 1996:1).

Over the years, there have been two different approaches to the development of aquaculture in Ghana. The first type is where communities are the target. Here the ponds are communally owned and managed by members of the community. The community derives benefits in the form of fish or cash. This type of approach has the highest rate of failures because of poor management. The second approach targets individual some of which have their own land (Prein and Ofori 1996:2).

3.7 THE INLAND SUB-SECTOR

The inland sub-sector in Ghana is very important. This fish mainly comes from the Volta Lake. The others include Lake Bosomtwe, Weija, Barekese, Tano, Vea and Kpong.

According to Braimah 2001, the Volta Lake is rich in fish of about 140 species. In terms of fish landings, tilapia species comprise 38.1 %, *chrysichtys spp* 34.4 %, *synodrantis spp* 11.4 %, *Labes* 3.4 %, *Mormyrids* 2.0 %, *Heterotis* 1.5 %, *Clarias sp* 1.5 %, schileide 1.4 %, with the rest which are less than 1 % in combination. These include *Alestes spp*, *Brycinas spp*, *Distichodus spp* etc. According to (ibid) the average yield of the fishery has decreased from 46.8 kg / ha in 1976 to 32.8 kg / ha in 1998 (FAO 2000-2008: 3-4).

According to Braimah 2001, the lake's potential of 40,000 tonnes per annum has been exceeded annually since 1995. This is confirmed by ibid that the annual catch per unit effort is estimated to be decreasing at 0.255 kg / boat / day. The Volta Lake also covers a total of 1232 communities (Braimah 2001) covering an area of 8,480 sq km with an average depth and length of 19 m (Braimah 1999) 410 km respectively. The Lake has a storage capacity of 190 km (ibid). Fish catches from the Volta Lake rose steadily from 3,000 tonnes in 1969, followed by a decline and now stabilising at around 40,000 tonnes (Braimah 1999). According to Anon (2003), fisheries from the lake account for about 16% of national output. Aquaculture in Ghana can also be considered as an inland fishery even though the potential is far under-exploited (FAO 2000-2008:4).

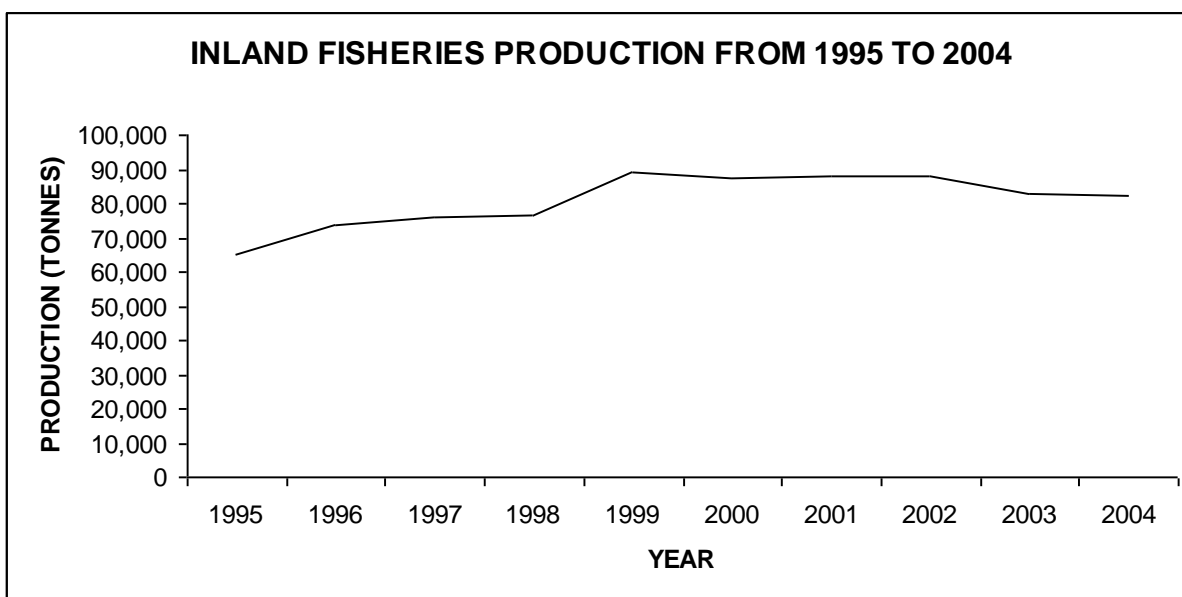


Fig. 4: A line graph showing fish production by the Inland sub-sector from 1995-2004. The Volta Lake is the single most important contributor to the inland sub-sector. It can be seen that there is a steady increase in production by the inland sub-sector year after year.

3.8 RESEARCH, AND INSTITUTIONS AND GOVERNMENT SUPPORT

The government of Ghana had an aim to increase aquaculture production to a minimum of 1,000 tonnes in a five-year period according to Wijkstrom and Vincke (1991:3), but this has not been achieved to date. However, the question is whether or not shrimp should be cultured. There is an argument against spending hard currency on developing a marine shrimp culture industry. The economic reason is that perhaps the probability of getting any net foreign exchange from shrimp farming is very marginal. The first reason is that, despite considerable effort to boost shrimp farming in the West African sub-region, no success has been achieved. The most important case here is the lagoons of La Côte d'Ivoire. Also, the market for shrimp in West Africa in the past two decades has been flooded because of increasing production from Asia and Latin America.

Culture in fresh water has the potential for both fin-fish and crustaceans but for now only fin-fish culture is being practiced. Fresh water prawns are being considered as candidates for culture yet no fresh water crustacean is being cultured commercially. Attempts have been made to culture *M. rosenbergi* and *M. vollehoveni* but without any sustained commercial

aquaculture emerging out of that (Wijkstrom and Vincke 1991:3). Principally, *M. rosenbergi* is cultured mainly in Thailand but *M. vollenhoveni* is not known to be cultured anywhere in the world. When the country wants to culture *M. rosenbergi*, the advantage is that there is a known technology for its culture that can be transferred. The drawback is that, the market is uncertain both in West Africa and world wide. But when it comes to *M. vollenhoveni*, the market in West Africa seems to be assured but the technology is not yet developed. In this case, the double strategy would be to develop a culture technology for *M. Vollenhoveni*. The second strategy will be to test-market imported *M. rosenbergi* to check whether it can be a close substitute for the *M. vollenhoveni* in local luxury markets.

According to the Directorate of Fisheries, there are a lot of institutions which are involved in aquaculture. These include the Ministry of Fisheries, Department of Fisheries, Water Research Institute (WRI), Environmental Protection Agency (EPA), Universities and Water Research Council (WRC). There are no private research institutions involved in aquaculture in the country. However, the Water Research Council is the only aquaculture research institution in the country even though the universities also conduct research into aquaculture. A lot of researches are ongoing. These are feed trials, Genetic make-up of the Volta *Oreochromis niloticus*, composition of agricultural by-products to assist in feed formulation, IAA trials in the Akwapim Valley and manual sexing of Tilapia fingerling. In terms of fish health, the farmers are being exposed to a lot of fish health issues. There is also a fish disease survey underway. Moreover, there are a list of parasites and diseases which are being prepared. The government institutions that are associated with aquaculture research and training can be seen in table 2.

Table 2: Government institutions associated with aquaculture research and training.

Institution	Purpose	Degrees Awarded	Key personnel	Areas of specialization of key personnel
Renewable Natural Resources (KNUST)	Training	PhD, MSc, BSc	PhD (1), MSc (4)	Aquaculture, fish nutrition, ichthyology, water resources management, freshwater ecology, biodiversity
Department of Fisheries and Oceanography (UG)	Training	MPhil, BSc	PhD (2), MSc (3)	Freshwater and brackish water aquaculture, fish health
Department of Fisheries and Aquatic Sciences (UCC)	Training	PhD, MPhil, BSc	PhD (3), MPhil (1), BSc	Fisheries, aquaculture, biology and culture of shellfish, fisheries biology and conservation of marine mammals
Water Research Institute (CSIR)	Research	-	PhD (13), MSc (5), BSc (1)	Aquaculture, genetics, fish breeding, fish biology, fisheries management, biological sciences and agricultural economics
Kwadaso Agricultural Training	Training	Agricultural Certificate	BSc (2)	Aquaculture, natural resources development and general agriculture
Ministry of Food and Agriculture	Development Agency	-	MSc (8), BSc (10), Dip. (4)	Aquaculture, shrimp and bivalve culture, hatchery management, fish health and extension

Note: Kwame Nkrumah University of Science and Technology (KNUST); University of Ghana (UG); University of Cape Coast (UCC); CSIR (Centre for Scientific and Industrial Research). Source: FAO (2000-2008:7).

There are other Ghanaian institutions that are involved in the development of the inland fisheries and the aquaculture sub-sectors according to MaCPherson and Agyenim-Boateng (1990:4). These are;

1. The Irrigation Development Authority (IDA). This is a division of the Ministry of Agriculture and they are responsible for the construction of multi-purpose reservoirs. However, in the Upper East and West Regions of the country, the same responsibility is carried out by the Upper Regional Agricultural Development Programme (URADEP).
2. The Irrigation Company of the Upper Region (ICOUR) also operates two fish culture stations at Tono and Vea.
3. The National Service Board (NBS) belongs to the Ministry of Education and has been involved in community unit extension service since 1982.
4. The Volta River Authority (VRA) operates ponds at the Kpong reservoir.

There are a lot of regulations and laws concerning aquaculture in order in Ghana. These include;

1. Regulations to govern aquaculture and protect the environment-Fisheries Act 625 of 2000.
2. Environmental Protection Agency (EPA) Act 490 of 1994 (LI 1652) embodies the requirements for EPA. Section 60 of this regulation requires a license for aquaculture and recreational fishing and Section 93 requires Environmental Impact Assessment but the Fisheries Commission accepts that approved by EPA.
3. Food and Drugs Law 1992 prohibits the sale of unwholesome, poisonous substance not of quality demanded (Department of Fisheries).

The government of Ghana is supporting fish farmers in various ways. These include the formulation of policies and strategies, collection of statistics, supporting of research, flow of information, control of feed, seed and food fish production and fish health services. The government is also promoting the formation of Fish Farmer Associations (FFA). Other activities are also focused on training of youth in pond construction skills. Moreover, fish farmers are trained in aquaculture techniques such as aquaculture as a business, draining of ponds, and regular harvesting of ponds. The government has supported aquaculture by the establishment of a number of field stations. The intentions of the field stations were the

production of fingerlings, farmer demonstration and training with some of them being used for research purposes.

3.9 CONSTRAINTS AFFECTING THE SECTOR

There are a number of constraints which have been militating against the development of aquaculture. These include;

1. The lack of adequate supply of seed
2. Lack of fish seed
3. Lack of suitable feed
4. Weak extension support
5. Lack of financial resources especially credit
6. Lack of organized markets
7. Incomplete understanding of what aquaculture can do
8. Shortage of trained staff
9. Not motivated staff
10. Poorly operating Government of Ghana status (Department of Fisheries).

CHAPTER 4

4.0 THEORETICAL ASPECT OF POVERTY

4.1 WHAT IS POVERTY?

An article on the web page of the World Bank gave the following characteristics of poverty.

“Poverty is hunger. Poverty is lack of shelter. Poverty is being sick and not being able to see the doctor. Poverty is not having access to school and not knowing how to read. Poverty is not having a job, is fear for the future, living one day at a time. Poverty is losing a child to illness brought about by unclean water; poverty is powerlessness, lack of representation and freedom. To know what poverty is helps to reduce poverty, what works and what does not, what changes over time, poverty has to be defined, measured, and studied-and even experienced (<http://go.worldbank.org/K7LWQUT9L0>)”.

This definition of poverty actually encompasses and reveals the harsh situations that the poor go through. Moreover, poverty is a complicated issue and not just a simple issue to deal with.

