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SUSTAINABLE FISHERIES MANAGEMENT PROJECT (SFMP)

Sardinella and other small pelagics value and supply chain of the fishery sector, Ghana

September 2015

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Citation: Nunoo, F.K.E., Asiedu, B., Kombat, E.O., Samey, B. (2015). Sardinella and Other Small Pelagic Value and Supply chainof the fishery scetor, Ghana. The USAID/Ghana Sustainable Fisheries Management Project (SFMP). Narragansett, RI: Coastal Resources Center, Graduate School of Oceanography, University of Rhode Island and Netherlands Development Organisation. GH2014_ACT044_SNV. 98 pp.

Authority/Disclaimer:
Prepared for USAID/Ghana under Cooperative Agreement (AID-641-A-15-00001) awarded on October 22, 2014 to the University of Rhode Island and entitled; the USAID/Ghana Sustainable Fisheries Management Project (SFMP).

This document is made possible by the support of the American People through the United States Agency for International Development (USAID). The views expressed and opinions contained in this report are those of the SFMP team and are not intended as statements of policy of either USAID or the cooperating organizations. As such, the contents of this report are the sole responsibility of the SFMP Project team and do not necessarily reflect the views of USAID or the United States Government.

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ACRONYMS

ACP-EU	Africa, Caribbean, Pacific – European Union
AFRCD	Armed Forces Revolutionary Council Decree
BoG	Bank of Ghana
CBFMC	Community Based Farmer Management Committees
DWFF	Distant Water Fishing Fleet
EEZ	Exclusive Economic Zone
EPA	Environmental Protection Agency
ERP	Economic Recovery Program
FAO	Food and Agriculture Organisation
FDB	Food and Drugs Board
GDP	Gross Domestic Product
GEPC	Ghana Export Promotion Council
GNCF	Ghana National Canoe Fishermen Council
GPS	Geographical Positioning System
GSS	Ghana Statistical Service
LI	Legislative Instrument
MCS	Monitoring, Control, Surveillance
NICFC	National Inland Canoe Fishermen's Council
NRCD	National Redemption Council Decree
OECD	Organisation for Economic Co-operation and Development
WTO	World Trade Organisation

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EXECUTIVE SUMMARY

The fishing industry is important to Ghana on many fronts including the provision of food security, nutrition, income, employment and generally sustaining many livelihoods. Marine fish production dominates total fish landings. Sardinella and other small pelagics constitute a significant amount of fish landings and virtually drive production in the marine sector. However, there has been fluctuating fish production over the past decades but with a resulting decreasing trend. Additionally, fish is a perishable commodity that starts spoiling right from haulage onto vessel deck at sea. The value of fish reduces in tandem with the extent of fish spoilage. These decreasing production trend and penchant of fish spoilage and therefore loss of value has significant attendant effects on the nation, fishers and all livelihoods associated with fisheries.

The production losses and desire to sustain wealth creation in the industry is a concern to fisheries managers and all relevant stakeholders. The United States Agency for International Development (USAID) has committed funds to the implementation of a Sustainable Fisheries Management Project (SFMP) in Ghana for five years. Partners in the project include the Ministry of Fisheries and Aquaculture Development, University of Cape Coast and SNV. The objective is to rebuild marine fisheries stocks and catches through adoption of responsible fishing practices.

This national (with a regional perspective) Sardinella and other small pelagics value and supply chain study have been carried out as part of SNV's responsibilities under the project. The objective is to assess into details the entire value and supply chain (from net to plate) of Sardinella and other small pelagics taking into consideration relationships between actors and options for value addition. Subsequently, the study makes useful recommendations on improving performance along the value chain. The results of this study will, therefore, assist the project in the development of its management strategy to rebuild small pelagic stocks.

Both secondary and primary data was collected and used in this report. The secondary data review involved consultation of existing data from stakeholders, grey and published literature including journal articles, books and other documents survey. The study sites were broadly demarcated into four *viz.*: Coastal belt, Middle belt, Northern belt, and Regional belt. The Coastal belt was made up of the four administrative regions in Ghana namely Western, Central, Greater Accra and Volta Regions. The Middle belt was made up of the Ashanti and Brong Ahafo regions. The Northern belt consisted of the Northern, Upper East and Upper West regions. Finally, the Regional belt was made up of countries in the West African region and beyond such as Burkina Faso, Cote D'Ivoire, Togo, Liberia, Senegal, and Guinea. Using a theoretical framework targeted interview guides were designed for each stakeholder group in the chain made up of fishers, fishing input dealers, fish processors, fish retailers, fish traders, government institutions, fisher associations, and consumers. Key informant interviews and focus group discussions using prepared interview guides was conducted with all above named stakeholders. The information provided by interviewees at a location determined the location of next interview. Overall, the study interacted with 121 (45 males and 76 females) key informant fishers, including representatives of two NGOs, from across all the ten regions of Ghana. GPS locations of places visited were used in the mapping of the circuits in the Sardinella chain. Ten individuals representing six stakeholder institutions in the value chain were also interviewed. Five key informants who are officers of the respective Fisheries Departments or Ministries in the identified countries (Guinea, Senegal, Cote d'Ivoire, Liberia, Burkina Faso, and Togo) were sent a questionnaire to fill and send back electronically.

Sardinella and other small pelagic production, import, export, number of processors, Ghana's commodity balances and food supply were obtained from various organizations (i.e. Fisheries Commission/Ministry of Fisheries and Aquaculture Development, Ministry of Trade and Industry, Ghana Export Promotion Authority, Custom Excise and Preventive Service, FAOSTAT). Production figures (artisanal, inshore and industrial) were obtained from MoFAD while import and export figures were obtained from MoTI. Consumption and commodity balance figures were obtained from FAOSTAT. Costs, revenue, profits and value addition figures were obtained at the various level of the chain (input dealers, traders, processors, and retailers) to estimate the profitability.

All data gathered and analysed was synthesized to generate this comprehensive report on the Sardinella value chain in Ghana. Two validation meetings was organized; an internal validation session with SNV on the draft and an external validation workshop with stakeholders and institutions on the final submitted document. The initial document was further reviewed with inputs from the validation workshop culminating in this final report.

In the Ghanaian marine ecosystem, there are two sardinella species: the round sardinella (*Sardinella aurita*) and flat sardinella (*Sardinella maderensis*). The round sardinella is more important than the flat sardinella in terms of total landings. These two sardinella species together with the European anchovy (*Engraulis encrasicolus*), Atlantic horse mackerel (*Trachurus trachurus*), Round scad (*Decapterus punctatus*) and chub mackerel (*Scomber japonicus*) are the most important small pelagic fish species in Ghanaian waters and throughout the Western Gulf of Guinea. The fishery for sardinellas in the western Gulf of Guinea is affected by various environmental factors; prominent among these is the coastal upwelling. Of the five principal fishing fleets operating in Ghanaian waters- artisanal, inshore, industrial trawlers, shrimpers and tuna fishing vessels, the artisanal and inshore purse seiners are the main harvesters of sardinellas and other small pelagics. The *ali*, *poli* and *poli-watsa* (purse seine) and to a lesser extent beach seine are the main artisanal fishing gears used. Important sardinella landing centres in the country include; Keta, Ahwiam, Tema, Chorkor, Apam, Mumford, Elmina, Shama and Sekondi/Takoradi.

Imported sardinella (around 15%) help to supplement consumption of fish in the country. Major countries that Ghana import sardinella from include; China (26%), Morocco (20%), Singapore (6%), USA (3%), UK (2%), Nigeria (0.6%) with the remaining countries such as Antigua, Belgium, Brazil, Canada, Mauritius, Mauritania and Norway catering for 42% of imports. In 2014, over 9,000 t of sardinella valued at GHC 23 million was imported to supplement domestic production (GEPA, 2015).

The main actors in the supply chain are fish input dealers, fishermen, fish mongers (processors, traders, retailers, including cold store operators), transporters and consumers. Profit margin varies from the fishermen to the consumer. The processor makes the highest profit (32.0%) while the fisherman makes the least profit (19.4%). Although there is reasonable amount of gender segregation in tasks in sardinella fish value and supply chain, overall females dominate.

Sardinella and the small pelagics form 60% to 80% of fish processed. Other fishes that are processed are the large pelagics including Tuna and swordfish; and demersals mainly consisting of barracuda *Sphyraena sphyraena*, Largehead hairtail *Trichiurus lepturus*, sole *Cynoglossus* spp. Red pandora *Pagellus bellottii*, and the seabream *Dentex* spp. In terms of product differentiation of landed quantity, 72% are smoked; 14% are frozen; 13% are fresh

and 1% is salted. These different products are consumed locally or exported. According to MoFAD (2013) official exports of small pelagics from Ghana between 2010 and 2012 have been fluctuating around 1-3 %.

The main markets for the sardinella product are firstly the national market and secondly international markets in Russia, USA, Canada, Australia, Spain, South Africa and regional markets such as Togo and Benin. Over 90% of sardinella forming about 80, 000 t of sardine is consumed at the subsistence level annually in Ghana. This clearly indicates the importance of sardinella to food security and nutritional needs of most fishers' families and fishing communities along the coast of Ghana. About 90 % of sardinella exports go into these fore listed countries. About 30 tons of sardinella and other small pelagics are exported every year to EU, USA, Russia with unaccounted quantity to the regional countries. In 2014 the export percentages were: Russia (70 %), USA (18 %), Australia (8 %), and South Africa (1 %) with the remaining 3 % going into countries such as Togo, Benin, Burkina Faso, Spain, Saudi Arabia. Sardinella is sold whole, frozen or fresh (degutted) to wholesalers, retailers or consumers.

Currently, none of listed West African countries officially import sardinella from Ghana. Generally, fish production within these countries has declined, thus, relying on imports from Europe, Russia, Namibia, and Ecuador. The annual average of fish imported to Liberia is 21,581 t valued at $5,790,540. About 104 t of sardinella valued at $ 73 000 was also imported annually into the country. The processing methods used in these countries include drying and smoking. Due to low income and salaries consumption of small pelagics is crucial in meeting food security needs.

Overall, there is very little (< 5%) post-harvest losses in the Sardinella and other small pelagics value chain because all landed catch is used directly by humans and indirectly through the poultry and aquaculture sectors. However, there are unknown but expectedly significant quantities of losses of landed catch from Ghana to neighbouring through processed fish taken across the borders to Togo, Benin, Ivory Coast, and Burkina Faso at the Elubo, Half Assini, Paga, Dormaa, and Aflao borders. This is due to inadequate capacity and effective co-ordination of activities of regulatory institutions.

The main formal institutions concerned with sardinella and other small pelagics trade, export, import and/or quality are the Ghana Standards Authority (GSA), the Ministry of Trade and Industry (MoTI), the Food and Drugs Authority (FDA), the Fisheries Commission (FC) Customs Excise and Preventive Service (CEPS) and the Driver Vehicle and Licensing Authority (DVLA). The informal institutions include Chief Fishermen, Community Based Fisheries Management Committees and Fish mummies. The various governance institutions interact more often with some specified actors. It is usual for one institution to interact with a number of the actors. Some of the roles of the institutions can be more efficiently served if collaborations are forged among them.
Recommendations include the establishment of documentation centre, improved hgiene along the supply chain, provision of timely credit, packaging and labelling of sardinella products for, fish processing education for all stakeholders, improved harmonization and collaboration of stakeholder institutions, and improved availability of pre-mix fuel and other fishing inputs. Recommended projects arising from the study are: consumers should be sensitized to improve utilization of other fish species for their livelihoods; the SFMP, government, NGOs, and other stakeholders should collaborate to set up model fish processing centres to help demonstrate best practices and modern methods in the industry to stakeholders in the value chain. One each of such centres should be set up in the Coastal, Middle and Northern belts of

the country respectively; woodlots should be established to supply fuelwood for fish processing, and research and extension should be sustained along each stage of the value chain.

1.0 INTRODUCTION

The fishing industry is important to Ghana on many fronts including the provision of food security, nutrition, income, employment and generally sustaining many livelihoods. Marine fish production dominates total fish landings. Sardinella and other small pelagics constitute a significant amount of fish landings and virtually drive production in the marine sector. Not surprisingly, there is a high demand all year round for sardinella and other small pelagics for food either fresh or processed in fried, smoked, dried, salted and cured, and canned forms. These Sardinella and other small pelagics are also widely used in the traditional hot pepper sauce ('shito') popular with students, homes and eating joints throughout the country. They are also exported through both formal and informal channels for foreign income. However, there has been fluctuating fish production over the past decades but with a resulting decreasing trend. Additionally, fish is a perishable commodity that starts spoiling right from haulage onto vessel deck at sea. The value of fish reduces in tandem with the extent of fish spoilage. These decreasing production trend and penchant of fish spoilage and therefore loss of value has significant attendant effects on the nation, fishers and all livelihoods associated with fisheries. The production losses and desire to sustain wealth creation in the industry is a concern to fisheries managers and all relevant stakeholders. The nation desires to have optimal and sustainable social and economic benefits from landed fish catch through implementation of prudent management measures.

The United States Agency for International Development (USAID) has committed funds to the implementation of a Sustainable Fisheries Management Project (SFMP) in Ghana for five years. The objective is to rebuild marine fisheries stocks and catches through adoption of responsible fishing practices. The project will contribute to the Government of Ghana's fisheries development objectives and USAID's feed the Future Initiative.

Working closely with the Ministry of Fisheries and Aquaculture Development, the Fisheries Commission, University of Cape Coast, and SNV, USAID/Ghana SFMP aims to end overfishing of key stocks important to local food security through a multi-pronged approach:

- Improved legal enabling conditions for co-management, use rights and effort-reduction strategies
- Strengthened information systems and science-informed decision-making
- Increased constituencies that provide the political and public support needed to rebuild fish stocks
- Implementation of applied management initiatives for several targeted fisheries ecosystems

This national Sardinella and other small pelagics value and supply chain study have been carried out as part of SNV's responsibilities under the project.

The objective of this study is to assess into details the entire value and supply chain (from net to plate) of Sardinella and other small pelagics taking into consideration relationships between actors and options for value addition. Subsequently, the study makes useful recommendations on improving performance along the value chain.

The study has a regional dimension which is a follow up to the national study, thus the study focuses on useful regional dimensions of the Sardinella value chain (Information on countries from which Sardinella is imported and exported with mass balance). There are reports

demonstrating that smoked Sardinella flows from Senegal and Guinea to Ghana while smoked fish from Ghana is sold in Burkina Faso, Liberia, Togo and other neighboring countries. These reports are investigated by the current study.

In general, value chain analysis is understood in the sense of characterizing and quantifying the relationships at all stages of production, processing and distribution to consumption of fish product. It identifies economic value at each stage of the chain and makes a comparative analysis of cost-benefits of each operation. The results of this study will assist the project in the development of its management strategy to rebuild small pelagic stocks.

1.1. Scope of assignment

a) Carry out a deep analysis of the value and supply chain for small pelagic products from artisanal and the semi-industrial fisheries landed in Ghana using information on fish landings and trade options at various landing sites.
b) Identify relationships at all stages of production, processing and distribution to consumption and understand the comparative advantages of different stakeholders involved. In addition, study will identify all actors along the chain and determine business and working relationships across the chain.
c) Identify entry points and possibilities for improving profits and equity at all levels of processing (from the landing site to processing sites to selling points).
d) Recommend ways to increase added value from small-scale fisheries and for women working in traditional roles in the processing of small pelagic species.
e) Identify problems associated with postharvest losses in the processing, commercialization and seasonality of these products and provide recommendations on how to manage these issues.
f) Identify gender concerns as well as the characteristics of these fisheries products in the economic sector, throughout the study.

g) Identify the means of production and marketing and map the distribution of costs and benefits among stakeholders in the entire circuit.
h) Map the chain value circuits at the national and regional levels and analyze the mass balance of imported and exported fish.
i) Characterize the relationship between each link and quantify the benefits received by each category of stakeholders in the distribution chain.

The output of the study addresses the following issues:

i. An understanding of the value of fresh and processed fish and identifies links in the chain between traders and fishermen and the conditions by which they gain revenues and potential economic growth.
ii. For consumers, it helps to understand the difficulties related to the question of the health and the quality of processed products (contamination, loss of nutrients, inadequate technology, poor conservation etc.) and food security issues (the main source of animal protein) associated with access to products in artisanal fisheries.
iii. For the Fisheries Commission in charge of fisheries management, it helps to understand the mechanisms that allow allocation of resources in the fisheries sector to maximize revenues, prevent post-harvest losses and to ensure that effective management is put in place to promote the sustainable use of resources.

1.2. Content of report

The main chapters of the report are:

- **Executive Summary**

- **1.0 Introduction** (Provides the contextual background of the study, scope of assignment, methodology and content of report)
- **2.0 The Sardinella fishery in Ghana** (An updated literature review that provides an overview of the sardinella fishing industry in Ghana and introduction to the value chain concept.)
- **3.0 Sardinella and other small pelagics value and supply chain** (Presents the principal findings on the Sardinella and other small pelagics fish value chain that covers all issues stated in the scope of work and any other interesting issues).
- **4.0 Governance of sardinella and other small pelagics value and supply chain in Ghana** (Presents the principal findings that cover all governance issues).
- **5.0 Conclusions and Recommendations** (Provides an outline of the principal findings of the study and some recommendations towards future project interventions and to help with maintaining and strengthening the Sardinella value chain in Ghana.
- **References** (A listing of all literature sources including both cited and non-cited information).
- **Annexes** (e.g. Background information on Ghana's fishing industry, Interview Guides, Tables and Figures; List of Key informants interviewed; and participants at Validation workshop).