4.2 MEASURING POVERTY AT THE GLOBAL LEVEL

According to (Neiland and Béné 2004:42) the World Bank in its World Development Report (2001), recognised poverty elimination as the “World’s greatest Challenge”. It uses US\$ 1 and US\$ 2 a day in measuring poverty. It was estimated in 2001, that 1.1 and 2.7 billion people lived below US\$ 1 and US\$ 2 a day respectively (<http://go.worldbank.org/K7LWQUT9L0>). Nonetheless and despite these striking figures, it has been shown that living standards have risen dramatically over the past decades. It also continued to say that, the proportion of the developing world’s population living in extreme poverty defined as living on less than US\$ 1 per day fell from 28 % in 1990 to 21 % in 2001. To buttress this point, it was stated in Collier and Dollar (2001:1787) in (Neiland and Béné 2004:10) that “Ten percent of the world’s population produces 70 % of its goods and services and receives 70 % of its income, an average of US\$ 30,000 per person. At the other extreme, half of the world’s population lived on less than US\$ 2 a day.

Most of the global trends in poverty reduction have been dominated by rapid economic growth in China and the Pacific region. In South Asia for instance, poverty has fallen rapidly

over the past 20 years, with almost 45 million people no longer being considered as living in extreme poverty by 2001 (<http://go.worldbank.org/K7LWQUT9L0>). But nonetheless, in Sub-Saharan Africa, GDP per capita shrank 14 % and poverty rose from 41 % in 1981 to 46 % in 2001. Sadly enough to say, an additional 150 million people were living in extreme poverty during that 20 year time period.

The White Book of the British Co-operation development, Department For International Development (DFID) relating to institutional development, was quoted in DFID, (2000) that one out of five people in the world lives in abject poverty, with two-thirds of them being women who are on the fringes of survival, without enough food, safe drinking water, health systems, medical care and education. This has caused the lives of about 1.2 billion people to be destroyed by poverty and their dignity flouted in a world which has recorded increased wealth and great material abundance over a couple of decades ago (Campbell and Ward 2004:121).

4.3 HOUSEHOLD ECONOMIC SITUATION IN GHANA

According to the Ghana Living Standards Survey (GLSS1) conducted in 1987/88, households are considered to be poor if their expenditures fall below two-thirds of the mean per capita expenditures and extremely poor if it falls below one-third of the mean per capita expenditure. About 35.9 % of the Ghanaian population fell below the poverty line and 7.4 % of the population in extreme poverty according to this approach. It was also discovered that poverty was mostly a rural phenomenon with 43 % of rural inhabitants being poor (<http://go.worldbank.org/43FDUKODX0>).

However, the concept of well-being of a people should not only be limited to poverty. It should include inequality and vulnerability. This means that limiting the discussion only to poverty gives a very narrow perspective of the situation existing on the ground. For example, there can be a situation where the poverty level in a particular country may not be relatively high but the distribution and consumption of income may be biased in favour of only a few privileged people. Another dimension which is also very important is vulnerability which may be defined as the probability that a person who is above the poverty line will fall into poverty today or in the near future. This can happen in countries of political instability where people can stand the risk of losing all they have acquired in a lifetime to the terrors of war. Table 3

indicates the economic situations of people in a survey under the Ghana Poverty Reduction Scheme (GPRS) to know whether people’s livelihoods were better than the year before.

Table 3: Welfare of different categories of the population in 2003 compared to the year before.

Household economic situation compared to one year ago					
	Total	Rural	Rural poor	Urban	Urban Poor
Worse now	51.5	51.6	52.2	51.4	53.1
Better now	27	28.9	26.9	24.6	26.4

Source: Ghana Statistical Service, 2003 CWIQ (Core Welfare Indicators Questionnaire) data in GPRS (2004:45).

It could be deduced that in general, households were better-off the year before than the year under review. Moreover, the urban poor were worse off than the rural poor. This means that it is not enough that governments should just rely on decrease in macro-economic indicators such as inflation, interest rates and other parameters as the only indicators of well-being. This is because there can be situations where these parameters may look favourable superficially but the economic situations of households might be deteriorating. The fact that the rural poor were better-off than the urban poor in a matter of one year mean there are a lot of untapped potential in the rural areas which can be harnessed for development. Moreover, the government should direct its focus on the poorest of the poor by implementing pro-poor policies instead of pro-growth policies. This can be done by targeting certain categories of people in the society. This includes women, the unemployed, street children, orphanages, the physically challenged, those living in very remote villages, illiterates and resource-poor communities among others.

On a regional basis however, it was observed that the Volta (VR), Greater Accra (GR) and the Eastern (ER) Regions were very severe in terms of economic deterioration of the masses. It is obvious that the Greater Accra Region recorded the highest because being the capital of the country, a lot of young people migrate from other regions of the country to seek greener pastures only to find out that their situation moves from bad to worse. This might be due to the fact that most of these young people are either uneducated or do not have any skills to

help them earn a living and so are not able to land on living wage jobs. This can be seen in the table 4. Moreover, the reasons behind the deteriorating conditions of the different regions should be investigated and so as to help develop proper strategies to deal with them.

Table 4: Regional distribution of household economic situations in 2003 compared to the year before.

		WR	CR	GR	VR	ER	AS	BA	NR	UE	UW
Worse now	51.5	48.6	49.7	58	68.7	57.9	40.6	47	45.9	45.9	59.3
Better	27	27.5	27.6	16.3	13.1	27.5	36.7	35.7	29.9	26	26.3
Difference	26.5	21.1	22.1	41.7	55.6	30.4	3.9	11.3	16	19.9	33

Source: Ghana Statistical Service, 2003 CWIQ data in GPRS (2004:45).

4.4 LEVELS OF POVERTY

Chambers (1983) in Ellis (2000) distinguishes between five absolute levels of poverty and deprivation. The first is what he terms as poverty proper. In this case, the individual or household lacks income or the assets to generate income. The second as he talked about is physical weakness which may be due to under-nutrition, sickness or disability. The third level of poverty that he talked about is isolation. This actually occurs if a people are marginalised and cut-off from mainstream economic activities due to gender, tribe, ethnicity, nationality and race among others. The fourth as he put it is vulnerability which means proneness to risk, stress and hunger. Finally, he talked about powerlessness within social, political and cultural structures (Ellis 2000:85). It has also been observed that, the poorest of the poor are cut-off from participating in higher return activities due to entry constraints in the form of skills or capital investment. According to various influential documents (e.g. World Bank 1989; Jazaily 1992), female headed households, and indeed the people within such households were for some time dubbed ‘the poorest of the poor’ (Tinker 1990 in Ellis 2000). It can therefore be inferred that policies that assist female-headed rural households to raise their standards of living will have the dual beneficial effects of reducing gender inequalities in income, and of reducing overall poverty (Ellis 2000:142).

4.5 TYPES OF MONETARY POVERTY LINES

Monetary poverty lines have a direct link with the amount of money that an individual or household has. There are various ways of classifying individuals or households as to whether or not they are poor according to Neiland and Béné (2004:48). The point here is not to say that one approach is better than the other but it is worth to understand how each of the can be relevant to different situations. The first is the biological poverty line. In this case, it has been estimated that an individual needs about 2400 calories a day for normal daily activities. In a person eats less than the amount of calories that his or her body requires, then this might be due to the fact that perhaps the person is poor. The second is the needs based poverty line. In this case, it is assumed that every individual should have the right to the three basic needs of life. These are food, housing and clothing. Therefore, lack of these things can be attributed to the fact that the individual is poor.

The fourth is the normative poverty line. A classical example is US\$ 1 or US\$ 2 a day. An individual or household that lives below US\$ 2 a day is considered to be poor. However, an individual that lives on less than US\$ 1 a day is considered to be extremely poor. The last is the relative approach. In this case, the individual or household's income is compared to other people with whom they go to the same market to purchase things at the same price. This means that an individual that is poor in a particular economic environment might not be considered poor if they operated in a different economic situation with the same level of income.

4.6 THE MONETARY POVERTY INDICATORS

Monetary poverty has four main indicators. The first is the incidence of poverty. This refers to the percentage of the total population living under the poverty line. However, this information alone about poverty is not enough. The second talks about the extent of poverty. This takes into account the distance of the poverty line that the income of the poor lies. Sometimes a particular group of people described as poor may be very far away from the poverty line. This means that a lot of commitment has to be made if such people are to be lifted from poverty.

However, if a people are poor but are close to the poverty line, little effort will be required to lift such people from poverty compared with those who are the poorest of the poor. Another dimension is the severity of poverty. In this case, a very high severity means that the income differentials among the poor are very high. This means that perhaps certain sectors of the

economy may be major contributors to the overall national poverty. In this case, the contribution of each socio-economic entity in space to overall national poverty can be determined which can help in national planning. This may be perhaps a particular region of the country, gender, occupation etc. The last is vulnerability to poverty. This takes into consideration the proportion of the population living in the segment which is immediately below the poverty line.

This is very important because a people may be described as not been poor because they are not below the poverty line but in reality they may not be very far from the line putting them in a very risky situation against any unforeseen and unfavourable eventuality in the future. The United Nations declared 1997-2006 as the “first UN decade to the eradication of poverty”. However, and practically speaking, this goal has not been met and the reasons why it was not met can serve as a feedback mechanism and the lesson learnt can be incorporated into any future poverty alleviation strategies.

4.7 WHY ARE PEOPLE POOR?

Poverty is a very broad concept. There are two crucial factors which can determine the well being of a household. The first is the access of the household to these assets. People who are poor are considered to lack these classes of capital or assets. If it becomes difficult for households to have access assets, it can lead to poverty. The second determinant is the external conditioning variable which either constrains or encourages households to use the assets productively to generate wealth. In effect, the poor are those who do not have access to these capital assets or even if they do have these assets after all, still lack the favourable external conditioning that will help them use their assets productively in order to generate wealth. There are five types of capital assets according to Rakodi (1999:322) in Neiland and Béné (2004:24). These are natural capital, human capital, social capital, physical capital and financial capital.

Natural capital or assets are those assets which are nature-given. They are associated with the environment in which we live. These include land, water and other environmental resources such as mineral, forestry and fish stocks. Human capital assets refer to the quality and quantity of labour resources available to the country. This is determined by educational level, innate skills and health status of the people. A people with very high human capital have a high potential to generate wealth compared with those who do not have much human capital.

The next is social capital or asset. These are the rules, norms, obligations, reciprocity and trust embedded in social relations. Social capital refers to how individuals and household are socially positioned within the society. This social positioning comprises such factors as gender, caste, class, age, ethnicity and religion and they are very important in determining the right and extent to which people can hold on to assets.

According to Nayaran (1997:80) in Neiland and Béné (2004:25), this refers to the social structures and the institutional arrangements in the society which enable its members to achieve their individual and community obligations. The fourth asset is physical asset or capital. This includes infrastructure such as roads, access to electricity and other utilities. The last is financial asset. This comprises of stocks of money to which the household has access to probably through loans. However, according to Neiland and Béné (2004:25) poverty is not a static concept. This means that no person should consider themselves as destined to poverty forever. This is because over time the capabilities of an individual as well as the opportunities available to them may change thereby influencing the individual's destiny. It also asserts that poverty is not just a matter of circumstance or accident but also how individuals and households respond to the environment in which they find themselves.

Poverty in fisheries has been linked to two factors. These are sectoral and non-sectoral factors. The sectoral factors are those that originate within the fisheries itself which causes fishermen to be poor. These factors more or less depend on the effectiveness of the fisheries management system. A good fisheries management is expected to lead to rich fishermen and a bad fisheries management on the other hand will lead to poor fishermen. The non-sectoral factors are those factors outside of the fisheries sector which are likely to dictate the poverty situation in fishing communities.

The resilience of the fisheries sector to become more robust to the conditions outside the fisheries sector will depend on the effectiveness of the management. When a very good fisheries management system is lacking, non-sectoral factors such as alternate employment will dictate the poverty situation in the fishing communities. This is because if the fisheries management is not good, leading to poverty in the fisheries, yet with no external alternative employments available to give them higher returns than the fisheries, they may be forced to stay in the fisheries and still remain poor. However, if there is poverty in the fisheries, yet

with no other alternate employments offering higher returns, most of the fishermen will leave the fisheries thereby reducing the poverty situation in fishing communities.

4.8 POVERTY IN FISHERIES AND THE TRAGEDY OF THE “OPEN ACCESS”

The Food and Agriculture Organisation estimates that there are some 5.8 million fishers earning less than one US\$ 1 / day globally and a further 17.3 million in upstream and downstream activities such as fish processing, trade and boat building (FAO 2002 in Campbell and Ward 2004). In attempting to explain why many fishermen have low incomes, it should be understood that fishing incomes indeed are often low. However, there are two contrasting interpretations about the relation between poverty and fisheries. The first relates to the paradigm, “they are poor because they are fishermen”. This means that “poverty stick to the fisherman like mud sticks to shoes” and this notion has strongly persisted over ages in the minds of people. Therefore, no matter what they do, they will always be poor and stay poor. This is the ‘endemic poverty’ perception of poverty in fisheries (Neiland and Béné 2004:64). Bailey says, fisheries communities are ‘the poorest of the poor (1988:36) in (Neiland and Béné 2004). This means that poverty is inherent in fisheries and there is nothing that the fisherman can do to stay out of poverty so long as they still remain fishermen. This is the endogenous origin of poverty; that is, poverty that comes from within.

4.8.1 THE ENDOGENOUS ORIGIN OF POVERTY IN FISHERIES

In order to explain the endogenous origin of poverty in fisheries, Gordon attributes it to common property nature of the resources of the sea. He thus stated in Gordon (1954:134) according to (Neiland and Béné 2004) as follows; “That the plight of fishermen and the inefficiency of fishing production stems from the common property nature of the resources of the sea and is further corroborated by the fact that we find similar patterns of exploitation”. This means that the open access nature of the fisheries dissipates wealth (or rent). This leads to excessive effort being used in the fishery causing the stocks reduce dramatically. This leaves fishermen to be poor. Therefore fishermen will be left with incomes only slightly above their opportunity incomes. This theory has been known to be the conventional wisdom and the endogenous nature of poverty in fisheries. Hardin (1968:124) stated in “The tragedy of the Commons” as stated in Neiland and Béné (2004), as;

“a therein is the tragedy (of the “commons”) (...) Ruin is the destination which all men rush, each pursuing his own interest in a society that believes in the freedom of the commons. Freedom in a common brings ruin to all”.

Weaving Hardin’s and Gordon’s theories together between common property and open access nature of the fisheries means that more and more people are allowed to enter the fishing sector, leading to the economical (and possibly biological) over-exploitation of the resources, dilapidating of the rent and finally impoverishment of the fishing community. It is thus the open access nature of the fisheries which is the actual reason of the fishing poverty. The concept is what Copes (Copes 1989:10) named the “conventional wisdom”. According to this conventional wisdom; poverty in fisheries is therefore related to the level of exploitation of the resource, that is, over-exploitation=low catch=low income=poverty (Neiland and Béné 2004:66).

No wonder, the Food and Agriculture Organisation, FAO (1974) emphasised that “the people engaged in shore activities and their families with few exceptions, live at the margin of subsistence and human dignity”. It also quoted Copes (1989:6) as referring to these activities as small-scale fishers in developing countries. Additionally, it also quoted the World Bank (1992:2) as; “ The harvesting, processing and marketing of these resources is a source of income for over 100 million people, about 80% of whom are in the low income or poverty group”(Neiland and Béné 2004:62-66). There are statistics on the exploitation of the fisheries that buttress this point. For example, it has been stated that only 25 % of the world’s fish stocks remain under-exploited (FAO 2002 in Neiland and Béné 2004) with the majority being fully exploited and 18 % thought to be over-exploited. The percentage of stocks over-exploited is increasing annually reflecting the increasing pressure on these resources which will further aggravate the endogenous origin of poverty if nothing is done about it.

4.8.2 THE EXOGENOUS ORIGIN OF POVERTY

Under this theory, poverty in fisheries is explained by the fact that fishers do not work in isolation but hand in hand with other sectors of the economy. In this second school of thought, poverty in fisheries is because fishermen have low opportunity incomes. This means that there are lacks of alternative income activities outside the fishery sector which keep fishermen in the sector because there is perhaps no incentive to transfer their labour between different sectors of the economy.

Both Gordon and Hardin touched on this Malthusian mechanism in their respective papers- (Gordon 1954:125 and Hardin 1968:1243). Therefore even if the fishermen may wish to leave the fisheries, they may not be able to do it as they want to. In the case of small-scale fisheries in developing countries, this argument is disputable because they have low capital investments in the fisheries hence is relatively easier to leave the fisheries compared to their developed counterparts who have high capital investment. Cunningham (1993:6) and Copes 1989:6&10) refuted the argument that poverty in fisheries is related to the exploitation level of the fisheries. However, they asserted that, it is the economic situation outside of the fisheries which determines the level of poverty.

Sen in his seminal 1981 book “poverty and famine” also looked at poverty from a different but rather interesting perspective. He talked about the concept of ‘entitlement failure’. This means that famine can occur amidst plenty. Therefore, if people cannot sustain their livelihood, lack of resources is only one of a number of reasons. Central to the series thesis is the concept of food entitlements. He continued to argue that, if it is indeed true that people can starve amidst surplus, then this is due to what he termed (food) “entitlement failure”. This means that there is a collapse in the means of command over food governed by a range of social, economic, cultural and political factors according to Neiland and Béné (2004:74).

This view is a dramatic change and a paradigm shift in the way in which famine is now perceived. Previously, famine was seen as a production failure often known as a Malthusian crisis. However, with this change of perception, famine is now seen as a breakdown in the right of access to food. There have been strong and heated debates over the past two decades (1980 and 1990) as to whether or not entitlement failure is the cause of poverty and not only famine. It has been observed that, power and vulnerability were amongst the most important concepts which surround the ‘entitlement failure’. This is because, when a people are empowered, their right and ability to access, maintain and defend their entitlements are enhanced. On the other hand, when a people are vulnerable, their rights to access maintain and defend their resources not fully accessed. Sen put the same opinion in another way that, “scarcity is the characteristic of people not having enough... not the characteristic of there not being enough” (Sen 1981:1 quoted in Mearns et al, 1998:5). This means that we should look beyond the availability or the unavailability of resources when it comes to poverty and look critically into how people have or are denied the access to what is truly due them.

4.8.3 APPROACHES TO POVERTY REDUCTION

Poverty in fisheries may occur as a result of production failure (e.g. Malthusian crisis). However, it has been observed that poverty building on poverty in fisheries can also occur even if fish are caught and surplus (rent) is generated. This can happen as a consequence of institutional mis-management (e.g. distribution or entitlement failure). A first case of the fishery related poverty may be due to ‘production-failure poverty’. Under this situation, fishermen are unable to derive enough economic surplus (rent) from their fishing activity to cover their ‘minimum needs’ (whatever ‘minimum needs’ means).

This production-failure in fisheries may be either due to a technical and/or economic failure. This may be due the lack of cost effective or efficient gears. It may also be due to an ecological crisis whereby there is temporal disappearance or collapse of the exploited stocks. The very core foundation of ‘fishery management sciences’ in the late 18th century (Duhamel du Montcaeu 1776, *Le Masson du Parc*, 1727 quoted in Mollat 1987:150) and the approach to “fishery management” in an attempt to alleviate poverty in fisheries has been through the use of technical and economic interventions (Neiland and Béné 2004).

In order that both economical and biological variables are maintained under this approach, there should be an ‘optimal’ trade-off between the resources and the markets. Even when the fisheries are well managed and economic rents are generated, poverty can still occur because of institutional failures. In other words, satisfying the constraints of ecological and economic variables is a necessary but not sufficient condition to reduce the level of, or to prevent the occurrence of poverty in fisheries. Even after the rent has been generated, a second type of necessary condition should be fulfilled. There should be a proper means of (re)-distribution of the rent to the community in order not to allow the most powerful in the society to appropriate the rent to their advantage.

In order, to avert this problem, the local (micro-level) and national (macro-level) institutions have to be restructured. These institutions include market, state and civil society, informal moral economy etc. These are the key institutions that shape and govern the allocation, distribution and redistribution of the wealth generated through economic activities among members of society. However, the theory of political economy (Grindle and Thomas 1991, Manor 1999, Sen 1999, Herring 2000), new international economics (Thomson et al. 1992:132)

and empirical examples (Kohli 1987, Baue1997, Breman and Mundle 1991) in Neiland and Béné (2004:86) all point to the fact that changes that tend to modify or challenge the existing distribution and allocation of rights and resources does not take place automatically over time, unless they are underpinned by a strong political willingness and administrative ability. Therefore if there is no political willingness to change the current status-quo which is as a result of a combination of past and present processes, the situation will persist and thus sustain the institutional failure poverty.

There are a number of reasons why sometimes, the political willingness may not be strong. A typical situation is where the political and local leaders themselves are beneficiaries of the loopholes in the current status-quo and therefore any positive change in the institutional arrangements meant to benefit the masses will jeopardize their future gains. Moreover, some political leaders also fear the resistance which might come from some sections of the populace as a result of the change for fear of being unpopular and losing votes in subsequent elections. It can be said that production failure is the result of conventionally managing fisheries using technological and economic interventions whereas entitlement failure is the role of institutions. From the ongoing discussions and for aquaculture to have an impact on the poor, it should be seen as a pro-poor business. However, for this to be effective, a new institutional approach is required whereby the problem of asset distribution should be solved for the poor to also have access to land in order for aquaculture to expand. This can be a step forward in combating extreme poverty and hunger by 2015 as encoded in the United Nations Millennium Development goals.

4.9 FOOD SECURITY IN GHANA

In 2003, the extension officer farmer ratio was 1:2,200. Usually, the poor always have difficulty with food needs . In terms of regional basis, the Upper East, Upper West and the Volta Regions were the regions which had the greatest food needs. These regions have difficulties with food needs higher than the national average. The extreme figure of 40.3 for the upper east region is perhaps due to a lot of factors. One factor might be that the place has long periods of drought and short periods of rainfall. Moreover, the Upper East is among one of the least developed regions in the countries.

Table 5: Regional distribution of the food needs as well as the rural and urban areas.

	Tota l	WR	CR	GR	VR	ER	AS	BA	NR	UE	UW	R	RP	U	UP
Difficulty with food needs (%)	12.8	9.5	10.3	12.1	21.9	10.8	12.2	5.4	8.7	40.3	23.3	13.8	22.5	11.6	13.7

Source: Ghana Statistical Service, 2003 CWIQ data in GPRS (2004:56). Note: WR = Western Region, CR= Ashanti Region, GR = Greater Accra Region, VR = Volta Region, ER = Eastern Region, AS = Ashanti Region, BA = Brong-Ahafo Region, NR= Northern Region, UE= Upper East Region, UW = Upper West Region, R= Rural, RP = Rural Poor, U = Urban and UP = Urban poor

4.9.1 POLICY DEVELOPMENTS MATRIX FOR MTP, HIPC, PRSC, MDDBS

There were a lot of policy objectives under this sector but the ones that concerned aquaculture were as follows:

Table 6: Policy objectives that concerned aquaculture in the Ghana Poverty Reduction scheme. Note MTP = Medium Term Plan, MOTI = Ministry of Trade and Industry, MSE = Medium and Small-Scale Enterprises, HIPC = Highly-Indebted Poor Country, MDDBS = Multi-Donor Budget Support, PRSC = Poverty Reduction Support Credit

Policy Objective	Activity & Measures	Status
AGRICULTURE MTP Modernised Agriculture based on rural development	Promote farm mechanization Provide irrigation facilities Acquire land for commercial farming Rehabilitate fish hatcheries Improve access to inputs for livestock and crop production Promote the production of high value crops	The farmers-tractor ratio improved from 1:180,000 to 1:150,000 Total land area under irrigation is 0.08% of arable land(target of 0.12 for 2005) Inventory of agricultural land acquired by government undertaken Several on-going projects were continued Not much progress achieved though several projects embarked on
MOTI MTP Development of agro-processing	Providing processing equipments to micro and small-scale producers Promote the development of agri-business zones Facilitating access to credit Encouraging exports of MSEs	Not on course Not on course No information No information

Ghana Statistical Service, 2003 CWIQ data in GPRS 2004:59 & 61.