1.3. Methodology

Literature review and desktop work

Both secondary and primary data was collected and used in this report. Secondary data acquisition consisted of desktop literature review which was conducted to update an earlier version completed by SNV. The review involved consultation of existing data from stakeholders, grey and published literature including journal articles, books and other documents survey.

Field work

The study sites were broadly demarcated into four viz.: **Coastal belt**, **Middle belt**, **Northern belt**, and **Regional belt**. The Coastal belt was made up of the four administrative regions in Ghana namely Western, Central, Greater Accra and Volta Regions. The Middle belt was made up of the Ashanti and Brong Ahafo regions. The Northern belt consisted of the Northern, Upper East and Upper West regions. Finally, the Regional belt was made up of countries in the West African region and beyond such as Burkina Faso, Cote D'Ivoire, Togo, Liberia, Senegal, and Guinea.

Using the theoretical framework in Fig. 1, targeted interview guides were designed for each stakeholder group in the chain made up of fishers, fishing input dealers, fish processors, fish retailers, fish traders, government institutions, fisher associations, and consumers. The interview guides were pre-tested at two locations in Accra, namely Madina and Agbogbloshie. Amendments were made to the interview guides using the experience from pre-testing.

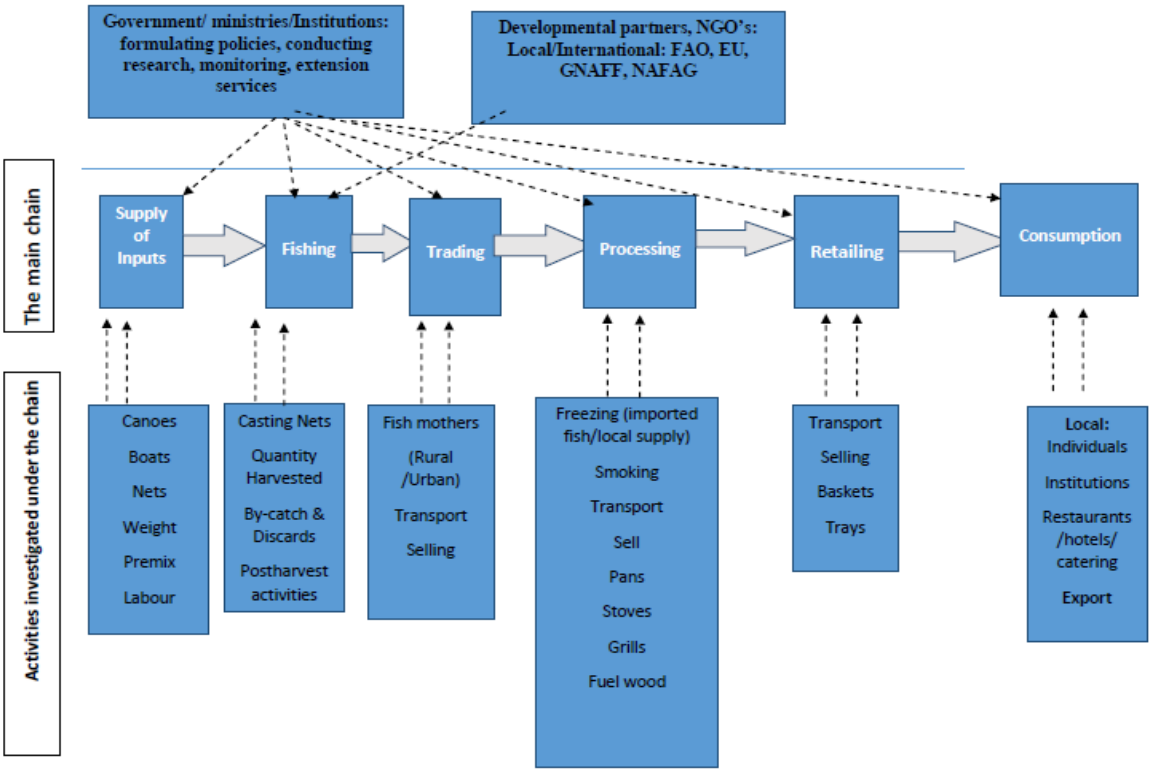

Figure 1 Theoretical framework and analytical guide

Field visits were made to each belt in Ghana, to interact with fishers and other stakeholders in the value chain to survey actors according to scope of work. At each visited site the GPS location was recorded. Key Informant Interviews (KII) and Focus Group Discussions [FGD] (Using prepared Interview guides – See Annex 3) was conducted with all relevant stakeholders including government officials at national institutions, representatives of fisher organisations, and individual fishermen, fishmongers such as processors, traders, and retailers, and consumers using prepared targeted interview guides. The information provided by interviewees at a location determined the location of next interview. Overall, the study interacted with 121 (45 males and 76 females) key informants including representatives of two NGOs, from across all the ten regions of Ghana (Annex 1). In addition, ten individuals representing six stakeholder institutions in the value chain were also interviewed.

Five (5) key informants (Annex 2) who are officers of the respective Fisheries Departments or Ministries in the identified countries (Guinea, Senegal, Cote d'Ivoire, Liberia, Burkina Faso, and Togo) were sent a questionnaire to fill and send back electronically. Follow up enquiries were done through electronic mailing to clarify any points that were unclear at the beginning.

The main aim of the survey was to identify and map actors along circuits of the chain, assess actor habits, practices and competencies as well as effectiveness of linkages and functions; as well as clarify basic and support functions. It is also geared towards gathering information on entry points, value addition, postharvest losses, and gender concerns.

Mapping the value chain and mass balance

Sardinella and other small pelagic production, import, export, number of processors, Ghana's commodity balances and food supply were obtained from various organizations (i.e. Fisheries Commission/Ministry of Fisheries and Aquaculture Development (MoFAD), Ministry of Trade and Industry (MoTI), Ghana Export Promotion Authority, Custom Excise and Preventive Service, FAOSTAT).

Production figures (artisanal, inshore and industrial) were obtained from MoFAD while import and export figures were obtained from MoTI. Consumption and commodity balance figures were obtained from FAOSTAT (http://faostat3.fao.org/download/FB/BL/E).

According to FAO (2014) and MoFAD (2013), about 80% of sardinella is used for human consumption. However, from various interactions with fish processors, traders and consumers, it was observed that about 95% is rather used for human consumption.

The 2013 Canoe Frame Survey (Akyempon, 2014) estimates 27,000 fish processors in the coastal communities while Failler *et al.,* (2014) estimates 20,000 fish processors and traders in Lake Volta. Ghana Standards Authority gives the number of industrial fish processors that are allowed to export smoked fish including smoked sardinella and other small pelagic fish as seven (7) but only four of them are currently active in the industry (Jessica Nkansah, pers. comm., 2015). These processors were taken into account in estimating the processing at the various levels, i.e. local fish monger, industrial processing and unprocessed frozen storage.

In estimating small pelagics and other pelagics fish balance in West Africa; production, import and export figures were obtained from FAOSTAT. FAO (2003) estimate that small pelagics constitute 70 % of the total landings in West Africa. Thus 70 % of pelagics production figures were estimated as composition of small pelagics. Export percentage was estimated as: export divided by production multiply by 100. Pelagic fish deficit was also estimated as production minus import.

Profitability estimation

Cost of operations, revenue, profits and value addition figures were obtained at the various level of the chain (input dealers, fishermen, traders, processors, and retailers) to estimate the profitability. Cost of operations involved the expenses made in the production process by the various actors in the value chain process. For fisherman, cost of operations involved cost of nets, ice, premix fuel, food, and labour. For traders, it consisted of storage, transportation, packaging/labelling, salaries, market tolls and other services. Operational cost for processors involved the cost of smokers, fuel wood, water, transportation, packaging/labelling, salaries and other services, while that for trailers were cost of transportation, packaging/labelling, market tolls and cost of other services. The revenue of each actor was estimated as the total income gained from selling the fish by the actors. Profits of actors were estimated by subtracting the total cost from total revenue of the actors. The total value added to fish was also estimated by the addition of all profits made by each actor along the various level of the value chain.

The SPSS and Excel software aided data processing and analysis, which was largely descriptive with some quantitative descriptors. GPS locations of places visited were used in the mapping of the circuits in the Sardinella chain. All data gathered and analysed was synthesized to generate this comprehensive report on the Sardinella value chain in Ghana and submitted to SNV.

Two validation meetings was organized; an internal validation session with SNV on the draft and an external validation workshop with stakeholders and institutions. The document was further reviewed with inputs from the validation workshop culminating in this final report.

2.0 SARDINELLA FISHERY IN GHANA

2.1 Sardinella Fishery (Production and Stock)

The fishery for sardinellas is an extremely important economic activity in Ghana. Sardinella is a relatively cheap food resource and its fishery constitutes the livelihood of many fishers; fish processors and traders in coastal areas in Ghana depend on the sardinellas. In years of good sardinella fishery, the species could constitute as much as 40% of total domestic marine fish production. Inter-annual differences in fish landings of Ghanaian fishing fleets are caused mainly by the quantities of sardinellas and anchovies caught in the years. High landings of these species result in high total landings of fish for the year and poor landings result in low total landings for the year. The sardinellas are more important than anchovy as food fish and invariably a good fishing season means large quantities of sardinellas were landed in that season.

In the Ghanaian marine ecosystem, there are two sardinella species: the round sardinella (*Sardinella aurita*) and flat sardinella (*Sardinella maderensis*). These are the only sardinella species in the western Gulf of Guinea; that is, the area between Cote d'Ivoire and the Republic of Benin. The round sardinella is more important than the flat sardinella in terms of total landings. These two sardinella species together with the European anchovy (*Engraulis encrasicolus*), Atlantic horse mackerel (*Trachurus trachurus*), Round scad (*Decapterus punctatus*) and chub mackerel (*Scomber japonicus*) are the most important small pelagic fish species in Ghanaian waters and throughout the Western Gulf of Guinea. Sardinellas have in the past played an important role in the Ghanaian fishing industry. Thirty years ago, Hammond (1962) reported that the most important fishing season in Ghana was the period when sardinellas were caught. Kwei (1964) noted that the round sardinella was the most exploited fish in the Ghanaian marine waters. In the early 1970, sardinella stocks were thought to be the greatest potential resources in the whole of the Gulf of Guinea (Ansa-Emmim, 1973).

The importance of sardinellas and chub mackerel to the Ghana fishing industry led to the setting up of a pilot cannery at Osu, Accra by the Fisheries Department soon after its establishment in 1946. This was followed by the proposition and/ or setting up of other fish processing plants with the main aim of canning sardinellas. These efforts by the Government of Ghana culminated in the establishment of the Fishery Research Unit (the Research and Utilization Branch) of the Fisheries Department. This research outfit of the Department was charged, inter-alia, with the responsibility of studying the biology and exploitation of sardinellas and the management of the sardinella fishery.

The artisanal sector employs 80% of Ghanaian fishers. Although it is typically men out on the boats fishing, women play an important role in artisanal fisheries, being almost solely responsible for selling the fish in markets (Akrofi, 2002). An informal but strong institutional framework governs artisanal fisheries at the village level (Bennett, 2000; Bailey *et al*., 2010).

Women play a very significant role in the sardinella fishery in the past. They controlled the marketing of fresh fish, dominated the processing and distribution of sardinellas and even contributed to the acquisition of new fishing nets and canoes.

2.2 Fishing fleets

Of the five principal fishing fleets operating in Ghanaian waters- artisanal, inshore, industrial trawlers, shrimpers and tuna fishing vessels, the artisanal and inshore purse seiners are the main harvesters of sardinellas. Large dug-out canoes that are usually propelled by 40 horsepower outboard motors, use beach seine nets, purse seines especially '*ali'* nets to catch sardinellas almost al1 year round. There are about 4,208 such canoes (or 49% of the total canoe population) operating in Ghana (Koranteng *et al.*, 1993). In the inshore fleet, locally-built trawler/purse seiners are used in the sardinella fishery. These vessels, ranging in sizes between 8 and 37 m, and numbering about 160 fish for sardinellas only during the upwelling periods. A few of the inshore vessels have echo sounders; otherwise detection of sardinella schools is by sight and through years of experience.

2.3 Fishing gears

The '*ali'*, '*poli'* and '*poli-watsa'* are the main artisanal fishing nets used in the sardinella fishery in Ghana. The *poli* and *poli-watsa* nets are used when the fish are schooling and the '*ali'* net is used when the fish are scattered, normally at the beginning or towards the end of the sardinella season. The '*ali'* is also the main net used in catching *Sardinella maderensis* off the main sardinella seasons.

The beach seine net which does not target sardinellas, also catches substantial quantities of sardinellas, especially young ones. Purse seine nets, similar in construction to the poli nets are used by the inshore vessels. The sizes of the meshes and twines constitute the difference between the two nets. Whereas the '*poli'* net has l0 mm stretched mesh, the inshore purse seine net has 25 mm mesh made of thicker twine.

2.4 Marine environment and Sardinella fishing seasons

The fishery for sardinellas in the western Gulf of Guinea has been found to be affected by various environmental factors; prominent among these is the coastal upwelling. Relationships between the upwelling and the availability of sardinellas in the Ivoiro-Ghanaian ecosystem have been described by Oren and Ofori-Adu (1973), FRU/ORSTOM (1976), Cury and Roy (1987) and Roy (1992).

The sardinella fishery, especially of the round sardinella, is seasonal and coincides with the upwelling period in Ghanaian coastal waters. The flat sardinella is caught in small quantities throughout the year. Two periods of upwelling occur in the Ivoiro-Ghanaian marine ecosystem. These are the major upwelling in July-September each year and the minor upwelling of January/ February and in rare cases, March. Whereas the major upwelling lasts for about three months, the minor upwelling lasts for just about three weeks and sometimes longer. In Ghana, the upwelling is assumed to have started when the sea surface temperature drops to 26°C or less. The strength of the upwelling is measured in terms of an upwelling index which takes into consideration the time period within which the surface temperature was below 26 °C (FRU/ ORSTOM, 1976). Until recently, the major upwelling was thought to be more important than the minor upwelling, apparently because more sardinellas are caught during the major upwelling period. Recent works (Koranteng, 1989; Pezennec and Bard, 1992) have shown that the minor upwelling is as important as the major upwelling for the sustenance of sardinella resources in the Ivoiro-Ghanaian ecosystem.

In addition to the upwelling, the distribution and abundance of sardinellas in the western Gulf of Guinea have also been associated with rainfall (Ofori-Adu, 1975; Binet, 1982) and year-class strength (FRU/ORSTOM, 1976). The sardinella season begins with the fall in sea

surface temperatures and the breakdown or rise in depth of the thermocline when the sardinellas undertake a spawning and/or feeding migration. Usually, the bulk of the fish is first seen in the Western Region of Ghana and moves eastwards, apparently following a migration pattern proposed by Ansa-Emmim (1976). The eastwards movement continues into the Republic of Togo and to a lesser extent the Republic of Benin. *Sardinella aurita* is the main candidate in this migration which was known by the early fishers and which widened their (fishers) movement. There have been occasional departures from this general pattern of fishing (Koranteng, 1989), as the Greater Accra and Volta Regions often record smaller than usual proportions of landings of *Sardinella aurita*. Pezennec and Bad (1992) and Pezennec (this series) have noted some of the changes in the upwelling, especially the minor upwelling, and the resultant effects on the distribution, abundance and fishery of sardinellas in the Ivoiro-Ghanaian ecosystem.

2.5 Catch Effort and Performance of Fishing Fleets

Like al1 pelagic fishery resources, the landings of sardinellas in Ghana have usually fluctuated from year to year. These fluctuations have sometimes given cause to fishers and fisheries managers to worry. There was a bumper harvest of sardinellas and other small pelagics in 1972. Landings in the three ensuing years were so low that the fishery was thought to have collapsed. Since the early 1980s there has been an increasing trend in the landings of sardinellas, especially of *Sardinella aurita*. These increases in landings have, however, not been commensurate with assessments of the biomass of the resource. For example in acoustic surveys conducted with RV Dr. Fridjoft Nansen (Stromme, 1983) and RV Cornide de Saavedra (Oliver *et al*., 1986), the combined biomass of the two sardinellas and anchovy in Ghanaian waters was estimated at 40,000 and 74,000 tonnes respectively. In the years during which the surveys were conducted, the total landings of sardinellas alone were nearly 30,000 and 70,000 for 1981 and 1986 respectively.

2.6 Post-harvest processing

Atikpo *et al*. (1992) explained that, the most significant pelagic species of fish landed by Ghanaian canoe fisheries are the sardinellas (*Sardinella aurita* and *Sardinella maderensis*) and the anchovy (*Engraulis encrasicolus*). According to Antwi (2006), various traditional methods are employed to preserve and process fish for consumption and storage. These include smoking, drying, salting, frying, fermenting and various combinations of these.

Among the various traditional processing methods employed in Ghana to preserve fish, smoking and sun-drying are the most widely used techniques for anchovies (Atikpo *et al*., 1992). Smoking is the most widely practised method; practically all species of fish available in the country can be smoked and it has been estimated that 70-80 percent of the domestic marine and freshwater catch is consumed in smoked form. Fish smoking in Ghana is traditionally carried out by women in coastal towns and villages, along river banks and on the shores of Lake Volta. Efforts are being made to improve the traditional methods of smoking, salting and drying. The main species smoked traditionally are the anchovy, sardinella, chub and horse mackerels. In 2002, the quantity of smoked fish exported was 5,312 MT with a value of US$4,380,199; that for 2003 was 6,031 MT with a value of US$3,291,750 (GEPC, 2005).