4.9.2 HOW AQUACULTURE IS LINKED TO FOOD AND NATIONAL SECURITY

According to Ahmed and Lorica (2002:1), aquaculture is linked to food and national security in three ways. These are;

1. Adoption-income linkages
2. Adoption-employment linkages
3. Adoption-consumption linkages

This means that aquaculture has an impact on the economy through income, employment and consumption. Aquaculture has the potential to increase income because fish and other sea foods have very high income elasticity of demand. This means that when the incomes of consumers increase, there is a high tendency that their patronage for fish and seafoods will increase and vice-versa. It has been estimated that the income elasticity of fish in Ghana is close to unity (1). Moreover, the Gross Domestic Product (GDP) of Ghana is estimated to grow to about 5 % per annum. This means that the demand for fish will also grow at about 5 % per annum. The comprehensive framework that links aquaculture to food and nutritional security can be seen in the figure below.

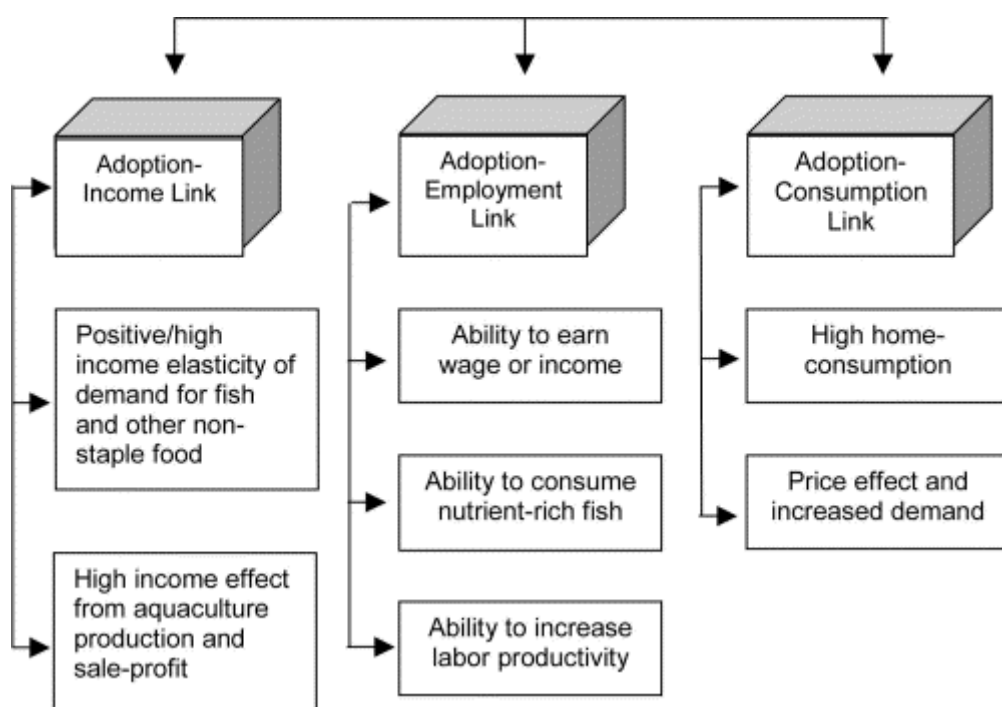


Fig. 5: A framework to analyse how aquaculture is linked to food and nutritional security.

Source: Ahmed and Lorica (2002:3)

CHAPTER 5

5.0 CHALLENGES FACING THE AQUACULTURE INDUSTRY

5.1 INTRODUCTION

According to Kapetsky and Vincke (1990:1), there are a lot of water supplies in the villages of the three northern regions in Ghana. These are the Upper East, Upper West and Northern Regions. There are also a number of dams and dug-outs in these regions. However, their fishery potential has not been realised because of a number of reasons. First of all, it has been stated that the inhabitants of these areas are not fishermen or fish eaters by tradition. Secondly, they do not catch the fishes in the dams and dug-outs until they are drying out by which time most of the fishes would have died. Finally, the northern areas of the country have long periods of drought. Because of that, they believe that when they fish in the waters, they are compromising the portability of the water.

According to the Ghana News Agency (2007:1), Minister of Fisheries, Mrs. Gladys Asmah, was quoted to have said that lack of commitment, expertise and the fact that people treated aquaculture as a hobby have been the reasons why the promotion of aquaculture failed in the past. She also added that, in addition to the factors above, the situation was worsened by the fact that the institutional policies were not clear and responsibilities were not properly allocated. The issue of weak institutions, lack of trained staff, poor networking and lack of motivated staff were also stated. Moreover, there was the lack of complete understanding of the scientific aspects of aquaculture. Finally, she said that the fact that marine and inland fisheries were giving good returns at that time did not make people see the need to pursue aquaculture as a viable enterprise (ghanaweb homepage).

In addition, it was stated according to a meeting held in Accra, on the feasibility studies of aquaculture in Ghana that the main bottleneck debilitating against the potential of aquaculture in the country is the poor quality of feed (Tradezone International 2007:2). This issue was also raised by Mr. Yitzhak Simon, an aquaculture consultant from Israel, from the Aquaculture Division, Extension Services of the Ministry of Agriculture of Israel, that the main problem of aquaculture in Ghana is the poor quality of feed (Ghana News Agency 2007:1). Mr. Peter Oppong, President of a Non-Governmental Organisation (NGO) in the country, Business Centre Advocacy Challenge (BUSAC), mentioned the lack of hatcheries for

the production of good fingerlings as a major constraint to aquaculture production. It was also stated that the national fish requirement was 940,500 tonnes but production was about 434,855 tonnes (Ghana News Agency 2007:1).

5.2 SOME GENERAL PROBLEMS OF AQUACULTURE

5.2.1. LAND TENURE PROBLEMS

There are land tenure litigations in several parts of the country where there is no formal land registration and boundaries are imprecisely defined by traditional methods. Ethnic conflicts in some areas over land boundaries have been reported in areas like Kokomba-Nanumba and Peki-Tsito. Where matrilineal inheritance is practiced, women's tenure can be insecure if the husband dies intestate. In areas where patrilineal system dominates, land ownership is less available to women (MaCPherson and Agyenim-Boaten 1991:13). Problems with land tenure have affected agricultural development projects and can similarly affect aquaculture and culture-based fisheries. Some local rulers depend on fishermen's fees for the upkeep of their stools and so do not care if there is over-exploitation of the fisheries.

Land ownership in Ghana is very important for households. This is because it has the tendency to appreciate quickly over time. Households can be able to sell their lands in times of financial difficulties as a coping mechanism. However, the net acquisition of land is not very high. This means that in as much as a lot of people are acquiring lands, a large majority of owners are also selling their lands in order to cope with the economic situation. It was only in the rural areas where there were some improvements in the land ownership. It could also be observed that the rural poor did not have any improvement in the net land ownership. This means that the increase in the land ownership in the rural areas is due to the well to do people in the villages. This can be seen in table 6. Table 7 on the other hand shows the net ownership of land on a regional basis. On a regional level it could be observed that the Volta (VR), Western (WR) and Upper East (UE) regions recorded net losses in land ownership. However, the net loss in land ownership in the Upper East Region is very striking. This means that there is something serious that should be looked into. It can also be inferred that perhaps the economic situation of the people is deteriorating. Of all the regions that showed a net increase in land ownership, the Northern Region (NR) showed very outstanding improvement.

Table 7: Rural-Urban Core Indicators Welfare Questionnaire Results (CWIQ) Result on Household Land ownership.

Land owned compared to one year ago	Total	R	RP	U	UP
Less now	2.6	3.8	5.1	1.2	2.5
More now	2.9	4.1	5.1	1.2	2.5

Table 8: Regional Distribution of the Core Indicators Welfare Questionnaire Results Result on Household Land ownership.

Land owned compared to one year ago	Total	WR	CR	GR	VR	ER	AS	BA	NR	UE	UW
Less now	2.6	5.7	1.8	0.5	2.8	1.1	1.2	1.6	5.3	12.3	4.4
More now	2.9	5.3	2.5	1.1	2	1.3	1.4	3.1	10.7	2	4.5

Source: Source: Ghana Statistical Service, 2003 CWIQ data in GPRS (2004:65).

5.2.2 FEED PRODUCTION

The quality of feed produced is also very important. For example, a test of a sample of eleven common feeds and four organic fertilizers used in Ghana indicated three of the feeds (i.e. biscuit waste, groundnut husk, and dried termite) and three of the organic fertilizers (i.e. cow manure, pig manure, and cow blood) contained fecal streptococci. These and many pathogens may be passed on in effluents to receiving waters (Quansah et al., 2007:1256).

5.2.3. LACK OF CAPITAL

The banks are willing to lend money for the construction of fish ponds but the conditions for the loans are strict and make them suitable mostly for those who are already well established economically. Generally, the estimated market value of the collateral has to be at least equivalent to the amount of funds loaned. The practical experience of these bank officers in commercial aquaculture is weak and most bank managers say they will refer any loan request by a fish farmer to the headquarters in Accra, before deciding on whether or not to give credit. For fish ponds, interest is generally reported to be about 26 % per annum (Wijkstrom and Vincke 1991:15). Because of the difficulty in assessing formal credit, a lot of farmers resort to informal credit. Most informal credits do not carry interest except for specialised money lenders. Money lenders charge very high interest rates between 50-100 % and are for short periods. The advantage of the informal credit is that the provision of the loans is relatively faster compared to the banks (MacPherson and Agyenim Boateng 1991:15).

5.2.4 MARKETING OF FISH

One main challenge is that the extension services to individual farmers normally focus on improving production, while neglecting marketing, processing (cold chains, live marketing, smoking and value added products), socio-economic factors, and the adoption of aquaculture. Because of this, the farmers have little knowledge as to how to market their products. The extension officers should be trained in giving marketing advice to the farmers. The average Ghanaian is expected to have fish purchase income elasticity close to unity or one. This means that for every 1% increase in income, the individual also tends to increase fish purchases by 1 % (Wijkstrom and Vincke 1991:7). According to Central Intelligence Agency (CIA), 2008, the 2007 real GDP growth rate of Ghana was 6.2 %. This means that with fish purchase income elasticity of close to one, the average Ghanaian will also increase their fish purchases by 6.2 % during the last year.

Fish consumption is highest in the southernmost zone, with per capita fish consumption of about 30 kg / person / year, whilst it is 20 kg in the middle zone, roughly the forest belt. However, the Northern regions are the lowest, with only 10 kg. Meanwhile the percentage of catfish and tilapias supply is about 40 % in the northernmost zone, 15 % in the forest belt and 3 % in the southernmost zone (Wijkstrom and Vincke 1991:7). Another challenge here is to use very strong marketing techniques to increase the sales of fish up north since the per capita

consumption is very low. Fish marketing is mostly centralised around the southern and middle zones of the country.

5.2.5 LACK OF INSURANCE

According to Pillay (1994:111), there is a general perception that aquaculture is a high risk activity involving a risk higher than other food production industries such as poultry, pigs, cattle etc. This may be due to various reasons. Firstly, fish is raised in an aquatic medium, generally outside the control of the farmer's direct observation and care as compared to the other food production industries. Also, aquaculture is comparatively a new industry and is still on a learning curve to establish itself on par with other allied industries. There are a lot of risks available to the sector. These include the state of technology, technical and managerial status, and uncertain financial support (Pillay 1994:111). Another group of risk also poses a challenge to the sector. These include diseases which reduce the stock, accidents, poaching, natural disasters, use of sub-standard facility inputs, production contamination and loss of income due to competition and over-production. These types of risks are common to all such ventures and not aquaculture alone (Pillay 1994:112).