2.7 Trade and Markets

The fisheries sector contributes 3% before oil production but now forms 1.5% of the national GDP. It is estimated that about 2 million Ghanaians comprising 860,000 females and 1,140,000 males are employed or dependent on activities in the sector (extrapolation from

GSS, 2002). Fish is one of Ghana's most important non-traditional export commodities. Nevertheless, Ghana is a net importer of fish since domestic fish supplies continue to fall short of meeting total domestic demand. The ratio of imports to exports declined from the 1960s to the 1980s, but increased in the 1990s (Atta-Mills *et al*., 2004).

The major inland fish trading centres on Lake Volta are Yeji, Kpando-Tokor, Buipe, Atimpoku, Agormenya and Kete Krachi. Nearly 40,000 MT of fresh fish are cured and transported from these towns annually to the urban markets, especially in Southern Ghana. About 10,000 MT of fresh fish are harvested from other smaller rivers and lakes each year, and processed for sale in urban markets. Inland fishing centres in remote areas are not easily accessible to the major consuming centres. This factor impedes internal as well as intra-regional fish trade. Bad roads from major fish producing towns make fish distribution in Ghana very difficult. These constraints make inland fish products expensive, and also result in deterioration in quality during distribution. Total export from fish and fishery products amounted to nearly US$96 million in 2002. Average annual exports have increased more than 500% since the 1960 (Atta-Mills *et al.*, 2004). The export destination is mainly EU countries such as Spain, Portugal and Greece (DoF, 2005) and USA and Japan. Fish exports from Ghana are made up of high value tuna (whole, loins and canned), frozen fish (mostly demersal species), shrimps, lobsters, cuttlefish and dried and smoked fish.

Frozen low value fish are imported into the country. In 2002, Ghana imported US$125 million worth of fish, including US$32 million of frozen mackerel, US$7 million of frozen sardines and US$12 million of Yellowfin tuna (Audun, 2002). Frozen horse mackerel, chub mackerel as well as sardinella are imported through the Tema and Takoradi Ports and distributed through the internal trade channels, during the lean season November to May (FAO, 2004). The five top suppliers of fish are Mauritania (20%), UK (14%), Poland (8%) and Netherlands (6%) (Canadian High Commission, 2005). Other suppliers are Morocco, Norway, the Netherlands, Belgium, Senegal, Namibia, and the Gambia. Many local Ghanaian fishing companies, such as Mankoadze Fisheries, which prospered throughout West Africa in the 1960s and 1970s, have either ceased operations or are engaged in the importation and retailing of fish. The only fishing businesses that are profitable under current economic conditions are those that import fish from Europe and other West African countries into the country for domestic consumption (Atta-Mills *et al*., 2004).

2.8 Role of women in Ghana's fishery sector

Women are particularly active in Ghana's fishing industry. In marine canoe fisheries, only men fish but women are crucial as intermediaries in processing, distribution and exchange. The canoe fisheries have experienced a tremendous expansion through the introduction of outboard motors and modern nets over the last three decades. In this process the large scale female fish traders were and are central as creditors and financiers of canoes and equipment, and an increasing number of women are also owners of means of production and managers of fishing companies themselves. In the artisanal fishery sector, women have proved important in financing innovation – they supported male fishers with credit in procuring outboard motors (Overå, undated; Antwi, 2006).

Overå (1998), who did her research in Ghana, noted, for example, that in the first five decades of this century, long distance fish trade was a female occupation. A study in Guinea Conakry indicated that there are more women than men involved in marketing fisheries products. It was found that women are especially active in the retail trade while men may dominate wholesaling activities. This appears to be the pattern in other countries as well, with

certain ethnic groups dominating fish processing and trade in the region. In Ghana, wholesale trade is in the hands of the Ewes, Fantes and Gas. In inland countries like Mali and Burkina Faso, it is men who dominate both processing and trading activities.

In every fishing community, men, women and children have clearly defined activities to perform on a daily basis. Traditionally, and still in the main, men do the fishing itself while women play a supportive role. But women are now becoming more involved in diverse fishing activities ranging from processors/traders to boat owners (Browne, undated).

2.9 Value chain concept

A Value Chain can be considered as the linkage of all steps in production, processing and distribution of a product together, allowing the evaluation of each step in relation to the previous and succeeding steps (Russell & Hanoomanjee, 2012). A value chain is thus a chain of activities. Products pass through all activities of the chain in sequence and at each activity the product gains some value. The chain of activities gives the products more added value than the sum of added values of all activities. It is important not to mix the concept of the value of the product with the costs of producing it.

The value chain describes the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use.

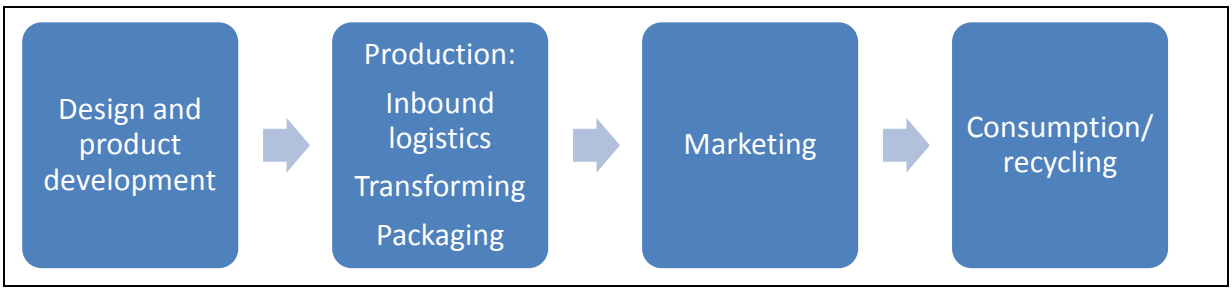

Figure 2 A simple value chain

2.9.1 The value chain concept applied to fisheries

Value chains for capture and culture fisheries differ from fish to fish and from country to country, and frequently within regions. Value chains of economically important species, such as tuna, salmon, skipjack, shrimp, tilapia, etc. composed of several nodes and products that pass through longer chains to meet the consumer. In contrast, some of the species are not economically important, but socially important, such as Hilsa for Bangladesh, Mackerel for Thailand etc., consists of shorter value chains. Value chain describes a high-level model of how fishery businesses receive raw materials as input (captures and culture fisheries), add value to the raw materials through various processes and sell finished products to customers. Moreover, fishery value chain can be defined as interlinked value-adding activities that convert inputs into outputs which, in turn, add to the bottom line and help to create competitive advantage. A value chain typically consists of inbound distribution or logistics, manufacturing operations, outbound distribution or logistics, marketing and selling, and after-sales service. These activities are supported by purchasing or procurement, research and development, human resource development and corporate infrastructure.

2.9.2 Value chain analysis

Value chain analysis looks at every step, a fisheries business goes through, from raw materials to the eventual end user. The goal is to deliver maximum value for the least possible total cost. The value chain framework has been used as a powerful analysis tool for industry's strategic planning for nearly two decades now. The value chain framework shows that the value chain of an industry or a company may be useful in identifying and understanding crucial aspects to achieve competitive strengths and core competencies in the marketplace. The model also reveals how the value chain activities are tied together to ultimately create value for the consumer. Analysts conducting the value chain analysis should break down the key activities of the company according to the activities entailed in the framework, and assess the potential for adding value through the means of cost advantage or differentiation. Finally, it is important to determine strategies that focus on those activities that would enable the industry or a company to attain sustainable competitive advantage.

The nature of value chain activities differs greatly in accordance with the types of species and companies. The value chains of companies have undergone many changes in the last two decades due to advancements in technology facilitating change at a very rapid pace in the business environment. Outsourcing will cause major changes in organizations and their value chains, with significant managerial implications. Value chain analysis is an innovative, sector-based approach to competitiveness focuses on getting more value from goods and services produced for export. Value chain analysis can help fish export of developing countries to be competitive in the international market. Goal of value chain is to offer the customer a level of value that exceeds the cost of the activities, thereby resulting profit margin. Cost advantage can be pursued by reconfiguring the value chains. Reconfiguration or structural changes of value chain refers to activities such as new production processes, new distribution channels or a different sales approach. Moreover, differentiation of value chains stems from uniqueness. Differentiation advantage may be achieved either by changing individual value chain activities to increase uniqueness in the final product or reconfiguring the value chain.

2.9.3 Fish supply chain

Entire set of processes and activities required to produce a product then deliver it to a target market is considered as supply chain. Supply chains for most of the fish species start from oceans and end up with consumer markets far from thousands of miles. A supply chain is a network of retailers, distributors, transporters, storage facilities and suppliers that participate in the production, delivery and sale of a product to the consumer (Harland, 1996).
The supply chain is typically made up of multiple companies who coordinate activities to set themselves apart from the competition. A supply chain has three key parts, these are:

- **Supply** focuses on the raw materials supplied to manufacturing units, including how, when and from what location.
- **Manufacturing** focuses on converting these raw materials into semi-finished or finished products.
- **Distribution** focuses on ensuring these products reach the consumers through an organized network of distributors, warehouses and retailers.

2.9.4 Governance of the Fish Value Chain

The Governance of the value chain is held by a combination of national institutions and supporting organizations. A number of institutions provide support to the fish value chain,

including fish exports and imports. Services rendered by these institutions include certification, traceability, research on fish stocks, enforcement of sanitary conditions and regulating best practices in relation to the fish value chain. However, some of them are limited largely in terms of logistics, manpower and capacity building of their employees. Table 1 is a summary of all the different bodies involved in the Governance of the fish value chain in Ghana.

Table 1 Institutions involved in the Governance of the Fish Value Chain in Ghana

Institution	Services offered
Fisheries Commission	Fish production
	Fish processing
	Fish marketing and sanitary
Ghana Standards Authority	Fish health certification
	Fishery products regulations
	Fish Inspection Unit (CA – EU)
Food and Drugs Authority	Fish traceability
	Fish products consumption
Ministry of Trade and Industry	Innovation & technology (particularly on fish processing) Incentive regulations
Customs Excise and Preventive Service	Fish export and imports – collection of import duty and other tarrifs
Ghana Ports and Harbours Authority	control of the fishing vessel movements and activities at the Tema Fishing Harbour. Examination of relevant documents related to imports
Ghana Export Promotion Authority	Promoting, coordinating and monitoring of fish export
Bank of Ghana	Monitor financial transactions of fish exporting companies
Food Research Institute	Fish processing
Environmental Protection Agency	Environmental impact assessment
Federation of Association of Ghanaian Exporters	Promote the expansion and diversification of Ghanaian exports to foreign markets
Ghana chamber of commence	Local business promotion and trade opportunities

Source: Updated based on Failler *et al*., 2014

Table 2 also shows value chain projects that have been completed or on-going in Ghana.

Table 2 Some Value Chain Projects in Ghana

Programme/project	Year	Geographical area	Scope of intervention & major activities
Ghana Agricultural Sector Investment Programme (GASIP)	2014-2016	Nationwide	-value chain development -value chain financing -promote equity style investments in value chain enterprises

Programme/project	Year	Geographical area	Scope of intervention & major activities
West African Regional Fisheries Program in Ghana Project WARFP (Component 3)	2012-2017	Nationwide	-value chain development -fish product trade & information
Artisanal Cold Stores Network Project – Spain Government	(2011-present)	inland & marine landing sites	-building cold stores and promoting good use of ice at the landing site -Improving sanitary control of the landing sites strengthen sanitary guarantees over the raw material reaching smoking plants
Better Training for Safer Food DG SANCO UEMOA/European Commission Directorate-General for Health and Consumer	(2010-present)	GSA / CA Fish Control Dept./ Exporters	-Continuous Training Major Activities related to the tuna industry: - Subjects: HACCP and Assessment of HACCP Systems, TRACES Systems
NORAD-FAO Project	2012	Nationwide	-value chain
The Agricultural Development and Value Chain Enhancement, USAID	2012	Nationwide	-grades & standards -value addition technologies -gender mainstreaming
USAID Integrated Coastal and Fisheries Governance Initiative for the Western Region, World Fish Centre	2011	Western Region	-fish smoking -fresh fish trade

Bailey *et al*. (undated) in their study on meeting socioeconomic objectives in Ghana's Sardinella fisheries sub-sector concluded that given the high growth rates of small pelagic fish, a sustainably managed sardinella fishery should be capable of yielding significant benefits in terms of contribution to small scale fishers and to food security. The best case scenario for the artisanal fishers would be for management to limit by-catch by the trawl fleet, and to ensure that the trawl vessels remain offshore and do not venture into coastal waters. In this situation, enough sardinella is caught by the artisanal fleet alone to supply about half of domestic fish demand, while ensuring economic benefits to coastal communities, job security and a sustainable stock. Such a scenario could therefore be considered biologically, economically and socially positive. Although higher cost scenarios result in a higher overall sardinella catch (probably due to a more productive stock), they also result in less effort, which will not be seen positively given the high unemployment rate in fishing communities in Ghana.

A more comprehensive review of background literature on the fisheries sector in Ghana generally with more focus on small pelagics especially the Sardinella fisheries is provided in Annex 3. The review also discusses information on the value chain and regional trade from a regional perspective.

3.0 SARDINELLA AND OTHER SMALL PELAGICS FISH VALUE AND SUPPLY CHAIN

3.1 Graphical representation

The flow of sardinella from production to consumption is presented in Figure 3. Sardinella production in Ghana originate from marine sources. In 2014, sardinella production was around 220, 000 MT. Between 2009 and 2014, the average annual sardinella production has been fluctuating around 226, 855 MT (Table 3). Over 50% of sardinella production come from artisanal fisheries while 25% come from inshore. The main species landed are *Sardinella aurita* (round sardinella) and *Sardinella maderensis* (flat sardinella). Other important species among the small pelagics are European anchovy (*Engraulis encrasicolus*), Atlantic horse mackerel (*Trachurus trachurus*), Round scad (*Decapterus punctatus*) and Chub mackerel (*Scomber japonicus*). Important sardinella landing centres in the country include; Keta, Ahwiam, Tema, Chorkor, Apam, Mumford, Elmina, Shama and Sekondi/Takoradi.

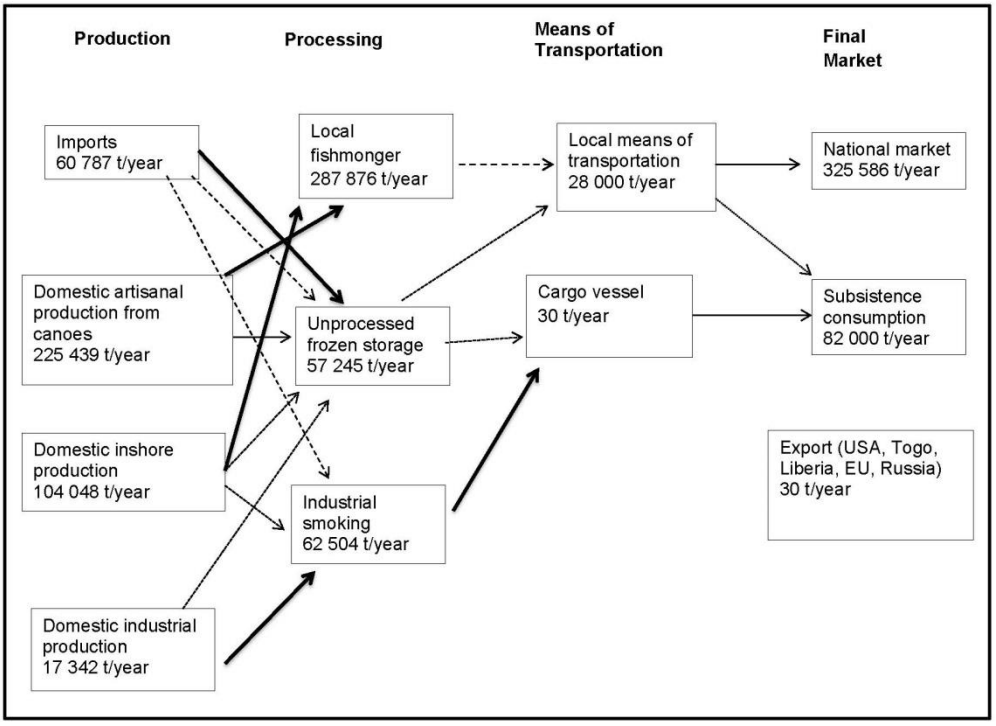

Figure 3 Flow of sardinella from production to consumption

In terms of product differentiation of landed quantity, 72% are smoked; 14% are frozen; 13% are fresh and 1% is salted. These different products are consumed locally (around 98%) or exported (around 2%). According to MoFAD (2013) official exports of small pelagics from Ghana between 2010and 2012 have been fluctuating around 1-3%.

Imported sardinella (around 15%) help to supplement consumption of fish in the country. The annual per capita consumption of fish in Ghana is currently around 28 kg. Sardinella and other small pelagics play important role in the nutrition of about 25 million Ghanaians, helping in reducing deficiencies of vitamins and iron in children. Major countries that Ghana import sardinella from include; China (26%), Morocco (20%), Singapore (6%), USA (3%), UK (2 %), Nigeria (0.6%) with the remaining countries such as Antigua, Belgium, Brazil, Canada, Mauritius, Mauritania and Norway catering for 42% of imports. In 2014, over 9,000

t of sardinella valued at GHS 23 million was imported to supplement domestic production (GEPA, 2015).

The main markets for the sardinella product are firstly the national market and secondly international markets in Russia, USA, Canada, Australia, Spain, South Africa and regional markets such as Togo and Benin. About 90 % of sardinella exports go into these countries. In 2014 the export parentages were: Russia (70%), USA (18%), Australia (8%), and South Africa (1%) with the remaining 3% going into countries such as Togo, Benin, Burkina Faso, Spain, Saudi Arabia. Sardinella is sold whole, frozen or fresh (degutted) to wholesalers, retailers or consumers.

Ministry of Trade and Industry (MoTI) figures indicated that in 2014 about 170 t of sardines value at GHC 240, 000 were exported. Frozen sardines from Ghana have been exported to Togo, Austria, China, EU and North America. Smoked sardinella are also exported mainly by industrial processors to EU and North America. The smoked fish exporters that have been approved by Ghana Standards Authority to export smoked sardinella are shown in Table 4.

About 80 000 t of sardine is consumed at the subsistence level annually in Ghana. This clearly indicates the importance of sardinella to food security and nutritional needs of most fishers' families and fishing communities along the coast of Ghana. An estimated 1.2 million Ghanaians are considered food insecure and facing chronic undernutrition. The annual per capita fish consumption in Ghana is currently about 28 kg, which is higher than the Africa and world average of 9 and 18 kg, respectively (FAO, 2014).

Table 3 Fish Production, Sardinella Production, Export and Import from 2000-2014 (t)

	2009	2010	2011	2012	2013	2014
Marine	326, 109	309,558	326,545	333,697	333,697.00	314,867.57
Inland (Wild)	74,500	83,126	95,353	95,791	95,000.00	86,740.75
Aquaculture	7,203	10,000	19,092	27,450	27,450.56	32,512.00
Total Fish Production	**407,812**	**402,684**	**440,990**	**456,938**	**456,147.56**	**434,120.32**
Fish export quantities	57,621	62,750	44,144	62,984	185,000	
Fish import quantities	170,744	199,798	191,428	175,340	484,000	
Sardinella production	228,276	216, 690	228,582	233, 588	233,587	220, 407
Sardinella export		543	1,510	2,153		176
Sardinella import	262	50,786	79,474	52,100	25,1889	9, 228

Sources: MoFA, 2015; MoTI, 2015; FAO STAT, 2015; MoFAD, 2012

3.2 Mapping of actors, Profitability and Regional Partners

Sardinella supply chain comprises mainly of fishing input dealers, fishermen, traders, processors, transporters, retailers and consumers (Figure 4) whose profiles are outlined below:

Fishing input dealers

- Have regular customers, anyone
- Sell or buy on credit when regular
- Competitors are Chinese shops and other local shops
- Constraints: Capital, high demurrage, taxes, and fluctuating exchange rates,
- Improve business when: exchange rate is stable, get capital, one stop supplier, improve documentation, innovative marketing strategies
- Import from Japan, China, EU
- Main sources in Ghana:- Accra and Tema.

Fishermen

- Source of livelihood, income, money to pay children school fees
- General decline in fish catch
- Increase in search time for Sardinella shoals
- Excessive use of fuel; increased fuel costs
- Premix fuel not always available,
- Over-priced outboard motor; often not adequately available
- In conflict with trawlers, pair trawlers and those fishing with light
- Sardinella comparatively perishes faster
- Fishmongers dictate price when they land at odd hours
- Sell cash/ Credit/ Supplies and inputs
- Have regular fishmongers who are often wives, kith and kin; sometimes help to prefinance or are owners of gear/canoe
- Want increased government subsidy on premix fuel and other inputs, deal with light fishing, and provide improved landing sites.

Fishermen sell to wholesalers or retailers and retailers in return sell to consumers who may be in urban or rural area. In some cases, fishermen sell directly to the final consumers who come to the landing sites. Sardinella traders (see Plate 1) sell to processors, retailers and consumers mostly in frozen form. Profit margin varies from the fishermen to the consumer. The processor (see Plate 2) makes the highest profit (32.0%) while the fishermen (see Plate 3) make the least profit (19.4%). However, depleting fish stocks, open-access nature of the fishery, climate change and lack of alternative livelihoods are challenges confronting the sustainability of fishermen jobs.

The unit price of sardinella depends on demand and supply. It is ranges between GHC 3.20 and GHC 5.50 per kilo.

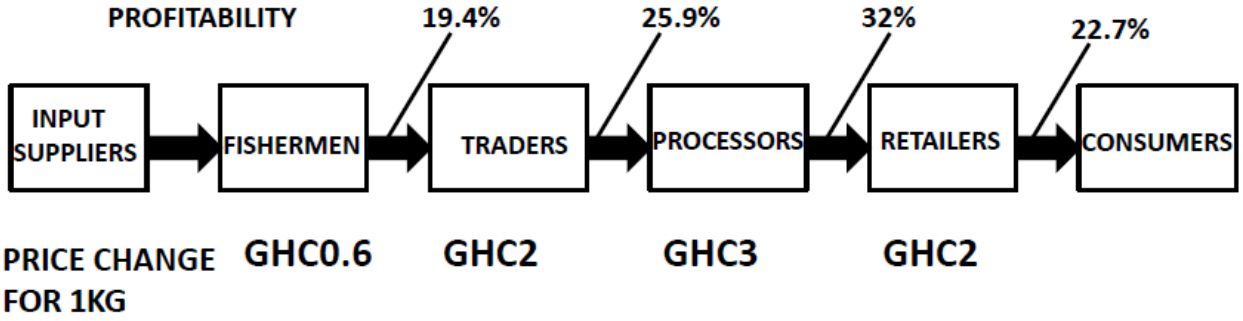

Figure 4 Sardinella and other small pelagics smoked fish supply and value chain

(Source: Field study)

- There are about 220, 000 artisanal fishermen in Ghana (with about 2 million dependents) operating 13,000 canoes from 334 landing centers in almost 200 fishing villages located along the coast (Akyempon *et al*., 2013). These fishermen target sardinella and other small pelagics of all sizes and able to land over 225 000 t/year (Figure 3). About 27, 000 people are involved in sardinella processing and marketing (Akyempon *et al*., 2013).
- Industrial fish smoking sector (approved establishments) is currently represented by four companies (see Table 4) having the following features in common:
    - Mainly Ghanaian owners
    - Relying mainly on marine and inland small-scale fisheries and occasionally on imports for the raw material
    - Employing skilled processing employees
    - Customers: mainly the African Diaspora living in European countries
    - Employment: 90 people divided as follows:
      -Small-scale fishermen: 10 people
      -Smoking processors: 50 people
      -Upstream: 20 people
      -Downstream: 10 people
    - Competitors: Africa (Gambia), Asia (China, Thailand), South America.

Table 4 Current Active GSA Approved Smoked Fish Exporters

Name of smoking establishment	Location	Clients
Liwon Enterprise	Tema	USA, UK, Netherlands, Germany, Belgium, Switzerland, Norway
Can & Kaa	Achimota	Germany, Belgium, UK, Netherlands
Cipomaah Enterprise	Ashaiman	
African Smoked Fish	Accra	

Source: GSA, 2015

Plate 1 Fish imported stored at cold room (Adom Mboros cold store, Kumasi)

Plate 2 Fish processors (male and female)

Plate 3 Fish retailers (Top: stationary in market; and Bottom: itinerant)

Transporter

Transport is relatively costly in Ghana. For sardinella and small pelagics, all transport over longer distances is by road-transport using cold vans, taxis (Plate 4) or other passenger vehicles. Road-transport is relatively costly, per ton-km, as a result of the large import content of transport services and the relatively bad conditions of the road-network.

Transporters complain of high import tariffs, bad roads, recent over 100% hike in insurance fees, high cost of inputs, unstable prices of petroleum products, and inconsistencies in road user enforcement by the Ghana Police. Within the markets and at the beaches, transportation is mainly through head porters, small trucks and tricycles. These are regulated by fish mummies and the metropolitan and district assemblies respectively, usually through the payment of market tolls.

Sardinella and other small pelagics exported goes through cargo vessels in Tema port. The airlines also allow individuals to carry up to 20 kg of fish products including sardinella and small pelagics.

Plate 4 Smoked sardinella being transported by taxi to a market

Appendices 4.1 and 4.2 show fish, sardinella and other small pelagics production, exports, imports from/to Liberia and Guinea between 2010 and 2014. Currently, none of these countries import sardinella from Ghana. Generally, fish production within these countries has declined, thus, relying on imports from Europe, Russia, Namibia, and Ecuador. The annual average of fish imported to Liberia is 21,581 t valued at $5,790,540. About 104 t of sardinella valued at $ 73 000 was also imported annually into the country. The processing methods used in these countries include drying and smoking. Due to low income and salaries consumption of small pelagics is crucial in meeting food security needs. The per capita consumption of fish within most regional countries is 2.50-27.91 (Table 5)

Table 5 Per capita fish consumption in West Africa

Country	Item	2008	2009	2010	2011
Ghana	Fish, Seafood +(Total)	27.61	23.97	23.37	27.19
Benin	Fish, Seafood +(Total)	14.20	13.30	13.40	13.50
Burkina Faso	Fish, Seafood +(Total)	2.60	4.30	5.30	6.80
Cote d'Ivoire	Fish, Seafood +(Total)	17.30	19.10	20.20	19.80

Gambia	Fish, Seafood +(Total)	29.20	29.50	28.60	26.50
Guinea	Fish, Seafood +(Total)	8.40	11.50	9.80	9.70
Liberia	Fish, Seafood +(Total)	3.80	2.60	2.50	2.50
Nigeria	Fish, Seafood +(Total)	16.30	14.20	15.20	17.10
Senegal	Fish, Seafood +(Total)	26.20	26.10	25.40	24.70
Togo	Fish, Seafood +(Total)	7.40	6.80	6.70	6.50

FAOSTAT FAO Statistics Division, 2015

3.3 Performance of the processing industry and Gender

A significant number of fishmongers encountered doubled up as fish processors, fish traders and fish retailers. In the few instances where the fishmongers did not retail fish, the retailers of their produce were often kith and kin. These arrangements enabled fishmongers to take advantage of all profits from one stage of the chain to the other.

Fish smokers can be categorised into four based on their size of operation. There are the industrial fish processors who are maily export driven. Those with up to 10 ovens were labelled as small scale; from 11 to 25 ovens as medium scale and those with ovens beyond 25 in number were categorised as large scale fish processors. Some of the large scale fish processors are an aggregation of a number of individual processors forming an association e.g. Dzigbodi Fish Processing Co-operative at Atorkor, Dzigbodi Fish Processors Association at Tema, and Abuesi Fish Processing Association at Abuesi. These associations are able to reap the benefits of economies of scale as well as able to meet the large demands of partners or agents who buy fish for export. The large scale fish processors often stay at their processing site and fish traders either come to buy fish from them. It was common for the small scale processors to double as both fish traders and retailers. The fish traders and fish retailers take fish to the markets. Fish traders buy fish from processors in wholesale and send them to markets for direct sale to retailers. Their business is dependent on regular fish supply and availability of capital. There are two types of fish retailers, those that sit in the markets and wait for buyers and those that are itinerant and take fish to the doorsteps of consumers and restaurant operators. The small scale processors mainly buy fish from Ghana, including ‘trash fish’ (‘Saiko fish’) from any fisherman or craft with cash. The medium and large scale processors either had their own vessels or designated vessels to regularly supply fish landed in Ghana; or sometimes buy locally caught ‘trash fish’ (‘Saiko fish’) at landing beaches, or import fish from Cote d’Ivoire and other countries, as well as buy imported fish designated cold stores for processing. They are either supplied fish on credit or pay with cash. The major sources of credit to fishmongers are microfinance, personal savings, and rural banks.

Large and medium scale processors have partner traders and agents that either come for the fish at the processing grounds or are sent the fish at their locations. Some of the agents are outside Ghana in places such as Canada, Spain, and New York and Washington DC in the USA. Those with a permanent arrangement called ‘partners’ receive supplies regularly and remit cash through the banking system while a few more are labelled as ‘agents’ who come in as and when they want and buy fish for export in their own time. Sometimes these agents do

not meet times of bumper harvest so purchase whatever quantity is available. Such agents therefore buy from many other processors.

The common fish processing methods for Sardinella and the other small pelagics are drying, salting and drying, drying and smoking, frying, and smoking. Anchovy *Engraulis encrasicolus* and carangids such as *Chloroscombrus chrysurus* and *Selene dorsalis* are often dried. A significant amount of Anchovy is dried and smoked. Both species of Sardinella are commonly smoked. Sardinella is only salted when it goes bad before processing. In such a situation it helps to minimise the losses as processor at least gets some income. The mackerel *Scomber japonicus* and the horse mackerel *Trachurus* spp. are commonly smoked. In this case also, it is only when these fishes go bad that they are salted and dried. *Trachurus* spp. can sometimes be fried and enjoys large patronage from consumers of kenkey, fried yam or fried potatoes. Fish processors indicated that Sardinella and the small pelagics form 60% to 80% of fish processed. Other fishes that are processed are the large pelagics including Tuna and swordfish; and demersals mainly consisting of barracuda *Sphyraena sphyraena*, Largehead hairtail *Trichiurus lepturus*, sole *Cynoglossus* spp. Red pandora *Pagellus bellottii*, and the seabream *Dentex* spp.

The Sardinella and other small pelagics fish processor needs a number of inputs that are expenditure items to dry, salt and or smoke, store and market fish. These include but not limited to fresh fish, ice-block, truck or any means of transport for fish, aluminium bowls, baskets, open space, oven, wooden trays fitted with wire mesh, fuelwood, brown paper (either cement paper or empty carton paper), potable water, seawater, nets, twine, and labour including both males and females. The fish processors use all manner of fuelwoood, including cut mangroves, which is their major expenditure item following fish purchase and labour costs.

Although there is reasonable amount of gender segregation in tasks in sardinella fish processing and supply chain, females dominate at all levels. The female fishmonger buys the fish and washes them at the beach. The males transport the fish on trucks to the processing site when fish landings are high. When fish landings are low, females carry fish on the head to the processing site. Similar arrangement pertains to fish bought from the cold store. The sorting of fish as well as arrangmeent of fish onto trays at the processing site is done by both sexes. Often the lifting of fish onto the oven is done by the males but are sometimes helped by the females in situations of inadequate labour. The tending of the heat and the fish on the trays are the preserve of females while the males dominate in the turning around of trays on the oven. When smoking is completed both sexes can help pack the fish for storage. Lifting of packed fish is the preserve of males, when they are available. Women sprinkle water on the floor prior to sweeping the bare floor to receive Anchovy for drying. On hot sunny days, Anchovy can take between 3 to 5 days to be properly dried for subsequent storage or smoking. Men often lifts baskets of processed fish onto trucks or vehicles for marketing. However, in their absence the women can do same because Sardinella and the small pelagics are not that heavy to break the human back. The large scale fish processors have clerks who are often males but in a few instances the women fish processors take their own records. The average ratio of females to males in the sardinella value chain is 7: 3.

Overall the common fish smoking technology is the ‘Chorkor smoker’. However, the round metal barrel ovens were common in the northern belt and was used largely by the small scale operators. The ‘Kosmos oven’ was available at only a few places in the middle and coastal belt regions but totally absent in the northern belt. It was second popular to the Chorkor

smoker because of its dual use for both smoking and storage of processed fish. Gas smoking of fish was only seen at Abuesi in the Western Region and operated by the Abuesi Fish Processing Association. The Morrison oven, although commonly talked about by fishers, was not spotted at any of the many processing sites visited.

The Abuesi Gas Fish Smoker (see Plate 5) is a liquefied petroleum gas (LPG) operated fish smoking equipment designed by GRATIS Foundation, Ghana. The current cost of one such stainless steel oven is GHC 45,000. Other accessories needed for operation are a steel metal table (5 x 3 x 3 ft) valued presently at GHC 5,800, fish trolley GHC 4,300 and a number of aluminium basins sold at GHC 50 each.

The Abuesi Gas Fish Smoker is a double-chamber oven with the dimensions of 1.2 m x 2.4 m x 1.8 m. The frame/body is made of a stainless steel to prevent rusting. At the bottom of each chamber is a perforated metal coil through which the gas burns to heat the entire oven. The coil is connected externally to a hose that also connects to a gas cylinder. The oven is also equipped with a thermometer for temperature determination. Within each chamber is a suction fan that sucks moisture from the oven since the heated oven moderately cooks the fish during the process of smoking. Each chamber is designed with a number of grooves where oven wire meshes can be slotted for fish to be arranged on them for smoking. A fully loaded oven takes about 0.7 tons of fish and the smoking process can be accomplished in two hours. The smoking process can also be staggered such that after the fish are smoked in one oven chamber, the gas can be turned off allowing the heat in the chamber to further dry the fish whiles fresh fish can be loaded into the second chamber for smoking. This would allow one fish processor to be doing different work such as descaling, smoking and packaging within the two hours.

The advantages of the Gas Smoker are as follows:

1. Processors do not come into direct contact with fire as it is with fuel wood operated ovens.
2. It prevents deforestation
3. It is more hygienic
4. The threat to the health of processors by smoke/sooth is prevented
5. Processors can do other tasks while fish is in the oven
6. It takes a shorter time to process the fish than the traditional smoking methods

The disadvantages may include:

1. The cost of installation and operation of oven as compared to fuel wood
2. The dangers involved in case of explosion of the gas cylinder accidentally
3. The unreliable supply of LPG in the country.