5.2.6 ISSUE OF SUSTAINABILITY

Few of Ghanaian fishermen are in their 30s and 20s. This means that the issue of sustainability of the sector should be reconsidered. One possible reason might be the fact that it takes the farmers perhaps a longer time to accumulate the capital required to enter the venture. It is therefore advisable that instead of people to wait to use a greater portion of their lifetime accumulating capital, there should be mechanisms put in place to assist the youth that are interested to enter into the aquaculture business. It can be seen in figure 6 that only 5 % of the fishermen were 33 years or younger. Moreover, over 80 % were over 40 years with two-thirds being over 60.

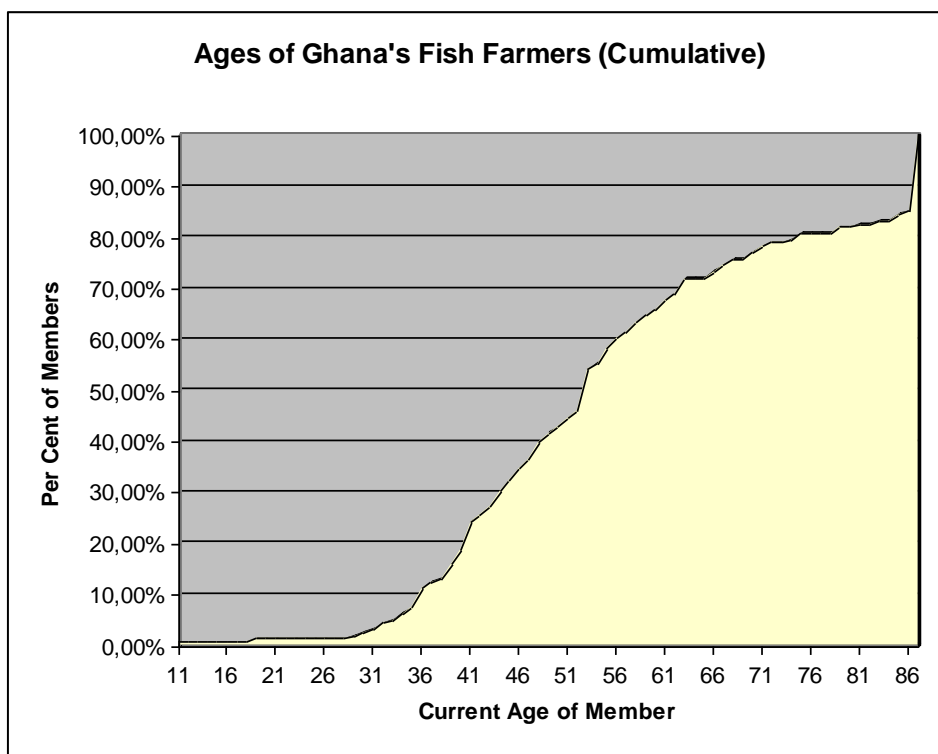


Figure 6: cumulative age of some members of four fish farmer associations interviewed in the 2003-2004 fish farmers baseline survey in Ghana. Source: FAO (2005:5)

5.3 CONSTRAINTS WHICH ARE SPECIFIC TO AQUACULTURE

1. It is unrealistic to expect that fish farming will be able to produce cheap food enough for the poorest sections of the rural and urban communities. Those fish farmers who will be able to compete with the fresh water fishermen in terms of low price are perhaps those that have access to free water and / or manure/feed.
2. The existing agro-industrial by-products are not sufficient enough at affordable prices to form the backbone for the development of aquaculture.
3. High cost and difficult access to land and water are the key determinants of the type of aquaculture likely to be successful and promoted.
4. High cost of transportation of aquaculture inputs and products.
5. Competition (seasonal) from capture fisheries for the fresh fish markets.
6. Limited fingerling production capacity, especially for catfish, *Clarias gariepinus*.
7. Lack of formal credit for aquaculture development in the short-term.
8. Lack of the appropriate materials to construct nets for pond harvest and high cost of such materials, even when available.

9. Lack of organization and co-ordination of existing research capacity. Applied research is lacking especially in the areas of:

- Artificial reproduction of *Clarias gariepinus*
- Natural and artificial reproduction of *M. vollehovenii*
- Lagoon ecology and aquaculture potential
- Use of Azolla¹¹ in fish culture
- Feeding under local conditions
- Lack of the capability for effective extension services and the appropriate extension message to carry around.

5.4 CONSTRAINTS WHICH ARE SPECIFIC TO CULTURE-BASED FISHERIES

There are a number of constraints which affect the effective development of culture-based fisheries. These are

1. Lack of research on the hydro-biological characteristics of the dug-outs, dams and small reservoirs.
2. Lack of information on the outcome of previous culture-based fisheries to serve as a basis for evaluation and the development of improved strategies for the future.
3. Lack of fry / fingerling production facilities in areas where dams and dug-outs are concentrated. This makes it impossible to stock the water or even if they are stocked, the price will be high because of transportation over long distances.
4. Lack of knowledge in fishing and fish processing techniques in some parts of the three northern regions of the country.
5. Lack of appropriate fishing gears.
6. High stocking and management cost of small isolated water bodies.
7. Lack of co-ordination between the fisheries department and other bodies involved in water resource management especially the Irrigation Development Authority (IDA) and Ghana Water Company Limited (GWCL).
8. Lack of information on the conditions for reproduction and the lack of technology for the culture of *M. vollehovenii* (MacPerson and Agyenim-Boaten 1990:12-14).

¹ Is a free-floating aquatic plant which forms symbiotic relationship with blue-green algae *Anabaena azollae*. It fixes atmospheric nitrogen and is very productive. The rotten plant contains a lot of protein and has been used in rice farming in many Asian countries like China. Their high productivity makes them very advantageous in the production of fish.

5.5 SUMMARY

There are many constraints that are fighting against the aquaculture sector in Ghana. Each of the constraints has to be taken seriously in order to be able to help aquaculture to take off in the country. However, the issues of land, capital, feed, lack of expertise and fingerling production need major attention and intervention from the government, specifically the department of fisheries and other stakeholders such as NGOs, chiefs, district chief executives, banks and the research institutions. Moreover, the leaders of the various fish farmer associations and other important stakeholders in the industry on periodic tours to neighbouring countries and other countries with the expertise in aquaculture where necessary and affordable so that they can familiarise themselves with how things are done. These tours can be co-financed by the government and the various fish farmer associations.

CHAPTER 6

6.0 PRESENT STRATEGIES

6.1 FUTURE PERSPECTIVES

Marine capture fisheries have more or less stabilised. Meanwhile the population of the country is growing. If the population is to grow at say 2.6 % per annum an estimated 28.4 million people are expected by the year 2020. On the other hand, if 3 % is used, then about 32 million people will be expected in that same time. However, according to the CIA, the estimated 2008 population growth of the country is 1.9289 %. The July 2008 estimate of the population is 23,382,484. The annual protein demand is expected to reach 405,412 tonnes per year by the year 2020.

The youthful population of the country is one of the reasons why the population is expected to increase rapidly in the near future. For example, the age groups of 0-14 years, 15-64 years and 65 years or more represent 37.8 %, 58.7 % and 3.6 % respectively. Moreover, the unemployment rate currently stands at 11 %. This expected population growth has a lot of implications. These include employment generation, the provision of social amenities and more importantly, food supply. Aquaculture is seen as having the potential to meet the protein requirements of the country even as the marine capture fisheries are collapsing. One main concern is that protein from chicken and meats are relatively expensive compared to fish. According to FAO (2001:9), cost is the main determinant factor in the selection of animal protein in Ghana. This can be seen in figure 7.

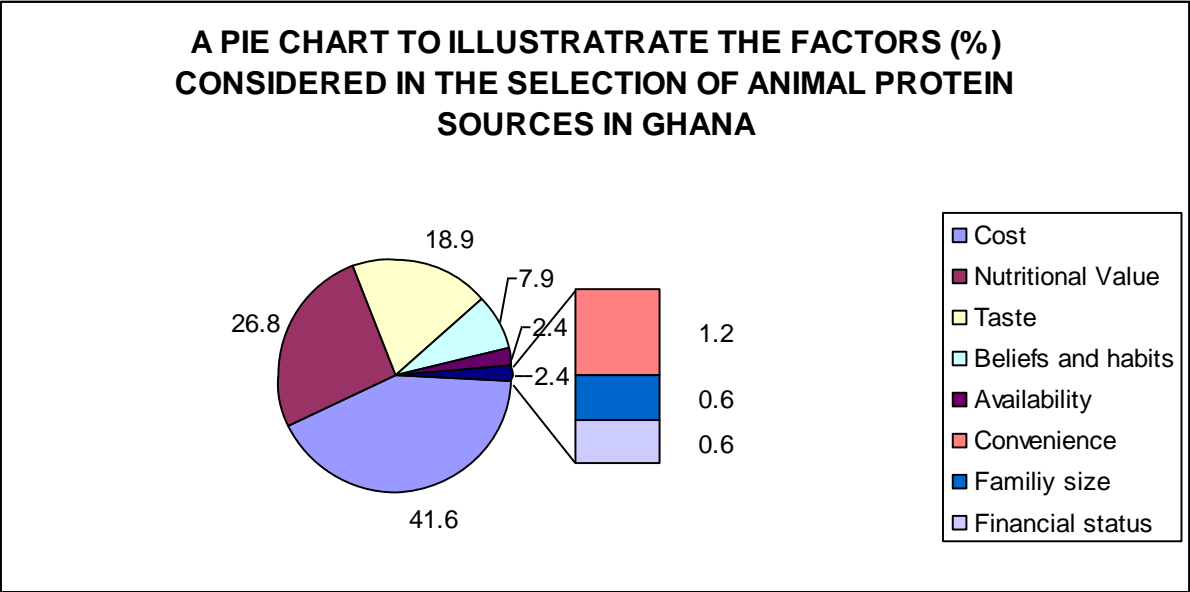


Fig. 7: Factors that are taken into consideration in the selection of animal protein in Ghana. The cost of the protein is the most important accounting for about 41.6 %. The figure was adapted from FAO (2001:29).

The pursuit of aquaculture and culture-based fisheries is justifiable for many reasons. The first is the fact that the potential of using aquaculture and culture based-fisheries to meet the protein demands of the country has not been realised. Moreover, Ghanaians are a people already accustomed to fish and promotion and marketing of cultured fish will not be a problem. This can be seen in figure 8 which shows that consumer preference for fish as an animal protein is 82 %.

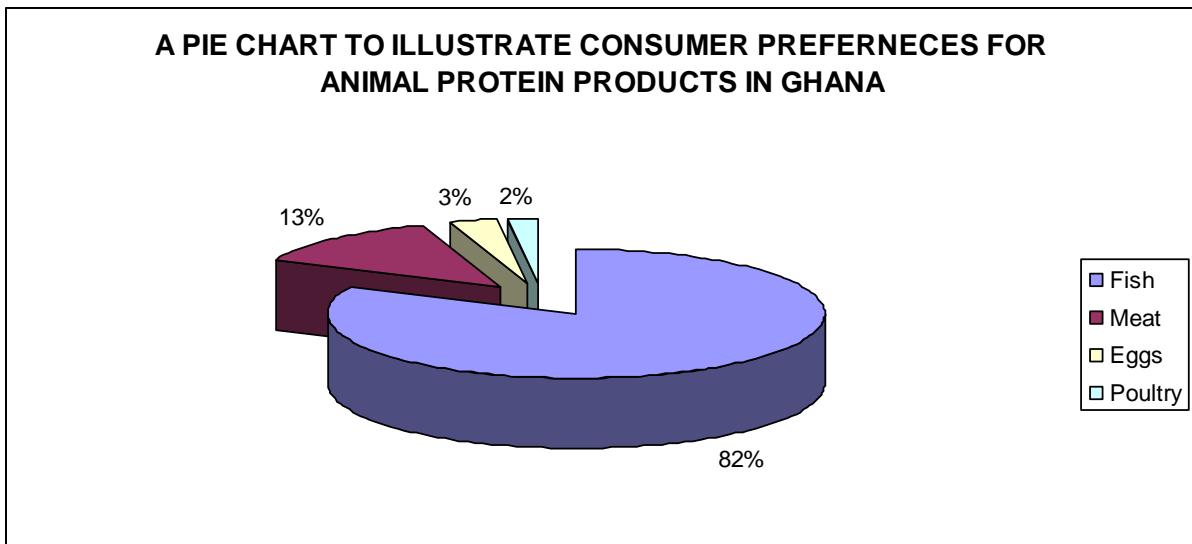


Fig.8: Preferences for animal protein in Ghana. Source: FAO (2001:29).

There is also a growing entrepreneurial interest in aquaculture and there are already a number of fish farmer associations in the system that can be sources of valuable information. The future and industrial potential of aquaculture in Ghana is bright. According to Tradezone (2008:2), the following reasons form the basis for future industrial development of the sector. These are;

1. Ghana's stable political and economic climate over the years.
2. The Ghana Investment Centre and other government agencies are currently providing the necessary support for investors.
3. When investors with high technology begin to invest in the sector, the constraints in the technological know-how could be reduced.
4. The fact that lease/purchase of land for agricultural purposes have been subsidized is another added advantage.
5. The projected fish supply and demand for Ghana to 2023 are as follows;

Table 9: Ghana’s projected fish supply and demand up to the year 2023.

YEAR	SUPPLY (TONNES)	DEMAND (TONNES)
2007	511,836	913,992
2012	584,767	1,044,226
2017	668,090	1,193,017
2022	763,286	1,363,010
2023	783,894	1,399,811

The shortfall in fish supply as against demand is an opportunity for the development of the industrial potential of aquaculture in Ghana. This is also an opportunity to create wealth and increase employment. From the period 1995 to 2000, the country on the average was 61.3 % fish sufficient within that time frame. But since the population is increasing and Ghana has a very high consumer preference for fish, there is the need to use aquaculture to satisfy the requirements now that marine capture fisheries have more or less stabilised. The figure 9 give the trend of the percentage of fish requirements satisfied over the period.

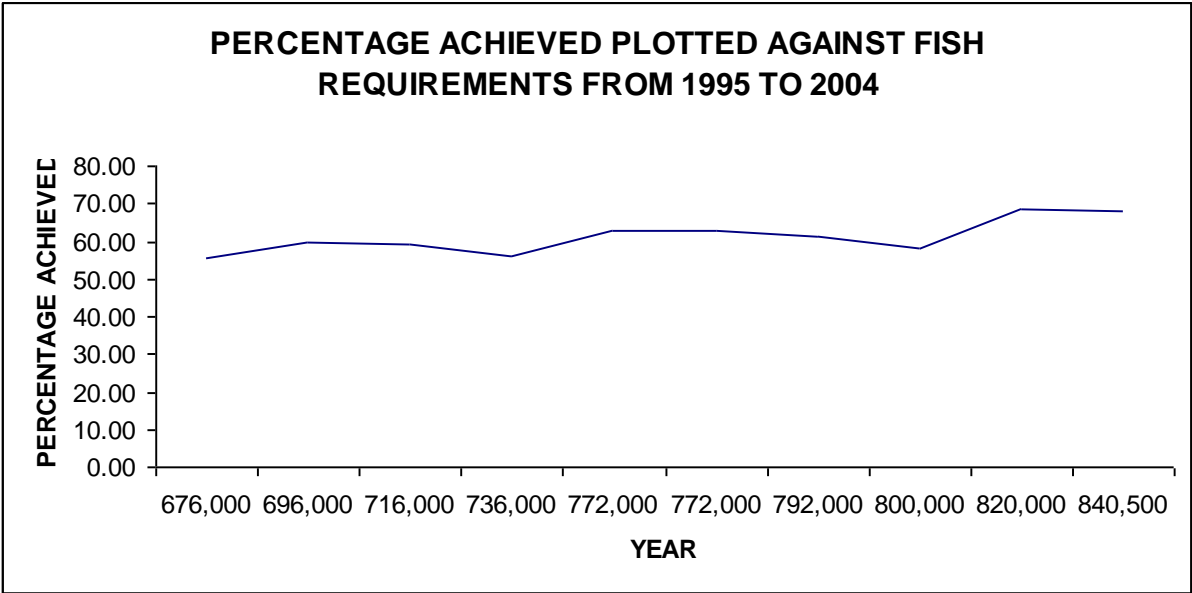


Fig. 9: Percentage of national fish requirements satisfied from 1995 to 2000.

6.2 CRITERIA FOR POVERTY REDUCTION STRATEGIES

The conventional approach to poverty reduction has been an emphasis on sectors and their performances. However, the livelihood approach goes far wider than that. It focuses on people, their assets, activities and access. The livelihood approach puts forward four criteria for analysing the livelihood of people. The first is the remoteness. It has been shown that remoteness is associated with greater poverty. This is because of the few livelihood options available. This means that when trying to reduce poverty, the remote areas should be given a lot of priorities ahead of those areas which are well integrated into mainstream economic activities (Ellis 2000:237). The second is access or lack of access to assets. This means in addition to remoteness, a very strong emphasis should be placed on the asset-less poor. The third is the substitution between assets and activities. This means that those people that do not have a lot of assets and are limited in the activities that will bring them income should be given priorities in the poverty alleviation strategies. The last are the options available to them. This can be motility which means the ability of the individual to afford to move from place to place. Moreover, there should be reduced regulation on feasible causes of action and information. Therefore poverty alleviation should focus more on those people who do not have the option to choose from among a lot of alternatives (Ellis 2000:238).

6.3 GHANA POVERTY REDUCTION STRATEGY

The Ghana Poverty Reduction Strategy (GPRS) is the key development policy framework for the country which implementation began in 2002 (GPRS: 1). The GPRS has five thematic areas. These are macro-economic stability; production & gainful employment; human resources development and the provision of basic services; vulnerability and exclusion and good governance (GPRS 2004:2).

6.3.1 MACRO-ECONOMIC SECTOR

The favourable macro-economic environment has been attributed to a number of reasons. These are the improved fiscal management, increased cocoa production and higher world prices for cocoa and gold. At the beginning of the year a 4.7 % target of GDP was exceeded when a 5.2 % growth rate was recorded by the end of the year and it was largely due to the increase in the cocoa sector. The increase in the cocoa sector was also directly linked to increased credit to the agricultural sector (2004:2). There has been some progress in land reform with respect to the issuing of Land Title certificates to individuals, and the establishment of two customary and administration units in 2003 (GPRS 2004:5).

The level of child malnutrition as measured by the proportion of children underweight has increased by 10.5 percentage points in the last five years. Analysis by region reveals that child malnutrition increased in all the regions, except the three northern regions. Prevalence is above national average in the Ashanti (46 %), Greater Accra (40.4 %) and Western (36.9 %) regions (GPRS 2004:10). Aquaculture has a very critical role to play in terms of food security. It was observed that the area under fish farming increased, yet the quantity of fish produced showed significant no progress from 2002 to 2003. It can be inferred that policies on aquaculture could not be translated into improved output (GPRS 2004:6). Moreover, there have been a lot of regulatory and administrative barriers regarding trade and investment. A very strong impact was made along this direction when the time to start a business was reduced from a hundred and twenty nine days to eighty five days (GPRS 2004:7). To boost fisheries production and support aquaculture development, the following projects were undertaken in 2003. Three dams in the Upper East region were stocked with 32,000 fingerlings of tilapia and catfish. Moreover, 20 fishponds at Tono projects area have been rehabilitated and 13 ponds were constructed in the eastern region. Additionally, two thousand one hundred fingerlings were produced and in the restocking community dams in the Northern regions. Also, thousand and thirty fingerlings were distributed to farmers in the Volta region (GPRS 2004:62).

6.3.2 PRODUCTION AND GAINFUL EMPLOYMENT

This thematic area focuses on policies designed to reduce poverty and stimulate growth. The first is about the development of the rural economy through modernising agriculture. Under this sector, additional 1200 ha of land have been irrigated in 2003. In 2002, very little progress was made with respect to releasing / acquiring land for commercial use. In 2003, the Ministry of Food and Agriculture (MOFA) in conjunction with Ministry of Land and Forestry initiated a project to help in the acquisition of land for commercial farming. The second is through sustained environmental protection through re-afforestation. The rate of deforestation per year is being decreased from 65,000 hectares to 50,000 hectares.

The third focuses on the enhancing of infrastructural development. The length of motorable feeder roads is 32,601 kilometres of which 36 % are in good condition, 26 % fair, and 38 % in poor condition. The improvements in the routine and periodic maintenance of feeder roads achieved 88.8 % of targets in 2003 whereas in 2002, 53.8 % of targets were achieved. The last

focuses on the creation of an enabling environment for private sector activities and development (GPRS 2004:4). Unemployment increased from the two Core Welfare Indicators Questionnaires (CWIQ) surveys between 1997 and 2003 from 3.9 % to 5.4 % respectively. It was worse for females than males and unemployment among the urban poor declined, with a greater decline for males from 12.5 % to 6.4 % (GPRS 2004:44). Analysis of the impact of aquaculture on income revealed clear evidence of positive income and consumption effects of aquaculture on households but the employment effects are still insignificant.

When the rates of unemployment and underemployment for 1997 were compared with that of five years later, 2003, it was observed that the situation was better in 1997 than in 2003. Even though the unemployed rates of females in 1997 (3.2 %) was lower than for the male (4.7 %) counterparts in the same year, it was higher in 2003 for females than for males. However, in 2003 the rate for females rose to 5.6 % whilst that for the males was 5.1 %. In order to address this situation, most of such women (as far as is financially possible) can be trained in aquaculture. On a regional basis Upper East is the region showing the most unfavorable conditions. Greater Accra, which is the regional capital of the country, has relatively high rates of unemployment and under-employment, probably due to migration youth from the other regions of the country only to find themselves job-less or under-employed.

Table 10: Unemployment and under-employment rates of the rural and urban households for the years 1997 and 2003.

2003 CWIQ	Total	Rural	Rural Poor	Urban	Urban Poor
Unemployed	5.4	3.5	4.1	7.6	7
Male	5.1	3.3	4.4	7.4	6.4
Female	5.6	3.7	4.1	7.8	7.6
Underemployed	13.6	14.9	8.9	12.1	10.7
Male	14.3	16	9.5	12.2	9.5
Female	13	13.9	8.4	12	11.7
1997 CWIQ					
Unemployed	3.9	2.2	2.6	7	9
Male	4.7	2.3	3.1	9.2	12.5
Female	3.2	2.2	1.3	5.2	7

Source: GPRS (2004:45)

Table 11: Regional distribution of unemployment and under-employment rates by gender for the years 1997 and 2003.

2003 CWIQ	Total	WR	CR	GR	VR	ER	AS	BA	NR	UE	UW
Unemployed	5.4	4.9	3.1	8.8	4.4	3.7	6.5	3	2	13.2	4
Male	5.1	4.6	3.1	9.2	3.9	3.2	5.6	2.3	1.7	14.4	4.5
Female	5.6	5.1	3	8.4	4.8	4.1	7.2	3.6	2.3	12.1	3.6
Underemployed	14	14.3	12.1	13.2	12.6	16.4	17	15	6.7	13.2	8.4
Male	14	14.6	11.6	13.4	12.9	18	18	17	7.5	14.1	9.5
Female	13	14	12.6	13	12.4	15.1	16	13	5.9	12.3	7.5
1997 CWIQ											
Unemployed	4.6	4.8	3.2	7.8	3.9	4.9	7	3	2.9	0.4	0.5
Male	5.5	7.1	4	10.1	4.7	3.5	7.2	4.1	3.9	0.3	0.6
Female	4.1	2.7	2.6	5.8	3.3	5.8	6.8	2.2	2	0.5	0.3
Underemployed	1.1	1.2	1.4	2	2.4	0.9	0.5	0.6	0.4	0.1	0.5
Male	1.5	1.5	1.8	2.8	2.6	1.7	0.8	0.8	0	0.3	0.8
Female	0.8	0.9	1.2	1.3	2.2	0.4	0.3	0.5	0.7	0	0.3

Source: Ghana Statistical Service, 1997 and 2003 CWIQ data in GPRS (2004:45).