Plate 5 Abuesi Gas Fish Smoker – Top showing both chambers closed and Below showing one chamber opened.

The first stage in Sardinella and other small pelagics processing is the purchase of fish from the supply source, often in multispecies. Some of the processors wash the fish thoroughly at the seaside using seawater while a few others after washing with seawater do wash with potable water at the processing site. Those who wash fish solely with seawater believe the seawater further preserves the fish for it to last longer in storage while those who wash with potable water believes it helps to remove particles of sand from the fish in addition to making it cleaner for consumption. The pre-washed fish is subsequently brought to the processing site in crates or bowls. Those who buy exported fish from the cold stores bring them in cartons to the processing site and spread them out on trays in the open after packaging is removed for thawing.

On arrival at the processing site, the locally sourced fish from the beach is commonly sorted into the different species from large spread of plastic mat onto wooden trays by hand by both men and women. The women commonly prefer buying the small sized small pelagics to the bigger sized Sardinella because the small sized fishes has higher value on the markets. The mixed species often comprise *Sardinella aurita* (round sardine) and *S. maderensis* (flat sardine), *Engraulis encrasicolus* (Anchovy), and *Decapterus punctatus*. The sorting into the various species is laborious and often takes a while to complete, given the dominance of small sizes. The processors prefer to have same species on each tray. For instance flat sardinella is often arranged on its side in a curved manner for efficient smoking (Plate 6).

Plate 6 Arranging sardinella in curved manner for efficient smoking

There are two types of trays used by the fish smokers; a lower depth one for smoking and another with deeper depth for storage purposes. During arrangement of fish on the trays for fish to dry before smoking, a common technique used is to turn the tray upside down such that the wire mesh face up. In this manner, the fish on the tray does not touch the ground. The practice aids in keeping germs and other contaminants that could affect fish safety away.

The smoked or dried fish is packaged for either storage or for the market. During packaging a key requirement is to reduce or totally remove air circulation from the fish. Commonly a big basket is lined with a similarly big ‘fertiliser bag’ made of woven plastic. The basket is placed on a strong twine mesh of net. A layer of brown paper is placed on top of the ‘fertiliser bag’ prior to whole fish being arranged in layers till basket is full. The brown paper is then pulled to tightly cover the fish. In some instances similar layers of fish in brown paper can be added on till a reasonable height. To provide a sturdy support for the fish at higher heights carton packaging can be placed at the sides of the net. The twine net is then tied with a bowline or figure of eight knot. If packaged fish is for storage, then small pieces of insecticides are placed on the ‘fertiliser bags’ prior to placing the brown paper to avoid direct contact with fish and to repel invading insects from the fish. Such packaged fish can be eventually covered with large polythene bags, mounted on wooden stands and stored in well ventilated rooms or in open spaces under canopy for between 8 to 10 months. This storage

pattern helps to make Sardinella available on the market in Ghana almost all year round to satisfy a growing local demand.

Labour is needed at all levels of the sardinella chain. The labour needs are seasonal and fluctuates with catch availability. Because of the perishable quality of fish, labour is needed for immediate processing when fish is landed or removed from cold storage. The majority of the labour utilised by fishmongers are kith and kin. They learn the trade through apprenticeship at an early age, about 10 years old. Little or no formal training is needed to process fish. This means labour often drops out of basic school and only a few complete basic school. Often children or close relatives of processors who manage to get to Secondary school or a few to the University help the business as clerks. During the bumper season, some fishmongers in the urban centres go to their home villages to recruit young school dropouts with no employment to come and work. They are settled with between 400 to 500 Ghana cedis and four pieces of 6-yards of cloth at the end of a fishing season that last up to 6 months. During the period they are sheltered, fed and clothed. Some manage to stay for many years and eventually learn the trade while others break off at some point when they think they have gathered enough money to have their independence. Some of the fish processing helpers eventually help with fish trading and retailing to support their livelihoods. One processor informed us about an arrangement in some years back where female prisoners are brought in daily to help in fish processing during bumper harvest period. The women prisoners who exhibited good behaviour come in regularly and over some period are able to pick up fish processing skills that eventually become useful to them. This arrangement has long since been discontinued.

3.4 Post Harvest Losses

Most of the retailers of the dry smoked sardinella and anchovy did not have issues with post-harvest losses, partly because the fish was dry and also partly because most of the traders and retailers have very good storage rooms and methods. They explained they could store their products for several months with no issue of spoilage.

On the other hand, processors and retailers of freshly smoked sardinella complained about some losses due to the wet nature of the fish. A by-product of the fish smoking process is broken pieces of fish often dominated by fish heads; pieces of whole but burnt fish; and fish scales and skin (Plate 7). This by-product is available at the processing site in relatively larger quantities but found in smaller quantities at the fish markets. The by-product is collected and further dried and normally sold to poultry farmers; and in recent years to small scale fish farmers. Therefore, there are essentially little or no post-harvest losses of landed sardinella and other small pelagics.

Plate 7 Procesed fish by-product being further dried in the sun

Retailers described different methods they used to store their products but most of their methods where not effective enough to keep the fish from deteriorating. Some of the methods they described include sprinkling of salt solution on the fish and covering it up with either paper or polythene, storage in the fridge and storing in a cool dry room.

Cold store owners/managers cited erratic electricity supply as the main cause of losses since most cold stores did not have standby power plant they could depend on when there is power outages. Some of them also stated the high cost of power was killing their businesses since that consumed most of the revenue they make. High cost of transportation and other services were also cited by most cold store owners and managers as the main issues they faced. They stated that these problems went a long way to affect the pricing of their products. High prices of these products result in low patronage since most consumers within the north belt especially are poor. This they stated was the main cause of their businesses running down.

Overall, there is very little (< 5%) post harvest losses in the Sardinella and other small pelagics value chain because all landed catch is used directly by humans and indirectly through the poultry and aquaculture sectors. However, there are unknown but expectedly significant quantities of losses of landed catch from Ghana to neighbouring through processed fish taken across the borders to Togo, Benin, Ivory Coast, and Burkina Faso at the Elubo, Half Assini, Paga, Dormaa, and Aflao borders. This is due to inadequate capacity and effective co-ordination of activities of regulatory institutions. These leakages in fish export have negative financial implications to the country as taxes and accrued other levies cannot be collected by the revenue agencies.

3.5 Mapping the value chain circuit and mass balance of imports and exports

Table 6 shows production, imports, exports, deficit in pelagic fish among some regional countries (Liberia, Senegal and Togo). Import of pelagic fish from Senegal is between 20-25%, thereby generating foreign exchange to support the economy. Togo imports about 79 000 t of small pelagics annually and exports about 800 pelagic fish annually. The ratio of export and import of small pelagics is high in Liberia (1:220) which also import more pelagic fish than domestic production.

Small pelagic fish continues to play a crucial role in food security needs within the regional countries having annual per capita fish consumption of 14 kg (FAO, 2015).

Table 6 Pelagic Fish balance in West Africa

Country	Year	Production (Tonnes)	Import Quantity (Tonnes)	Export Quantity (Tonnes)	% Export	Deficit	Export Import Ratio
Liberia	2008	2725	3963	18	0.66055	-1238	1:220
Liberia	2009	2727	1725	14	0.513385	1002	1:123
Liberia	2010	2727	1725	14	0.513385	1002	1:123
Liberia	2011	2727	1725	14	0.513385	1002	1:123
Liberia	2012	0	0	0	0	0	0
Liberia	2013	0	0	0	0	0	0
Senegal	2008	306653	191	60684	20	306462	318:1
Senegal	2009	284252	111	70941	25	284141	639:1
Senegal	2010	284252	111	70941	25	284141	639:1
Senegal	2011	284252	111	70941	25	284141	639:1
Senegal	2012	0	0	0	0	0	0
Senegal	2013	0	0	0	0	0	0
Togo	2008	14350	16673	391	3	-2323	1:150
Togo	2009	17801	5001	899	5	12800	1:6
Togo	2010	17801	5001	899	5	12800	1:6
Togo	2011	17801	5001	899	5	12800	1:6
Togo	201	0	0	0	0	0	0

Togo	2 201 3	0	0	0	0	0	0

Source: Calculated based on FAOSTAT, 2015. Note: 0 means no data was available

In Ghana, cold store owners and operators in the middle and northern belts get stocks of Sardinella from importers in Tema and other fishing centres along the coast. Imports are made from other African countries such as Mauritania, Angola, Senegal, Guinea and from Russian fleets operating off Western Africa. Only few of the cold stores in the north have their own means of transport to carry large quantities of sardinella and other small pelagics such as the chub mackerel. Those that do not have their own means of transport pay huge amounts of money to get their goods transported and this expenditure is normally added to the retail price. This has made frozen fish in the northern part of Ghana relatively expensive.

Fish processors get their supply from cold stores. Most processors take their frozen fish stock on credit and pay only after processed and sold their products. Other processors are employed by cold store owners to process their fish for the market since in such areas consumers normally prefer smoked products to frozen or fresh ones.

None of the sardinella processed in the middle and northern belts is exported outside the borders of Ghana. All products are marketed across the country, often from the coastal belt all the way to the Upper East and West regions (Fig. 5), and consumed in Ghana. Occasionally, Ghanaians who outside travel by air are allowed to carry up to 20 kg of smoked fish (which represents the maximum weight of fish an individual can carry without declaring taxes). This forms part of the bulk export of salted/smoked fish which is estimated around 115 kg or 0.3% of exported fishery products in 2012 (MoFAD, 2012).

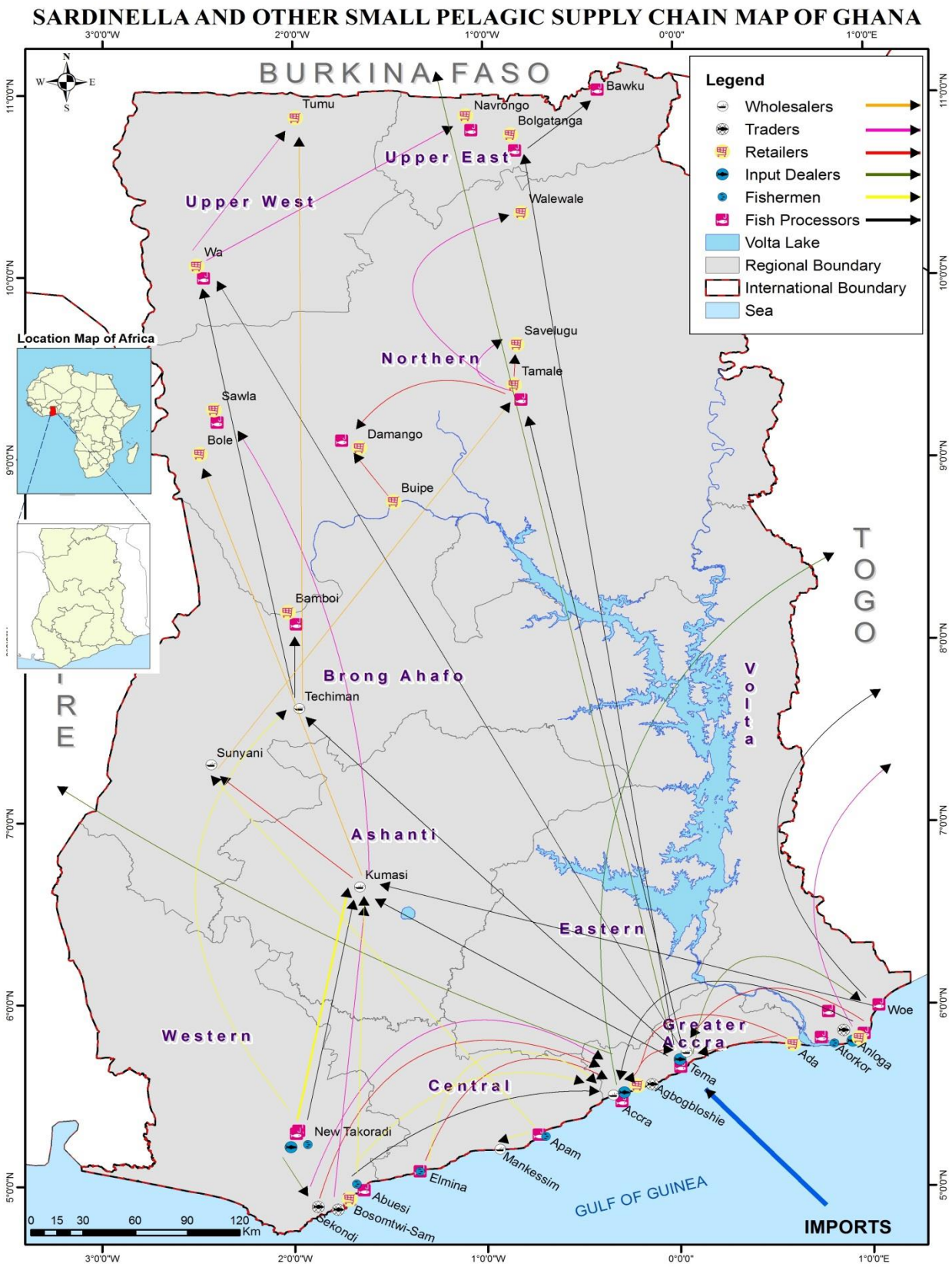

Figure 5 Sardinella and other small pelagics supply map

3.6 Quality sustainability requirements

The absence of cold storage facilities in the landing sites makes the activities of processors very important in the sardinella value chain. There are five traditional ways of processing sardinella, and these are smoking, salting, drying, frying and fermenting. The industrial processing of sardinella is not done in Ghana.

Sardinella in its fresh form has to be sold within three to twelve hours depending on the temperature to prevent spoilage. The most common form of processed sardinella is the one which is smoked and most of sardinella to the market is in this form. The inadequacy of cold storage in the fishing industry makes the distribution of fresh sardinella limited to a few kilometres from the fish landing site.

The main problems associated with sardinella smoking are hygiene and cleanliness. During the initial stages of smoking, flies and other insects are all over the fish and control of processed fish for levels of contamination is non-existent. One common theme among processors was the lack of storage facilities for processed fish.

The Ghana Standards Authority (GSA) as a regulatory body to ensure standardization for the improvement of the quality of goods, services and sound management practices in industries and public institutions is present in the fishery industry at the production and processing stages to control all aspects of hygiene and quality standards. However, GSA is limited largely in terms of logistics, manpower and capacity building of their employees. There is the need therefore, to strengthen the capacity of GSA and other public institutions of concern to sustain the quality of fish and fishery products.

With respect to information gathered during the study, including interaction with major stakeholders such as fishers, processors and marketers of sardinella, it does not appear the sardinella or the other small pelagics from large to small scale processors are exported into the European market. According to the Head of Fish Control at GSA, the EU are extremely difficult to appease with regards to sanitary and hygiene standards. The GSA incorporates EU regulation into their policies. To export to the EU is a difficult procedure because of the standards required. The USA has much lower standards but the market is more closed towards Ghana (O'Neill, 2013).

3.7 Level of commitments regarding quality

Except for imported sardinella, the environmental and product quality of locally produced sardinella is mostly unknown since laboratories to carry out such detailed analyses are non-existing. Currently, buyers of locally produced sardinella do not have any means to assess the quality of the products they buy from producers.

There are no labels with the required information on sardinella being sold locally, except for those meant for export because the GSA usually carries out analyses of sardines and other fishery products (tuna, mackerels, cephalopods) meant for export to the EU market. They should however be assisted and equipped to do the same to those to be consumed locally.

The Fish Health Inspectorate Division of Fisheries Commission and the Food and Drugs Authority are tasked to ensure that fish consumed locally is of good quality and safe for consumption. These aforementioned institutions must be strengthened in enforcing the food safety regulations for fishery products.

4.0 GOVERNANCE OF SARDINELLA AND OTHER SMALL PELAGICS SUPPLY AND VALUE CHAIN IN GHANA

4.1 Overview of key institutions

The main institutions concerned with sardinella and other small pelagics trade, export, import and/or quality are the Ghana Standards Authority (GSA), the Ministry of Trade and Industry (MoTI), the Food and Drugs Authority (FDA), the Fisheries Commission (FC) Customs Excise and Preventive Service (CEPS) and the Driver Vehicle and Licensing Authority (DVLA). Table 5 gives an overview of the responsibilities and limitations as far as sardinella and other small pelagics trade and quality are concern. Their mandate and accomplishments regarding fish products control, certification and trade procedures are presented in sub-sequent sections.

4.2 Ministry of Trade and Industry (MoTI)

The MoTI establishes policies so that trade and industry grow competitively within domestic, regional and international markets, specifically including economic growth and employment creation for the vulnerable groups. The MoTI wishes to promote Ghana as a major manufacturing, value-added, financial and commercial centre in West Africa by the year 2015.

The MoTI has in particular developed a Logistics and Value Chain Division that employs four people. This Division is interested in all activities that can bring value and be competitive to the country. More specifically, the Division concentrates on key areas including fish, mango and rice and is turned towards exports.

4.3 Ghana Standards Authority (GSA)

The GSA is under the Ministry of Trade and Industry (MoTI) and employs around 3,500 people on its various sites. The GSA mandate is to establish the standards, to undertake inspections on the agricultural and non-agricultural products and to run laboratory testing as well as to certify products. The GSA was established by the Standards Authority Act in 1973. Structured into different divisions, the GSA has evolved into the public institution of reference when food quality and safety are concerned. One of the major issues handled by the institution is linked with export promotion. The Fish Control and Export Project Department under the Fish Inspection Department, has been selected as the competent body dealing with fish exports from approved establishments. The department is comprised of ten inspectors and one administrative manager. It also houses a laboratory for various fish tissue analytical work.