6.3.3 OWNERSHIP OF LAND

One important indicator, which may provide some information on the trends in poverty, is land ownership especially in rural areas. A large percentage of Ghanaians depend on the land for their livelihood, and thus access to land will be an indicator of poverty in the agriculture areas (GPRS 2004:64). The land administration project was instituted in April 2003. At the moment, the target of fifty land administration units by 2008 will not be achieved. No progress has been made in the proposal to establish regional courts (GPRS 2004:57).

In April 25, 2003, the Ministry of Lands and Forestry, initiated a Land Administration Project (LAP) to reduce poverty and enhance economic / social growth by developing a sustainable and well- functioning land administration system that is fair, efficient, cost effective and decentralised. It is estimated that it will take fifteen years to complete the implementation of the Land Administration Project. The International Development Association, Nordic

Development Fund, Canadian International Development Agency (CIDA), Department for International Development (DFID), the German Technical Cooperation (GTZ) and KfW (Kreditanstalt Fur Wiederaufbau) are all helping to provide the needed financial and technical assistance for this project (GPRS 2004:65).

Achievements and progress concerning the issue of land include the following;

1. The acquisition of a stretch of the land from Dawhenya to Dawa in the Greater Accra Region and from Winneba through Kwanyarko. Swedru up to Budumburam in the Central Region has been identified and negotiations with the customary owners commenced in March 2003 with the view to encouraging them to use those lands as equity in new ventures. These lands will form part of the government's land bank project.
2. Since May 2003, the Government of Ghana has been taking inventory of public lands to determine those lands suitable for retention and the quantum of compensation payable. Once established to be suitable, those lands would be utilised as land banks.
3. Offices of the Lands Title Registry are being opened in Secondi-Takoradi and Koforidua in addition to the existing ones in Accra and Kumasi.
4. A public education programme, which aims at educating the traditional rulers and family heads to release land for investors started in August 2003. It is in the form of consultative meetings and phase one is targeting the three northern regions of Ghana (GPRS 2004:66).

The Ministry for Private Sector Development (MPSD) is mandated to co-operate with the various Ministries, Departments and Agencies (MDAs), NGOs, private sector entrepreneurs and other stakeholders in bringing into fruition the "Golden Age of Business" and thereby achieving the objective of the GPRS (GPRS 2004:72).

6.4 THE INSTITUTIONAL FRAMEWORK

The Department of Fisheries is the lead agency vested with the administrative control of aquaculture whereas the Water Research Institute (WRI) of the Council for Scientific and Industrial Research (CSIR) is mandated to carry out aquaculture research. Until January 2005, the Department of Fisheries was part of the MOFA, as one of the several directorates under the Minister. Fisheries extension was very weak because training in aquaculture and fisheries was not part of the curriculum of the agricultural colleges. The government on its part has implemented several measures to support and accelerate aquaculture development. These include the provision of free extension services and the training of fish farmers in aquaculture techniques. Groups of youths have been trained to construct ponds so as to reduce the cost of pond construction. The organisational capacities of fish farmer associations have been strengthened through training in book-keeping, group dynamics and the preparation of business plans. Fingerlings are also produced and sold to farmers. Also, the importation of farmed fish is prohibited except with a permit from the Ministry of Fisheries to prevent competition from cheap imported products.

6.5 RECENT DEVELOPMENTS OF THE AQUACULTURE INDUSTRY IN GHANA

When the Minister of Finance and Economic Planning, Mr. Kojo Baah-Wiredu read the 2008 budget statement he said that GH¢ 500,000 (US\$ 508,887.36) was given to newly trained and existing farmers for the construction of ponds, fingerlings and feed production. He also said that the Ashaiman Aquaculture Demonstration Centre (AADC) has been extensively rehabilitated and is expected to produce one million fingerlings annually in order to meet the ever-increasing demand for fingerlings by fish farmers in the country (Ghana News Agency 2007:1). He also said that the Ministry would work in conjunction with the district assemblies to re-organise ninety out of the hundred and eighty nine Community-Based Fisheries Management Committees (CBFMC) so as to effectively co-manage the fisheries resources at the community level (Ghana News Agency 2007:2).

The Ministry of Fisheries has set up an Aquaculture Development Committee (ADC) whose main duty is to liaise with the appropriate banking institutions on behalf of fish farmers that need loans in order to expand their production (Accra Daily Mail 1999-2007:1). The Ministry has also given fingerlings and fish feed as loans to prospective fish farmers and they were also assisted with the construction of ponds (Ghana News Agency 2007:1). In another development, the Ghana-Anglogold Ashanti (AGA) has invested US\$ 550,000 in an ultra-

modern aquaculture project at Homoase, in a small farming community in Obuasi in the Ashanti Region (GNA 2007). The Minister of Fisheries also presented a back-hoe excavator worth more than GH¢ 160,000 (US\$ 162,843.96) to the Wassa West Fish Farmers Association, Tarkwa (Ghana News Agency 2007:1). The Ministry of Fisheries has trained three hundred people country-wide in fish farming processes and this includes the inmates of the prisons (Ghana News Agency 2007:1). More than fifty Liberian refugees were trained in aquaculture so that they can use it as a source of income when they return home.

6.6 STRATEGIES FOR THE DEVELOPMENT OF AQUACULTURE

In order to develop aquaculture in Ghana both in the short-term and in the long-term, it is better to categorise it into two phases. The first is to strengthen the institutions which are directly or indirectly involved in aquaculture and culture-based fisheries in Ghana. This helps to address the institutional and structural bottlenecks of the sector. The second phase should be to overcome the production bottlenecks. The development of the second phase does not imply a compromise on the first. In addition, the institutions that are involved in aquaculture should be well resourced in terms of finances and staff in order for them to be able to carry out their duties well.

6.6.1 PHASE 1: ADDRESSING THE INSTITUTIONAL AND STRUCTURAL BOTTLENECKS

Strengthening institutions requires many strategies. This includes the improvement of co-ordination that exists between other Ghanaian institutions that are involved in the utilisation of the inland waters, research and rural extension. For example, there should be a very strong co-ordination between the Fisheries Department and institutions such as the universities, IAB and ICOUR to conduct extensive research into aquaculture in Ghana. The Department of Fisheries needs to partner strongly with the Irrigation Development Authority (IDA) in order to have more about the hydro-biology of the dams, dug-outs and reservoirs in the country and their potential for fisheries development in the country.

Moreover, there should be extensive training of fisheries staffs at all levels in fish farming, inland fisheries and culture based fisheries. Also, the Department of Fisheries should work in collaboration with the Ministry of Fisheries to train the agricultural extension staffs that are already in the fish farming techniques. This increases the productivity of the extension officers and is a cost effective strategy for the government. In addition, this will make it very

easy to implement Integrated-Agriculture Aquaculture techniques in the country since the same personnel are knowledgeable in both fields and most of the fish farmers produce other local crops either for subsistence or for cash. Also, there should be manuals for the extension officers in aquaculture techniques. In the 2003-2004 baseline survey, the areas where farmers needed training can be seen in figure 10.

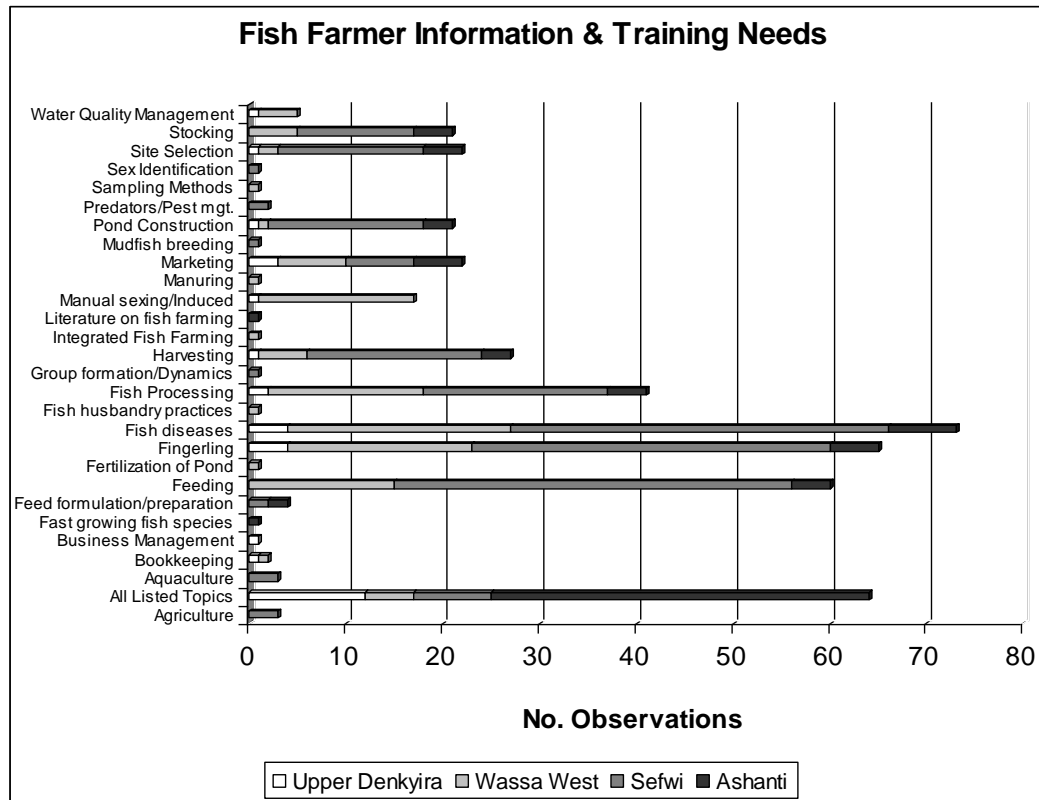


Fig. 10: Fish farmer information needs in the 2003-2004 Baseline Survey of Ghanaian Fish Farmers. Source: FAO (2005:26).

6.6.2 PHASE 2: ADDRESSING THE PRODUCTION BOTTLENECKS

(A) Development of culture-based fisheries

There are a lot of water bodies in the northern parts of the country. These are mainly dams, dug-outs and small reservoirs. However, because the indigenous people are not traditionally fish eaters, coupled with the fact that they rather use the water for domestic purposes instead of fishing due to prolonged periods of drought, the fishery potential of these areas are under-exploited. The water bodies are also used as a source of water for the irrigation of crops and as drinks for livestock. The Fisheries Department in collaboration with the IDA and the university research groups could conduct research to determine the hydro-biological characteristics of these water bodies for their effective stocking and management. This should concentrate in the Northern and Volta regions of the country because of the abundance of such water bodies.

Another study which should be conducted alongside the first is to determine the socio-economic and cultural characteristics of the communities that use the water bodies so as not to create any conflict of interest in the use of the water bodies. This can help to classify the water bodies into those that can be exclusively used for fishing purposes from those that cannot be used (MacPerson and Agyenim-Boaten 1990:16). Moreover, more fry / fingerling should be produced in sufficient quantities and in close proximity to a collection of water bodies and at the same time improving fry / fingerling production centres. Finally the government should also co-ordinate with the NGOs that are involved in the creation of new and maintenance of old water bodies (MacPerson and Agyenim-Boaten 1990:17). These programmes have the additional benefit of improving and augmenting the nutritional status of the people in the northern parts of the country.