4.4 Food and Drugs Authority

The Food and Drugs Authority (FDA) was established in August 1997. It is the National Regulatory Authority charged with the regulation of food, drugs but also food supplements, herbal and homeopathic medicines, veterinary medicines, cosmetics, medical devices, household chemical substances and tobacco.

The FDA Ghana's legal mandate is found in part 6 (Tobacco Control Measures), part 7 (Food and Drugs), and part 8 (Clinical trials) of the Public Health Act, Act 851 of 2012.

It is also an authority in the import and export of goods although it is mostly recognised for its role in the domestic market and imported goods to Ghana. The activities of the FDA are

carried out at the various entry and exit points of the country through mainly Tema Port, Takoradi Port and Kotoka International Airport. The main concern for the FDA is that imported food and drug products that reach the consuming public are safe, of good quality and efficacious (in the case of drugs). The agency seeks to achieve the above through the following:

- Confirming the authenticity of registered imported regulated products through inspections at the port.
- Identifying unregistered imported regulated products for registration.
- Continually widening the scope of regulation at the ports of entry to include all imported products that fall under the FDA's Ghana purview as per the Public Health Act 851 of 2012.

FDA is also responsible for enforcing the hazard analysis and critical control point (HACCP) standards. The aim of international exporting partners is to protect consumers in European countries. Regarding fishery exports and sanitary guarantees the role of the FDA currently seems not to be as deep-rooted compared to GSA responsibilities. Although FDA approval is necessary to export fish products to Europe, it is not sufficient.

4.5 Fisheries Commission

The Fisheries Commission is mandated by the Fisheries Law, Act 625 2002, to regulate and manage the use of fisheries resources in Ghana and to coordinate the policies in relation to them. It employs approximately 380 people, both in centralised and decentralised body on the coastal and inland landing sites. The Fisheries Commission has also launched the Ghana Aquaculture Regulations 1968 (2010) in the Ghana Fisheries Regulations LI 1968 (2010).

The Fisheries Commission is in charge of:

- Issuing a licence to fish (where size mesh, allowed gears are spelt out) for the four types of vessels including for the foreign vessels licence,
- Taking statistics on the catches (species, quantity, size, price, exports, imports),
- Monitoring fishing vessels with focus on Safety Certificates, Certificate of Competency of crew, fishing logbooks, fishing license, fishing gears and other relevant documents.
- Having the responsibility for the local post-harvest fisheries (auctions, markets),
- Controlling aquaculture, hatcheries, fish breeding and harvesting as well as the fish safety (monitoring fish disease), and
- Setting-up the measures related to the sanction for any infringements with the Fisheries law and
- Is responsible for Monitoring Control and Surveillance and Enforcement.

Very important for the Fisheries Commission and the Fish Exporters is the topic of the Catch Certificate. From the 1st January 2010, a “Catch Certificate” certifying that fish was caught legally in application of both EU requirements for the EC Council Regulations 1005/2008 to prevent, deter and illuminate illegal fishing, unreported and unregulated fishing (IUU) fishing and Commission Regulation 1010/2009 to implement the EC 1005/2008 are mandatory documents for Europe. Objectives of the certification scheme are to ensure product traceability at all stage of production, from catch to processing and marketing, to be a tool for

compliance with conservation and management rules and to support cooperation between flag states.

The Catch Certificate must be signed by the fishing master of the vessel and endorsed by the Director of the Fisheries Commission or his/her designated representative. This signed catch certificate must be supplied by the FBO to the CA with the bill of lading, as part of the documents provided to accompany the consignment. Only then, a Health Certificate can be signed by the CA for the consignment to be exported.

Government finance and polices in the fisheries and aquaculture value chain of Ghana is poor (Asiedu *et al.*, 2015). However, in recent times (2014) the Government of Ghana has established a dedicated value chain and post-harvest unit within the Fisheries Commission of the Ministry of Fisheries and Aquaculture Development (MoFAD).

4.6 Customs Excise and Preventive Service

The Customs Divisions belong to the Ghana Revenue Authority. They are responsible for collection of various taxes, particularly Import Duty, Import VAT, Export Duty, Import Excise and other taxes. In turn, the taxes are used to finance the country's budget and development projects in health, education, housing and transport sectors. This is achieved by physically patrolling the borders (Tema Port, Takoradi Borders and Kotoka Airport) and other strategic points, examination of goods, and search of premises, as well as documents relating to the goods.

As part of the process in trading fishery products, exporters or importers have to declare different details including quantity, fish species, vessel they are loaded to or unloaded from through the single electronic online network GC-Net MDA of the Ghana Trade Net. The Users will be able to track their consignment. The GC-Net declaration is taking more and more importance but has not reached its total capacity yet.

4.7 Driver Vehicle and Licensing Authority

The road transport industry is regulated by the Driver, Vehicle and Licensing Authority (DVLA). It was established by Act 569 of 1999 to be responsible for ensuring safety on Ghana’s roads.

The functions of DVLA as spelt out in the Act are as follows :

- Establish standards and methods for the training and testing of driving instructors and drivers of motor vehicles and riders of motor cycles.
- Establish standards and methods for the training and testing of vehicle examiners
- Provide syllabi for driver training and the training of instructors
- Issue of drivers licenses
- Register and license driving schools
- License driving instructors
- Inspect, test and register motor vehicles
- Issue vehicle registration certificates
- Issue vehicle examination.

Vehicle owners and drivers may belong to one of a number of trade associations, especially the umbrella Ghana Private Road Transport Union (GPRTU).

4.8 Other formal and informal institutions

Other formal and informal institutions along the chain are:

- Ghana National Fish Traders and Processors Association (GNFTPA)
    - Established in 2014 as umbrella body; education and advocacy.
- Environmental Protection Agency
- Volta River Authority,
- Water Resources Institute,
- NGOs
- Agricultural Development Bank,
- Rural Banks,
- Continental Christian Traders (a major dealer in fishing nets),
- National Fisheries Association of Ghana (NAFAG),
- National Inland Canoe Fishermen's Council (NICFC),
- Ghana National Canoe Fishermen's Council (GNCFC),
- Ghana National Association of Farmers and Fishermen,
- Ghana Co-operative Fisheries Association.

Table 7 Value chain institutions, Services and Limitations

Institutions	Current services provided in relation to fisheries	Services provided in relation to fisheries products (sardinella)	Limitations in carrying out duties
Ministry of Trade and Industry	• Facilitates enterprise development including Micro, small and Medium Enterprise(MSMEs) • Develop and enforce standards in trade and industry • Promote and facilitate Ghana's active participation in global trade through participation in multilateral and bilateral institutions as well as champion Ghana's market expansion drive. • Facilitate innovation and entrepreneurship with both formal and informal sectors. • Involved in activities geared towards Production, commerce and creation of gainful employment. • Promotes made –in-Ghana goods and services.	Supported SME's in fish processes *etc.*	Funding, infrastructure and to some extent limited expertise.
Ghana Standards Authority (GSA-MoTI)	• Metrology- calibration or verification service • Standards • Conformity Assessment.	**Fish inspection** Client submits official request (a letter to the executive director of GSA) Application form, available at the Fish Control and Export Project Department, shall be completed and returned to the department together with the relevant documents indicated on the application form such as HACCP and the best practice	Funding and Capacity building.

		manual, *etc.* Fishery Products Regulation (FPR) must be purchased from the GSA Library. This is followed by inspection of premises and facilities. Approval may be given if assessment is favourable. Regular monitoring takes place after approval.	
Food and Drugs Authority	• Mainly Inspections: Approval and licensing of cold storage facilities • Regulation of the Food, Drugs, Food supplements, veterinary medicines etc. • Is concerned by quality of the domestic, imported and exported products • Conducts inspections in domestic manufacturing industries	• Regulate safe consumption of Fish and Fish products including Sardinella. • Ensures that storage operations of frozen Sardinella are safe. • Labelling & Advertisement: ensures labelling of all processed fish packaged for sale)	• Limited scope of work; the department regulates just the storage facilities when considering the food chain. • Lack of generator sets as backup power. • Clients sell unwholesome fish to unsuspecting consumers. • Use of unrefrigerated vans/trailers as means of transport.
Fisheries Commission	• Issues fishing licence. • Approves catch certificate • Enforces Monitoring Control and Surveillance and Enforcement • Institution taking in charge of fish safety (disease)	• Providing fishing licence. • Approving the catch certificate	
Customs	• Enforces all the fisheries regulations	• Uses GC-Net to enter export and import	• Difficulty in tracking

Excise and Preventive Service	in relation to fish import and export • Verifying documents and good quantity at export and import at the main border points • Ensures that fish ban into the country are not imported and cleared into Ghana, e.g. fresh tilapia. • Calculate 'Cost, Insurance and Freight - CIF' for imported fish (life fish 20% of CIF; frozen fish 5% of CIF) in addition to VAT and processing fees.	sardinella figures • Calculate import duties for sardinella. • Store uncleared imported sardinella in bonded warehouse	sardinella and other that have been goods hided.

Source: Source: Updated based on Failler *et al*., 2014

Traditional Fisheries management Institutions

- **Community Based Fisheries Management Committee (CBFMC)**
  - local committees formed fishing community based on existing traditional leadership authority and local government structures
  - enforce national fisheries laws at community level, enact and enforce their own by-laws; collaborate with District Assemblies and FC.
- **Chief Fisherman**
  - Leads in resolution of disputes
  - Gives access to fishing in the communities.
  - Enforces a number of measures such as non-fishing days, ban on landing certain fish species during festival periods to prevent overfishing;
  - Leads in observing taboos and cultural practices such as performance of rituals to 'sea gods' and consulting of oracles during certain periods of the year help to manage the fish stocks.
  - Supervises acquisition and distribution of Premix-fuel.
- Limitations: Lack legal power through national policy or legislation.
- **Fish Mummies / Wives / Women importers**
- Mummies
  - Finance the fishing business
  - Negotiate / determine price for the day
  - Have large storage facilities
- Fish Wives
  - Can be wife or female relative of fishermen
  - Receive catch from fishermen and process
  - Sell to retailers and consumers
- Importers, e.g. Adom Mboroso andSarfo Nyame.
  - Import sardinella from EU, Namibia, Mauritania
  - Have large storage facilities
  - Sell to wholesalers, retailers and occasionally consumers.

4.9 Interaction of Governance Institutions with Actors

The various governance institutions interact more often with some specified actors (Table 8). It is usual for one institution to interact with a number of the actors. Some of the roles of the institutions can be more efficiently served if collaborations are forged among them. There is therefore a need to harmonise the activities of these institutions and harness them for effective and improved supervision and regulation along the chain.

Table 8 Interaction of Governance Institutions with Actors

Institution	Actors along the chain
Fisheries Commission	Fishermen, Fishing Input Dealers Fish Processors, Fish Traders, Consumers
Ghana Standards Authority	Fish Processors, Fish Traders Fish Exporters, Fish Importers Cold Store Operators, Consumers
Food and Drugs Authority	Fish Processors, Fish Traders Fish Exporters, Fish Importers Cold Store Operators, Consumers
Ministry of Trade and Industry	Fishing Input dealers, Fish Exporters Fish Importers

Customs Excise and Preventive Service	Fishing Input dealers, Fish Exporters Fish Importers, Transporters
Ghana Ports and Harbours Authority	Fishing Input dealers, Fish Importers Transporters
Ghana Export Promotion Authority	Fish Exporters, Fish Importers
Bank of Ghana	Fishing Input dealers, Fish Exporters Fish Importers
Food Research Institute of CSIR	Fish processors, Consumers
Universities and other research organizations	Fishermen, Fishing Input dealers Fish Processors, Fish Traders Fish Retailers, Fish Importers Fish Exporters, Cold Store Operators Transporters
Federation of Association of Ghanaian Exporters	Fish Exporters
Environmental Protection Agency	Fishermen, Fish Processors
Metropolitan / Municipal / District Assembly	Fishermen, Fishing Input dealers Fish Processors, Fish Traders Fish Retailers, Fish Exporters Cold Store Operators, Transporters
Ghana National Fish Processors and Traders Association	Fish Processors, Fish Traders Fish Retailers, Fish Exporters Cold Store Operators, Transporters, Consumers
Driver Vehicle and Licensing Authority	Transporters
Community Based Fisheries Management Committee	Fishermen, Fish Processors Fish Traders, Fish Retailers
Chief Fisherman	Fishermen, Fishing Input Dealers
Fish mummies / Fish wives	Fish Processors, Fish Traders Fish Retailers, Consumers

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

There are a number of clear principal findings from this study and they are listed below:

- Sardinella and other small pelagics are very important in food security, nutrition, income, employment, and livelihoods.
- High dependence on Sardinella and other small pelagics in both local and international fish trade.
- Demand and utilization of sardinella and other small pelagics is very high. This is sustained by their all year availability in Ghana from local and imported sources. However, there is sometimes sporadic incidence of bumper harvest during the year.
- Based on official statistics almost all sardinella and other small pelagics fish landed in Ghana is consumed locally but an unknown amount is exported in the informal cross border trade.
- 95% of small pelagics is consumed directly by humans. About 5% goes to poultry feed and fish meal.
- Small sized sardinella of higher value than large-sized ones.
- 60-80% of fish processed are small pegics including Sardinella.

- There is a very small amount of post-harvest fish loss in the chain because virtually everything is utilized one way or the other.
- Most common processing method of Sardinella is smoking while anchovy is usually dried before smoking, or sold dried.
- Higher value addition is gained after processing (32%) and fishermen make the least profit of 19.4%.
- Fish is distributed in a network from the coastal belt all the way to the northern belt; and to regional countries
- Women exhibit more influence on the value chain process. Fish processors, traders, retailers, and cold store operators are largely women.
- There is more cold storage fish in middle and northern belts.
- Timely availability of low interest credit and to some extent labour, are major limitations to expansion of business and sardinella processing.
- Discrepancies in data from various stakeholders.
- Power rationing ('Dumsorisation') in Ghana is affecting quality of fish sold to consumers and may be adversely affecting human health.

5.2 Recommendations

Recommendation 1: Up to date documentation centre

This recommendation relates to the documentation, database and information, on fisheries and fishery products that should be properly and continuously recorded and available online for general public purposes. There are major discrepancies in the data from the state institutions and should be harmonized.

Recommendation 2: Hygiene

Hygiene should be at the core of the value chain during handling and processing of sardinella and other small pelagics. Cold store operators, fish processors and retailers should be monitored regularly by GSA and FDA. They should be made to undergo regular health checks and the quality of their products and their working environment should be monitored. To achieve this, actors in the value chain should be registered and licensed before they are allowed to operate.

- Fish processors should be made to process fish in hygienic environments to help improve quality of fish and therefore add more value to processed fish.

    - Operations of cold stores should be monitored by the GSA to ensure fish in cold storage meet the required standards.
    - Enforcement mechanisms should be established for processing and handling of sardinella products.
    - Fish should be transported in refrigerated or cold environments.

The GNFPTA will be of great help in this regard.

Recommendation 3: Provision of credit

Cold stores, fish processors and fish retailers, especially in the northern belt, need to be given access to low interest credit. This credit must be timely allocated to coincide with bumper season. Most of them are still running small and dying businesses because they lack access to credit. Credit for expansion of the business should first be given to the organised processors and traders but funds should be given in individual names.

Electricity supply has become a serious issue for actors in the sardinella industry, especially, cold store operators. Government should work fast at fixing the power crises.

Recommendation 4: Packaging and labelling

Efforts should be geared towards the packaging and labelling of processed sardinella and other small pelagics for sale at the Supermarkets and other formal retail outlets due to its high demand in Ghana. This value addition will help create more wealth in the industry as well as helping to improve food and nutrition security of consumers.

Recommendation 5: Fish processing education

- Formal fish processing training for school dropouts and other vulnerable social groups should be established with the help of the organised Fish processing associations or the Ghana National Fish Processing and Traders Association (GNFTA). This will help increase the quality of processed fish in order to add more value to fish to meet the international market.
- The GNFPTA should get involved in educating their members to use the formal chains of fish export in order to export more as well as get higher value for their processed fish that goes to the Americas, Oriental, and EU markets.
- Fish processors should be adequately educated on fish quality standards. There should be awareness creation among processors to produce sardinella of good quality and safe for consumption for both local and international markets.
- Fish processing skills training given to female prisoners should be revisited as the practice provides ready labour to aid the business.

Recommendation 6: Collaboration of stakeholders

- There is the need to integrate the roles of the various stakeholder institutions in order for local consumers to be protected from eating unwholesome fish that has PAH values beyond internationally approved level of less than 5%.
- The GSA and FDA should increase their monitoring and surveillance on fish quality available on the markets as well as to check the virtual smuggling of sardinella products across Ghanaian borders.

Other recommendations

- Premix fuel and other fishing inputs should be further supported by government to improve availability
- Current power rationing (‘dumsorisation’) in Ghana should be fixed immediately.
- Enhance personnel and logistics to regulators (GSA, FC, FDA, CEPS).
- Establish a formal link between fish processors; and fish farmers as well as poultry producers to help take advantage of processed fish by-product to help minimize any post harvest losses.

Recommended Projects

- Consumers should be sensitized to improve utilization of other fish species for their livelihoods
- The SFMP, government, NGOs, and other stakeholders should collaborate to set up model fish processing centres to help demonstrate best practices and modern methods in the industry to stakeholders in the value chain. One each of such centres should be set up in the Coastal, Middle and Northern belts of the country respectively.
- Research and extension should be sustained along each stage of the value chain.
- Establish woodlots e.g. *Acacia* and mangrove plantations to produce fuelwood for fish processing.

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ANNEXES

Annex 1 BACKGROUND LITERATURE

This section assesses various literature on the fisheries sector in general with more focus on small pelagics especially the Sardinella fisheries. The review discusses information on the value chain and regional trade from a regional perspective.

Fish is the most valuable agricultural commodity traded internationally with annual sales of nearly US$80 billion and increasing each year (FAO FishStat, 2006). For developing countries in regions such as West Africa, fish exports to markets in developed countries, especially in Europe, are a major source of foreign exchange revenue, and help to underpin the domestic fisheries in terms of earnings and employment. On the other hand it has been suggested that an expanding fish trade aggravates the overexploitation of vulnerable fish stocks under conditions of weak governance and that local trade routes supplying local markets may be disrupted as fish supplies are diverted for exports.

Neiland (2006) informs that average volume of fish exported annually by West African countries is 11,776 tonnes, and the average value of annual exports is US $29 million. However, the export trade is dominated by just 4 countries:

- Senegal (97 Kt/yr valued at US $ 283 million)
- Ivory Coast (48 Kt/yr valued at US $ 141 million)
- Ghana (64 Kt/yr valued at US $119 million)
- Mauritania (44 Kt/yr valued at US $103 million).

It is interesting to note that both Ivory Coast and Ghana also import large quantities of fish, whereas Senegal and Mauritania are mostly producers.

The fishing industry in Ghana supports the livelihoods of about 10% of the population. The importance of the fishing industry stems from the significant contribution of about 60% of the national animal protein supply and around $87 million exports in 2009. Fish and sea food account for 16% of total household spending on food (GSS, 2008; Antwi *et al*., 2011).

Ghana's artisanal fishing sector, which targets the Sardinella fishery, has a total of about 13,000 canoes operate actively from over 334 landing sites located along the 550 km length of the coastline (Akyeampong *et al.*, 2014). Just over half of these canoes are powered by outboard motors with engine power of up to 40 hp (Akyeampong *et al.*, 2014). The target fish species for the artisanal fleet is the round sardinella, *Sardinella aurita*, although the flat sardinella, *S. maderensis*, is also caught (Bard and Koranteng, 1995). The country's Fisheries Bureau of Statistics estimated the 2006 artisanal sardinella catch to be around 87,000 tonnes (MFRD, 2007). The artisanal sector employs 80% of Ghanaian fishers.

Although it is typically men out on the boats fishing, women play an important role in artisanal fisheries, being almost solely responsible for processing and selling the fish in markets (Akrofi, 2002). An informal but strong institutional framework governs artisanal fisheries at the village level (Bennett, 2000).

The West African region is home to about 43% of the total population in sub-Saharan Africa (OECD 2008). The region consists of coastal and landlocked states with abundant and diverse

fisheries resources (FAO 2006). The fisheries sector plays an enormous role on the national economies of the region and constitutes the main livelihood for a majority of people living along the coasts and in riparian areas (Ajayi, 1994; Béné & Heck, 2005; Béné, 2006; Katikiro & Macusi, 2012).

Ghana has been a regional fishing nation with a long tradition of a very active fishing industry dating back to as early as the 1700s and 1800s when Fante fishermen embarked on ocean fishing along the coast of Ghana. Bounded on the south by the Gulf of Guinea, Ghana has a 550 kilometre coastline stretching from Aflao in the East to Half Assini in the West and a total continental shelf area of about 24,300 square kilometres to support a vibrant marine fishing industry. Ghana also has a system of rivers, lagoons and lakes that form the basis of an inland fisheries industry (BoG, 2008).

The fishing industry plays a major role in sustainable livelihoods and poverty reduction in several households and communities. The sector is estimated to contribute about 3.9% of the nation's gross domestic product (GDP) and 11% of the Agriculture GDP (GSS, 2008 Budget). In the rebased oil exporting economy the fisheries sector contributes 1.5% of the GDP. For a long time, fish has remained the preferred and cheapest source of animal protein with about 75% of total annual production being consumed locally (BoG, 2008).

There are a wide variety of fishes available in Ghana's waters. These include, the anchovy, cassava fish, chub mackerel, flat sardinella, largehead hairtail, meagre, moonfish, red pandora, red snapper, round sardinella, skipjack, and yellow fin (BoG, 2008). In general however, these can be classified into pelagic (coastal) and demersal (deep sea) fish species. Pelagic fish species are those fishes that are characteristically mobile and migratory and live in open waters of the sea. Some commercially important species include round sardinella, flat sardinella, skipjack, yellow fin, bumper and chub mackerel (BoG, 2008).

Ghanaian fish markets are dominated by small pelagic fish, such as sardines, anchovy and mackerel, which are caught by the canoe and the semi-industrial fleets. The availability of small pelagic fish is dependent on a seasonal upwelling, which corresponds to colder sea surface temperatures and the rainy season from June to October (Bakun, 1995; Demarq and Aman, 2002). In good years, the artisanal fishery for small pelagic species can supply up to 70% of the landed catch (MRFD, 2007).

OVERVIEW OF GHANA'S FISHING INDUSTRY

The fishery sector in Ghana principally encompasses marine fisheries, inland (freshwater) fisheries and aquaculture as well as related activities in fish storage, preservation, marketing and distribution. The marine fishing industry is an extremely important economic activity in Ghana. It has been estimated that the fisheries resources in Ghana's water bodies supports the livelihoods of a total of about 2 million people which includes fishers , fish processors (including fish canneries and cold stores), traders and boat builders (Onumah *et al.,* 2010). These people, together with their dependents, account for about 10% of the population (Ghana Statistical Service, 2002). The marine fishing industry is thus the mainstay of the fishery sub-sector and has been a significant non-traditional export since the introduction of the Economic Recovery Programme in 1984 (Quaatey, 1996).

Marine fisheries account for over 80% of the fish consumed in Ghana (BoG, 2008). However, freshwater fisheries including aquaculture is increasingly contributing considerable

share of the supply and consumption trends. The structure of the marine fishing industry in Ghana is described by the activities of four identifiable groups within the industry, namely the Artisanal, Semi-Industrial (inshore sector), Industrial (deep sea) and Tuna fleets. Aquaculture has only recently been adopted as an assured way of meeting the deficit in Ghana's fish requirements. The aquaculture sub-sector comprises largely of small-scale subsistence farmers who practice extensive aquaculture in earthen ponds in contrast to the intensive practices of commercial farmers (Kwadjosse, 2009).

There are several laws to regulate and govern the fisheries sector and the government has set up institutions that are responsible for developing fisheries and aquaculture policy, and directing and establishing research priorities. The Ministry of Fisheries and Aquaculture is the lead agency for fisheries development (GIPC, 2015). Major inland water bodies are the Volta Lake (8442 square km), Keta Lagoon (330 square km), Lake Bosomtwi (49 square km) and the Volta River and its tributaries- the Black, White and Red Volta, Densu, Oti and Pra Rivers, plus more than 50 brackish water bodies dotting the coastline, a number of which are RAMSAR designated sites.

BRIEF HISTORY OF GHANA'S FISHING INDUSTRY

Ghana abounds with water and about 10% of the entire land surface of the country is covered with water (BoG, 2008). Thus the potential for the fishing industry is immense. The fishing industry in Ghana started as an artisanal fishery; mainly for subsistence purposes, with very simple and inefficient gears and methods operating close to coastal waters, lagoons, estuaries and rivers. Fish caught were mainly to meet domestic demand for fish especially in the towns and cities. There were limited exports to neighbouring West African countries.

According to BoG (2008), marine fisheries in most parts of West Africa, even up to Angola, have been extensively influenced by Ghanaian fishing folk since the early 20th century. The increased fishing activity in the early 1900s caught the attention of the colonial Gold Coast government in the 1930s when it commissioned surveys on the fishing industry culminating in the enactment of the first regulatory regime in 1946 with the Fisheries Ordinance Cap 165. The establishment of the Sekondi boatyard in 1952 made local production of 27 to 30 feet wooden boats with inboard engines possible and hastened the emergence of a semi-industrial type of fishing. Another boatyard was established at Tema to build larger vessels of up to 70 feet. Many firms including prominent local firms such as Mankoadze Fisheries and Ocean Fisheries also imported steel vessels of various dimensions for deep sea fishing. The state also got involved with the establishment of the State Fishing Corporation in 1961/1962 with the importation of very large modern ocean-going vessels. Ghana negotiated bilateral agreements with Angola, Senegal, and Mauritania to fish in their economic zones. During the same time, Ghana made an agreement with a USA firm (Star Kist) to deliver tuna supply. Eventually Star Kist set up a tuna processing plant in Tema. These developments accelerated the growth of the fishing industry and increased the number of workers in the industry. By the early 1970s, the industrial component of the marine fishing industry was very active, yet the general worsening of the Ghanaian economy influenced the sector of imported materials. Some of the problems facing the industry include inadequate cold storage facilities and the inadequacy of of pre-mix fuel supply. Concomitantly, poor management of the state fishing corporation (SFC) contributed to its decline in the 1980s until it was divested by the state under the terms of the economic recovery programme (ERP). The adoption of exclusive economic zones (EEZs) by most coastal West African countries in the early 1980s was also problematic with most of these nations, specifically stopping Ghanaian boats from fishing in

their waters (Atta Mills *et al*., 2014). Despite these problems, the fishing industry generally grew over the period 1971-2009 with some foreign investment (Antwi-Asare & Abbey, 2011).

In summary, inadequate trade policies, globalization of the fishing industry, dominance of foreign distant water fleets, declarations of exclusive economic zones (EEZs) by neighbouring West African nations, overfishing and lack of adequate regulations have contributed to the decline of Ghana as a regional fishing nation; a position it had held since the 18th century. The prohibitive cost of access arrangements limited Ghana's access to distant waters, while the country's marine environment has been impacted by overexploitation of stocks and the use of destructive methods of fishing (Atta-Mills *et al.*, 2014).

Institutions

The fishing sector involves a variety of governmental and non-governmental institutions (NGOs). The Fisheries Commission was established under the Fisheries Commission Act 457 and has continued to operate under Act 625. Specifically, the commission ensures that fisheries resources are exploited on a sustainable basis, settles disputes and conflicts among operators, advises government in all matters related to fisheries, and advocates on issues to protect, promote and develop the fishing industry. The Commission is, however, constrained by lack of funding to effectively deliver its mandate. At the local fish landing sites, there are Community-Based Fisheries Management Committees (CBFMCs). These are local committees formed in a fishing community based on existing traditional leadership authority and local government structures, legally empowered by Common Law, and comprising all stakeholders, to oversee the management and development of the fishing industry. The principal responsibility of the CBFMCs is to enforce national fisheries laws at community level, as well as to enact and enforce their own by-laws to the same end. District Assemblies in collaboration with Fisheries Commission have been mandated to facilitate fishery resource management by helping in forming and sustaining CBFMCs; cooperating with the monitoring, control, surveillance and enforcement units (MCS units); providing legal and financial support to the CBFMCs; and approving levies proposed by the CBFMCs.

The Water Resources Commission and the Environmental Protection Agency also have activities relating to the fishing sector. Section twelve of the Water Resources Commission Act (1996) stipulates that "the property in and control of all water resources is vested in the President on behalf of, and in trust for the people of Ghana". The vesting of the water resources in the President is to make water resources management consistent with general natural resources management in Ghana and the 1992 Constitution. The role of the Environmental Protection Agency (EPA) covers among others protection of water resources and regulation of activities within water catchment areas including setting effluent standards. The functions of EPA are set out in the Environmental Protection Agency (EPA) Act, 1994 (Act 490). However, the Water Research Council is the only aquaculture research institution in the country even though the universities also conduct research into aquaculture. In addition, the Irrigation Development Authority has been involved in promoting aquaculture since the 1950s.

Other institutions that contribute to the management of fisheries resources in Ghana include the Volta River Authority, Water Research Institute, NGOs, the Agricultural Development Bank, Rural Banks, Continental Christian Traders (a major dealer in fishing nets), National

Fisheries Association Of Ghana (NAFAG), Ghana Tuna Association, the National Inland Canoe Fishermen's Council (NICFC), Ghana National Canoe Fishermen's Council (GNCFC), Ghana National Association of Farmers and Fishermen, Ghana Co-operative Fisheries Association, Universities and research institutions, and local CBFMCs in various districts.

Policies and Regulations

Traditional legal systems especially, ways of allocating fish and days when there was no fishing have always been implemented. In a majority of artisanal fishing communities, every Tuesday is a fishing holiday. In addition, in some parts of the Volta and Western region Thursdays, or Wednesdays or Sundays are declared as fishing holidays.

In terms of the fish catch, it was shared among various stakeholders according to the laid down ratios. Thus, percentage of the catch goes to the crew, the owner of the boat, the fishing net owner, and outboard motor owner.[i] For instance the sharing ratios in Greater Accra were 67% for the owner of the craft with its accoutrements and 33% for the crew. In most of the Western region, the net, canoe, and outboard motor owners get 16% each while the crew takes 50% of the catch. There are also regulations on the types of net mesh sizes that could be used. Various governments have since independence implemented various legislative interventions in the fisheries sector. In the early 1960s, the Fisheries Act and the Fisheries Regulations, 1964 (L.I. 364) were enacted. In 1972 the government of the National Redemption Council (NRC) promulgated the Fisheries Decree, 1972 (N.R.C.D. 87). In 1977, the Fisheries (Amendment) Regulations 1977 (L.I. 1106) were passed by the same government to amend the Fisheries Regulations, 1964 (L.I. 364). In 1979 the government of the Armed Forces Revolutionary Council (AFRC) also promulgated the Fisheries Decree, 1979 (A.F.R.C.D. 30). In that same year, the Fisheries Regulations, 1979 (L.I. 1235) were promulgated.

In 1991, the government of the Provisional National Defence Council (PNDC) promulgated the Fisheries Law, 1991 (PNDCL 256) to repeal the AFRCD 30 whilst saving the Fishing Boats Regulations, 1972 (L.I. 770) and the Fishing Boats Regulations, 1974 (L.I. 988). In 1993, the Fisheries Commission Act, 1993 (Act 457) was passed amending PNDCL 256.

Finally, in 2002, the Fisheries Act, 2002 (Act 625) was enacted by the then government to consolidate with amendments of all the foregoing laws on fisheries; to provide for the regulation and management of fisheries; to provide for the development of the fishing industry and the sustainable exploitation of fishery resources and to provide for connected matters. Fisheries Regulations L.I. 1968 intended to give effect to the Fisheries Act of 2002 (Act 625) and to streamline activities and bring about uniformity in the fishing industry was passed by Parliament in 2010.

In terms of sanitary and health issues relating to fish handling and sales, Food and Drugs Authority (FDA) is the main organisation involved. Its mandate involves ensuring all food products meets the appropriate standards of safety and quality through product evaluation, inspection and audit of manufacturing premises, industrial support services, investigation of consumer complaints and market surveillance activities. However, it has tended to be concerned about fish imports and not the handling of the domestic fish catch for local consumption. FDB certification is needed for fish imports, cold storage facilities and industrial fish processing sites. They also, to some extent, control the licensing of food

service establishments hence they have some influence in the formal sector on who buys and sells fish. Nevertheless, in most cases, there are no restrictions on who buys or sells fish. Furthermore, Ghanaian fishers are not allowed to sell their fish catch in other countries as per ACT 625. The role of the Ghana Standards Authority overlaps that of the FDA in the case of fish imports, since it claims that it is the competent authority mandated to undertake destination inspection for and on behalf of the Ministry of Trade and Industry.

GHANA'S FISHING SECTORS

The types of fisheries in Ghana can be classified into seven categories namely marine, artisanal, inshore, industrial, lagoon, inland fisheries and aquaculture. However, the data available from the Fisheries Commission does not explicitly include lagoon fisheries.

Artisanal Fishing Sector

This is a type of fishery system using very basic fishing methods such as dug out boats (canoe) often powered with outboard motors. The use of canoes can be found in almost all 300 landing sites in 200 fishing villages along the Ghanaian coastline It is generally considered small-scale fishing because it is dependent solely on local resources. The artisanal sub-sector consists of about 13, 000 traditional canoes and employs a wide range of fishing gear which includes purse seines (*poli/Watsa*), beach seines, drift gill nets (DGN), and surface set nets. Artisanal fishermen also use various forms of bottom set-nets, hook and line *(lagas*). The *laga* sand the DGN fleet operate beyond the 50 meter depth zone. The *lagas* are however well equipped with ice, food and fishing aids like fish finders and Geographical Positioning System (GPS). The artisanal sub-sector produces about 70-80% of the total annual volume of marine fish catch comprising mainly of small pelagic fish species and to a much lesser extent some valuable demersal fish species (Fisheries Scientific Survey Division, Ministry of Fisheries and Aquaculture).

The Marine Fishing Sector

The marine fisheries are essentially dominated by artisanal agents who provided an average of 71% of the total fish catch over the period 2000-2010. This result was followed by tuna fisheries (21%), other industrial fisheries (5.1%) and inshore fisheries (2.8%). Kwadjosse (2009) presents the total marine fishery catch as at 2007 in figure 6.