There are many candidates which can be considered for culture-based fisheries in the country. A typically example is *Oreochromis niloticus* (tilapia). The two main reasons that make tilapia a very good candidate for culture-based fisheries are the fact that the farmers are likely to get a very good price for the products and the fact that there is already an existing technology to produce cheap fingerlings. Another candidate which can be considered is *Clarias gariepinus* (fresh water catfish). The only challenge with this is that there is not a commercially viable production of fingerlings to support a large-scale industrial boom. This means that in order to support commercial production of the species, plans should be in place to be able to solve this problem. Another candidate is the freshwater prawn, *Macrobrachium*

vollenhovenii. This species has an already established market but the only challenge is that the development of a low-cost effective technology for large scale production of the product (MacPerson and Agyenim-Boaten 1990:9).

Lagoon fisheries in Ghana can be developed as well. Small catches from lagoons already indicate that there is over-exploitation. According to Kapetsky (1984) in Kapetsky and Vincke (1990:10), lagoons are very productive systems which provide yields per unit area of 1.5 and 2.8 times more than topical reservoirs and river floodplains respectively. Brush-park²Brush-park fisheries on Ghanaian lagoons can also be given a very important attention for development. This is because lagoons with brush-parks are more productive than the ones without them. It has proven successful in neighbouring countries such as Togo, Benin and La Côte d'Ivoire (MacPerson and Agyenim-Boaten 1990:9). The main challenge however of brush-parks is the supply of wood. However, this problem has been overcome in La Côte d'Ivoire by using bamboos specially grown for that purpose.

(B) Fish farming development.

Under this sub-phase, all efforts should be concentrated in the areas that have been identified by the Geographical Information Systems (GIS) to be of high aquaculture potential. This helps to prevent the dispersion and dissipation of efforts on a wide section of areas which will not yield any meaningful return. At this stage, the local marketing of fish products from aquaculture should be analysed and planned in advance. Any factor that should aid in the distribution of fish to the markets and consumers should be strengthened or put in place. Finally, there should be a more viable and reliable line of credit to existing farmers who want to expand their operations and for new people who want to venture into the business and at low interest rates (MacPerson and Agyenim-Boaten 1990:17).

In the foreseeable future, ponds should be constructed below reservoirs, in irrigated areas and along perennial rivers and streams. In terms of species, *Oreochromis niloticus* and *Clarias gariepinus* are the most favoured species. Animal manures at sufficient levels should be produced to be able to support a very large expansion in especially pond aquaculture. It has also been said that *M. vollenhovenii* and *M. rosenbergii* should be considered for

² Is found in many tropical African fisheries. The two main conditions for brush-parks are shallow and slow moving water. This can be lakes, rivers, lagoons etc. Areas of branches of species of certain trees are placed in the water. This can provide shelter for a lot of boring insects, mollusks and epiphytic organisms. The rotten trees can also add to the productivity of the parks and spawning fish can be attracted to these areas. In Benin, Togo and La Côte d'Ivoire, certain bamboo species are grown specifically for this purpose.

development. Moreover, brine shrimp farming in solar salt panels can be tested and developed (MacPherson and Agyenim Boateng 1990:11). Possible candidates for saltwork fish farming can be euryhaline³ tilapia such as *Oreochromis mossambicus*. About eleven production strategies were found to be very profitable with *O. niloticus*. However, *O. niloticus* using chicken manure, *O. niloticus* and *Clarias* in rice fields, male *O. niloticus* using pig slurry and *O. niloticus* using compost supplemented with institutional and financial support can form the basis of a national aquaculture strategy.

However, the production technology to be used will also depend on the district under consideration due to the fact that the availability and cost of resources is different in different districts. Moreover, integrated fish farming in ponds should be promoted. This requires that the agricultural extension officers be trained in fish farming techniques. When a GIS survey was conducted in the country, five districts were found to have very high chances of fish farming development. These are Atwima, Amansie West, Ho, Kumasi and Sunyani. However, the nation as a whole is considered to be generally suitable for aquaculture production. The main aim of the GIS is to be able to concentrate most of the effort in those areas that have been found to be technically and economically feasible for optimum performance (MacPherson and Agyenim Boateng 1990:10).

In general, the practice of Integrated Agriculture-Aquaculture (IAA) in Ghana is very low. One issue is that the IAA means the investment cost of farmers will increase, still coming back to the issue of credit. It has been shown for example that a 0.2 ha poultry-fish pond increases the average operational cost by 41 % over the fish-only system. But nonetheless, the corresponding annual net income is 57 % higher. Table 12 gives some highlight on the status of integrated agriculture-aquaculture system in the country (Ofori 2000).

³ Euryhaline organisms are those organisms that can adapt to environments where the salinity changes rapidly such as estuaries and tidal pools. For fishes, they can live in fresh, brackish or salt waters.

Table 12: Current status of Integrated Agriculture-Aquaculture (IAA) and its potential in some regions of the Ghana.

IAA system	Region	Number of farmers	Potential*
Rice-fish	Western, Ashanti Northern, Upper East, Central Volta	15	***
Vegetable-fish	Ashanti, Eastern, Greater Accra	15	***
Pig-fish	Upper East, Western, Greater Accra	12	***
Poultry-fish	Ashanti, Eastern Greater, Accra, Volta	6	**
Pig-duck-fish	Greater Accra, Eastern	4	**

***, very high; **, moderate; *, low

Source: Ofori (2000)

6.7 MEETING FUTURE DEMANDS THROUGH POND AQUACULTURE

Pond aquaculture is the most common production system used in Ghana and is likely to be so in the foreseeable future. The 2006 pond and reservoirs survey throughout the country by the Ministry of Fisheries is presented in table 13.

Table 13: Total number of ponds and reservoirs in 2006 on regional basis

Regions	Ponds		Total no. of functional ponds	Total surface area of ponds in (ha)	Reservoirs	
	No. of ponds	No. of farmers			No. of reservoirs	Total surface area of reservoirs in (ha)
Greater Accra						
Eastern	239	188	239	76.25	154	219.75
Volta	441	283	430	30.2	0	0
Central	898	393	750	98	96	639.01
Western	810	100	810	68.38	24	118.89
Ashanti	425	232	400	119.25	0	0
Brong Ahafo	297	106	225	38	2	40
Northern	0	0	0	0	437	832.21
Upper East	0	0	0	0	319	966.22
Upper West	0	0	0	0	228	298.89
Total	3472	1597	3234	508.58	1370	3240.37

Source: Department of Fisheries, Ghana.

From the table, it can be observed that the functional ponds per farmer are 3473 ponds / 1597 farmers which give 2.174. On the average, each farmer owns about two ponds. The average area of each functional pond is 508.58 ha / 3234, giving a value of 0.15726 ha per pond. This means that the ponds on the average are small in size. Since each farmer has two ponds on the average, this equals about 0.322 ha. This comes back to the subsistence and the small-scale

nature of the fish ponds. The productivity of the average ponds in the country is about 2.5 tonnes per / ha / year. Therefore, the expected productivity all the total number of ponds is supposed to yield $508.58 \text{ ha} \times 2.5 \text{ tonnes / ha / year}$ which gives a value of 1271.45 tonnes per year.

Given the projected demand of fish to be 1,399,811 tonnes and supply of 783,894 tonnes, for the year 2003, as indicated in Table 11, there will be a shortfall in supply of 615,917 tonnes. Assuming that pond aquaculture is the only production method that has been earmarked to fill in the gap, this means that about 410,638.242 ha of land is required. This requires an area of land of about eight hundred and seven times the current area of land being used for pond aquaculture. However, since each farmer operates about 0.322 ha of land, this will require about $410,638.242 \text{ ha} / 0.322$, that is 1,275,274.043 new farmers. This figure has a lot of implications. One point to consider is whether or not such a large number of people can develop interest in aquaculture all of a sudden within the next fifteen years. Another factor is whether the government can be able to recruit the required number of extension officers which would be required to provide support to the farmers. However, if this is done, it will be able to help a lot of the youth to earn income and reduce the unemployment burden on the government. This assumption does not take into consideration efficiency gains. The reality is that as the production increases and new technologies are used, the productivity of the ponds will increase and not that many farmers will be required to meet the demand. However, pond aquaculture has a very important employment which can be tapped to reduce unemployment.

Looking at the number of new people are needed to fill the gap using pond aquaculture alone, is an indication of the employment potential of the sector which has not been harnessed yet. However, the huge amount of land required is an indication that a very serious intervention is required on the part of the government and stakeholders for easy acquisition of land by the existing and potential farmers. This also requires that the Aquaculture Development Committee (ADC) should be very effective in helping farmers to get soft loans for rapid growth of the industry. Another factor of major concern is that, there should be research on how to increase the present productivity of pond aquaculture from the current level of 2.5 tonnes / ha / year. Moreover, it is relatively easier for the government to help the existing farmers to boost their production capacities than to persuade new people into the industry. The huge untapped aquaculture potential can form the basis the blue revolution. Another interesting development is that, when the capacity of aquaculture is boosted, there is the

likelihood of the emergence of auxiliary industries in the supply of hatchery equipments, feed, fingerlings and many more. This means that the attempt to fill in the gap through aquaculture will actually have a multiplier effect on the economy.

CHAPTER 7

7.0 CONCLUSION

In general, Ghana has a very good climate for the development of aquaculture. However, in order to maximise the potential of the country to produce food fish, lessons must be learnt from past mistakes. A typical case in point is the situation in the early 1980s where the government's effort at convincing people into entering the aquaculture business was not successful. There were a lot of reasons that were assigned but one which is worth looking at is the fact that people saw the production of fish as a hobby instead of a business entity. This mentality is a stumbling block to any serious business venture. Moreover, a lot of people were also practicing it as a part-time business. If the aquaculture industry is to boom, it requires people who have an entrepreneurial attitude, practicing aquaculture as a full-time business with the necessary attention and commitment it deserves. Also, the government on its part should give aquaculture a major priority in its poverty alleviation programmes with the necessary technical and financial report.

According to the GPRS (2004:158), it was discovered from a study in Ghana that policies that aimed at small increases in output by the small-holder farmers are better than those that aimed at large increases in output for large commercial farmers. This means that if the government comes out with aquaculture modernisation policies directed at improving the output of the aquaculture small-holder farmers, the aggregate impact on production will be greater than just focusing on the large-scale commercial farmers. There is also the dual advantage of increasing employment because of the large numbers of small-scale farmers. This is not to mean that commercial farmers should not be supported.

Moreover the government should use the development of aquaculture as pro-poor policy instead of pro-growth policy. This means that governments should not just appraise the performance of the industry based on its contribution to the macro-economic indicators such as interest rates, GDP, output and many more. However, the target should be to monitor and assess the number of poor people whose livelihoods have improved as a result of the development of aquaculture. This is because the macro-economic indicators can look favourable without really having any beneficial impact on the poor. The main concern here is that the poor find it difficult to enter into aquaculture even if they want to due to the two main

issues of capital and land acquisition. The Aquaculture Development Committee should find ways of assisting the poorest of the poor to acquire capital and land should they develop the interest in aquaculture.

The Ghanaian economy is mostly agriculture dominated. This is an opportunity to integrate agriculture and aquaculture in an Integrated Agriculture-Aquaculture system. This can enhance resource utilisation as by-products from agricultural practices can be formulated into feed for aquaculture. This also means research should be conducted into how the by-products from agriculture can be used to produce local feed at affordable prices to the farmers. This can help to reduce the cost of production drastically.

Moreover, the Ministry of Women and Children Affairs should also assist a lot of women to enter into aquaculture. This can be very advantageous more especially to those that are single parents and have a lot of children to cater for some of whom may not have any reliable source of income. Moreover, it has also been observed that in families where the females are very active economically, according to the (GPRS 2004), school drop-out rates were very low and the children are well-fed compared to the situation where they are unemployed. This means that helping the women becoming active economically will indirectly go a long way to even reduce the numbers of street children that are found on the cities. The various NGOs committed to the welfare of women should also help in this regard. Special micro-credit schemes can be established for women.

Moreover, aquaculture as a business entity should be a highly prioritised long-term government project and as part of national policies which implementation should not be dependent on the type of government in power. This is because sometimes, government policies and priorities can change depending on the government in power. Therefore, the quest to develop and expand aquaculture should not be limited to the lifespan and interest of particular governments but should be seen as one of the means of improving the livelihoods of households.

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