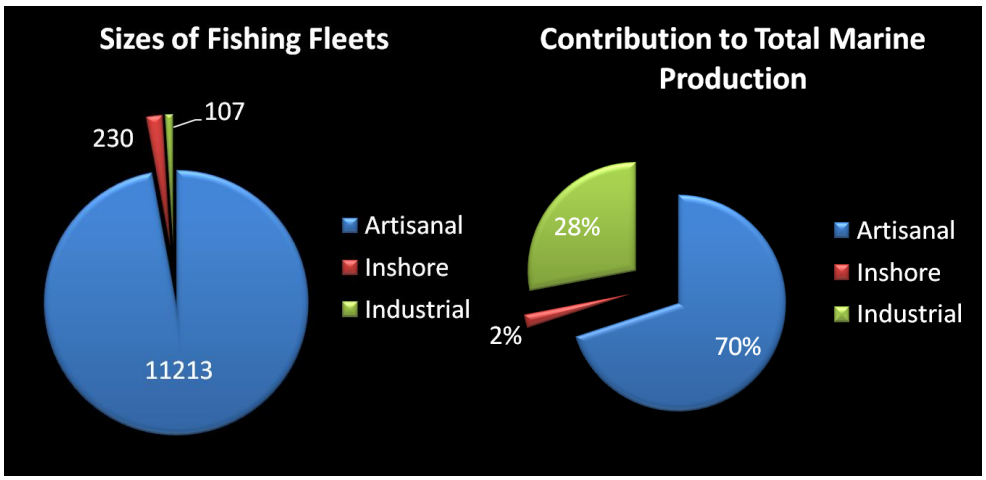

Figure 6 Total marine fishery catch as of 2007

Inshore Fisheries

The number of inshore vessels for the period of 2000-2009 is presented in Table 9, where the number of inshore vessels increased from 236 to 268 in the ten year period.

Table 9 Semi-Industrial or Inshore Vessel Numbers

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Inshore vessels	236	244	231	283	316	293	267	259	267	268
Operational vessels	167	178	152	233	253	240	255	231	240	226

Source: Fisheries Commission of Ghana, Antwi-Asare and Abbey (2011)

The operators of the inshore fishery use locally built motorised wooden vessels or small steel vessels measuring between 9 m and 12 m long, which operated both as trawlers and purse seines (MoFI, 2006). The vessels operated from Tema and Takoradi (where there were deepwater ports), the old Sekondi fishing habour and the Bosomtwi-Sam Fishing harbour in Sekondi. The fleet exploited both pelagic and demersal fish species and competed with the traditional canoes. In 2009, there were 226 operational boats which were generally fitted with 30-90 hp diesel engines. They fished during the upwelling seasons using purse seines mainly in the inshore waters between 30-50 m depth where they competed with the canoe fleet. The semi-industrial fleets produce about 2 per cent of the total marine catch.

The inshore fishery output by purse seine vessels from 2000-2010 is presented in Table 10, where some of the caught species were round sardinella, flat sardinella, chub mackerel, scad mackerel and others. The highest fish catch was in 2003 (11,891.84 tonnes) whereas the lowest was in the year 2002 (4,974.3 tonnes) (Antwi-Asare & Abbey, 2011).

Table 10 Inshore fishery output by purse seine vessels (tonnes)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Round sardinella	3177.99	3208.81	3449.14	8323.44	3585.03	2599.616	4326.38	4712.45	2888.73	7262.2	5792.79
Flat sardinella	34.97	529.79	80.91	158.34	49.33	77.687	2644.04	2320.054	128.21	273.79	565.96
Chub mackerel	3630.21	971.81	891.06	1999.56	1307.71	2023.968	1335.01	1176.626	1265.65	2088.49	1177.49
Scad mack	5.14	119.	149.	14.49	13.4	29.23	71.2	190.2	62.3	71.01	59.51

erel		46	93		3	6	9	59	4		
Others	368.21	381.89	403.26	1396.01	532.16	1987.79	5.49	388.38	899.84	1147.85	933.7
Sub-total	**7216.52**	**5211.76**	**4974.3**	**11891.84**	**5487.66**	**6718.297**	**8382.21**	**8787.764**	**5244.77**	**10843.34**	**8529.445**

Source: Fisheries Commission of Ghana, Antwi-Asare and Abbey (2011)

Inland fisheries

Inland fisheries cover fish production from Lake Volta, aquaculture, dams, other lakes and lagoons. However, fishery statistics are collected only from Lake Volta and aquaculture. Stocking of water bodies by fish began in the late 1940s in connection with the construction of community water supplies in Northern Ghana. Many small water bodies have been constructed in other parts of the country for the same purpose. Apart from the north, such dug-outs were common in the Volta Region. Stocking remains a Fisheries Commission activity in the north and also in the Volta Region; however operations have been hindered by the lack of mobility and availability of fingerlings. The Volta Lake is the largest source of inland fish and according to Braimah (1995), it supports about 140 species of fish and provides about 85% of the inland fish catch. The country's inland and marine fish production from 1998-2006 is presented in Table 11, where the marine fish production was generally higher than the inland fish production. The total production from the two sectors reached its peak in 2000 and its lowest production was in 2002.

Table 11 Fish Production (metric tonnes)

	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Total inland fish production	76000	89000	88000	88000	88000	75450	79000	76630	74331
Total marine fish production	376000	333000	380000	366000	290000	331412	352405	322790	315530
Total production	**452000**	**422000**	**468000**	**454000**	**378000**	**406862**	**431405**	**399420**	**389861**

Source: Fisheries Commission of Ghana, Antwi-Asare and Abbey (2011)

THE SARDINELLA FISHERY INDUSTRY

The fishery for sardinellas is an extremely important economic activity in Ghana. Sardinella is a relatively cheap food resource and its fishery constitutes the livelihood of many fishers; fish processors and traders in coastal areas in Ghana depend on the sardinellas. In years of good sardinella fishery, the species could constitute as much as 40% of total domestic marine fish production. Inter-annual differences in fish landings of Ghanaian fishing fleets are

caused mainly by the quantities of sardinellas and anchovies caught in the years. High Iandings of these species result in high total landings of fish for the year and poor landings result in low total landings for the year. The sardinellas are more important than anchovy as food fish and invariably a good fishing season means large quantities of sardinellas were landed in that season (Koranteng, 1995).

In the Ghanaian marine ecosystem, there are two sardinella species: the round sardinella (*Sardinella aurita*) and the flat sardinella (*Sardinella maderensis*). These are the only sardinella species in the Western Gulf of Guinea which encompasses Ivory Coast, Ghana, Togo and Benin. The two sardinella species together with the European anchovy (*Engraulis encrasicolus*) and chub mackerel (*Scomber japonicus*) are the most important small pelagic fish species in Ghanaian waters and throughout the Western Gulf of Guinea (Koranteng, 1995).

Throughout the entire region, the sardinella fishery, and that of anchovy, chub and horse mackerel are seasonal due to their periodical subjection to high variation in abundance due to environmental (climate) and/or anthropogenic (fishing effort) factors. *S. aurita*, for example, is most abundant during the period of the major coastal upwelling (July-September) although the juveniles are fished throughout the year, mainly by beach seiners and to some extent, by *poli* operators. The adults are fished during the two fishing seasons, i.e. July to September (main) and for about three weeks only in January/February (minor). *S. maderensis* on the other hand, being more tolerant to changes in salinity and temperature than *S. aurita* (Muta, 1964; Oren and Ofori-Adu, 1973), is around for most months of the year.

A Brief History of the Sardinella Fishery in Ghana

Sardinella fishery in Ghana has a long history. Before the introduction of the purse seine gear and motorized fishing in Ghana, the sardinella fishery which was localized in waters off Accra and Sekondi-Takoradi (Lawson and Kwei, 1974) was dominated by the use of beach seines. The beach seine and the '*ali*' nets were the traditional fishing gears for catching sardinellas. *Ali* fishing dates as far back as about 1850 (Lawson and Kwei, 1974).

Kwei (1964) noted that *Sardinella aurita*, accounting for over 50 % of yearly landings of marine fish, was the most exploited fish in Ghanaian marine waters in the sixties. Sardinellas, especially the *S. aurita*, form the socio-economic resource base for many rural fishing communities (Kwei, 1988).

In the early 1970s, sardinella stocks were thought to be the greatest potential resources in the whole of the Gulf of Guinea (Ansa-Emmim, 1973). Between 1963 and 1971, production from the fishery varied between 3,900 and 36,000 metric tons per annum providing the Ghanaian population with some 20,000 tons (average) of fish annually. This was consumed locally, and the sardinella fishery was regarded to be a very potential and consistent source of input for the new fish cannery at the Tema Food Complex Corporation. Even before this period the Fisheries Department, soon after it was established in 1946, had set up a pilot cannery and fishmeal plant (Ocran, 1973). The aim of the pilot cannery was to conduct trials into the canning of sardinella and mackerel. A similar attempt was made at Tema by the Russians in 1961.

Then came 1972 fishing season when Ghana alone harvested over 90,000 tons of both species of sardinellas. After this unusually high catch, especially of the *S. aurita*, this species

virtually vanished from the catches in 1973, then from the 1980s, there was a remarkable increase with an all-time high of 140,000 metric tons in 1992 (Mensah *at al*., 2003). Ever since, landing declined reaching 64,000mt in 1997. In recent years, catches of these species, especially of the round sardinella, have been highly variable and most unpredictable. The resources appear to have dwindled and showed signs of complete collapse in some years. In 2009, the annual catch of the Sardinella species was 13% of the country's ever historical maximum of 140,000 metric tons in 1992. According to Mullon *et al*. (2005), when yield is less than 10% of historical maximum, then there is collapse of the species. Implication is that the sardinella species nearly collapsed in Ghana

Description of the Current Sardinella Fishery in Ghana

The sardinella fishery in Ghana today is characterized by the use of various types of gears. The main gears used are '*poli*', '*ali'*, '*watsa*', and beach seine in the artisanal sector, and purse seine and, to a very limited extent, trawl in the industrial and semi-industrial fleets. These gears are mainly operated from dug-out canoes made from wawa (*Triplochiton scleroxylon*) trees. There are currently about 124,000 fishers employed in the artisanal sector. This number is quite close to the 123,000 fishers reported in 2001 (Bannerman *et al*., 2001), so it does not look like effort, in terms of number of fishers, has moved in or out of the artisanal sector. A total of about 11,000 canoes operate actively from over 300 landing sites located along the over 500 km length of the coastline (Amador *et al*., 2006). Just over half of these canoes are powered by outboard motors with engine power of up to 40 hp. (Amador *et al*., 2006). Canoes carry crews of up to 20 people.

Distribution of Sardinella Landing in the West African Sub-Region

Artisanal fishermen play a dominant role in exploiting the small pelagic resources. The anchovy stocks are harvested exclusively by the canoe fishermen operating off the Ghanaian and Togolese coastlines. The bulk of Ghana's sardinella landings are also from the artisanal sector. The Ivorian industrial fleets, on the other hand, are as equally important as the canoe fleets in the domestic production of sardinella (Tettey and Koranteng, 1995).

The sardinella season in the sub-region usually begins in June/July and ends in November/December. This has been consistent with the seasonal distribution in catches for Côte d'Ivoire and Ghana over the last couple of years. In Ghana, sardinella production for 1991 and 1992 reached their seasonal peaks in August and July respectively. In Côte d'Ivoire, the producers recorded their season high for both 1991 and 1992 in the month of August (Tettey and Koranteng, 1995).

To meet increasing demand for fish in Gulf of Guinea coastal countries, substantial volumes of frozen sardinella/herring, among other frozen fish, are imported to supplement local catches. The bulk of the imports originate from Senegal, Mauritania, Guinea and from Russian fleets operating off Western Africa. The leading frozen small pelagic markets in West and Central Africa include Nigeria, Côte d'Ivoire, Zaire, Cameroon, Ghana, Togo and Congo (Tettey and Koranteng, 1995).

Due to the species mix in the CECAF region and the difficulty in catching small pelagic species such as sardinella with the gear used for trawl surveys, it has been impossible to estimate the total biomass for the two sardinella species to any degree of accuracy. CECAF Project reports estimate the potential of sardinella in the area between Mauritania and Guinea

at around 400 000 and 600 000 tons, fluctuating yearly and sometimes close to one million tons. Marchal and Boely (1977) and Boely and Fréon (1979) estimate the potential of sardinella in the Mauritania-Senegalese zone at 300 000 tons. Reports of echo surveys for the Cote d'Ivoire-Ghana sector estimates the potential at 250 000 tons (Marchal and Picaut, 1978), and at 359 000 tons (Robertson, 1977). The potential of the sardinella stocks in the Congo-Angola sector has been estimated at around 600 000 tons (Anon, 1980).

The Sardinella Species

Sardinella are distinguished by their ranges and by specific body features, but they are often confused with one another. Fish of the genus have 7 to 14 striped markings along the scales on the top of the head. The paddle-shaped supramaxilla bones are characteristic; they separate Sardinella from other genera and their shapes help distinguish species. There are paired predorsal scales and enlarged fin rays. Sardinella is distributed in both sides of the Atlantic Ocean, throughout the Mediterranean Sea, and in the Indian and the Western Pacific Oceans.

Recent reports of the FAO Working Group on the assessment of small pelagic fish off North West Africa concluded that 5 of the 10 stocks studied were found to be either fully or over-exploited. Sardine (*Sardina pilchardus*) stocks (the most important for the region) have been subject to large, unpredictable, fluctuations, indicating vulnerability. While not intensively exploited in the southern area of its distribution, the Central sardine stock was found to be overexploited. Round sardine (*Sardinella aurita*), with catches of around 300,000 tonnes in 2006, has been showing an overall downward trend in biomass since 1999, although with a slight increase in 2006. More than half of the demersal stocks studied, targeted both by artisanal and industrial fishing are overexploited. A large part of the fishery resources of the West African region undertake trans boundary migrations: the smaller pelagic fishes (typically sardines, mackerels and horse-mackerels) remain relatively close to shore but migrate between EEZs (CCLME project document).

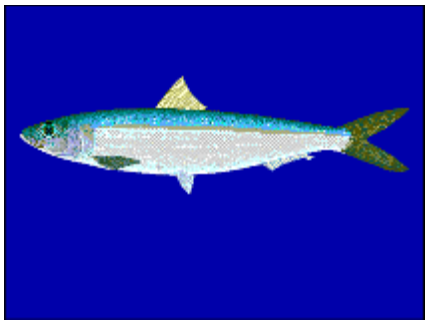

Plate 8 Sardinella aurita (Source: Froese and Pauly, (2002)

Commonly called the Round Sardinella, this species belongs to the order Clupeiformes of the family Clupeidae and the class Actinopterygii (Plate 8). It is locally called '*Eban' or 'Kankama'*. It is usually found in marine pelagic waters of 0-350 m depths especially in West Africa. It is distributed in subtropical climate (46°N-36°S) that is in the Black and Mediterranean Seas, in the Eastern Atlantic as well as in the Western Atlantic. Spawning occurs during the upwelling seasons. It is a highly schooling fish usually associated with the inshore shelf area and having a diurnal migratory feeding pattern. Its' typical diet is mainly composed of zooplankton and copepods. It is classified by the FAO as highly commercial and used locally for food as well as for live-bait in tuna fishing in the CECAF. The size distribution in Ghana has been estimated as 5-15 cm for the beach seine and 18 cm for the

ring net (Anakwah and Santos, 2002). It is fished mainly by beach seines and to some extent, 'poli' operators during the two main seasons, July to September (main) and for about three weeks in January/February. These fish are believed to be sensitive to changes in temperature and salinity (Koranteng, 1999).

Plate 9 Sardinella maderensis (Source: Froese and Pauly, (2002)

The flat Sardinella (as it is usually called) belongs also to the class Actinopterygii and Order Clupeiformes of the Clupeid family (Plate 9). To the local people, it is '*Antebo', druku'* or *'Antar'*. It is also a marine pelagic of the tropical Eastern Atlantic from Ola. It thrives at a depth of 80 m and below by feeding on fish larvae and plankton. Breeding occurs in the warm season (July to September) and it is used locally. There is a strong schooling behavior in coastal waters of 24°C with diurnal migration for a diet of fish larvae and zooplankton. Their movements are also correlated with seasonal upwelling (Froese and Pauly, 2002). It is also on the FAO list of highly commercial species and seems to be more tolerable to changes in temperature and salinity than *S. aurita* (Mensah and Koranteng, 1988).

Plate 10 Engraulis encrasicolus (Source: Froese and Pauly, (2002)

The anchovy is another marine pelagic found in the eastern north and Central Atlantic between 62°N and 19°S. It also occurs in brackish water. It is locally called '*Bornu* or '*Keta school boys'*. It belongs to the family Engraulidae, order Clupeiformes and Class Actinopterygii (Plate 10). Breeding occurs during the warm months. It is migratory and schooling occurs in saline waters. The diet is mainly composed of planktons. They can thrive in salinities of 5-41 ppt and in certain regions, migrate into lagoons, estuaries and lakes during spawning. It is also classified by the FAO as highly commercial.

Difference between Sardinella and Anchovies

Anchovies are placed in the family of Engraulidae. They have a forked tale with a single dorsal fin and the body is round and slender. The maximum length is 205 mm. Sardine (*Sardina philcardus*) Is a genus of fishes in the family Clupeidae. It has an oval-shaped body with sharp scales in its belly. The back is teal blue whereas the belly is silvery. *Sardinella aurita* (Round Sardinella) is a genus of fishes in the family Clupeidae. It has an elongate body and a rounded belly and it is one of the largest Sardinella species **(**Saviosrl, 2014).

OVERVIEW OF REGIONAL SARDINELLA FISHERIES SECTOR

Production

Global capture of sardines in tonnes reported by the FAO in 2012

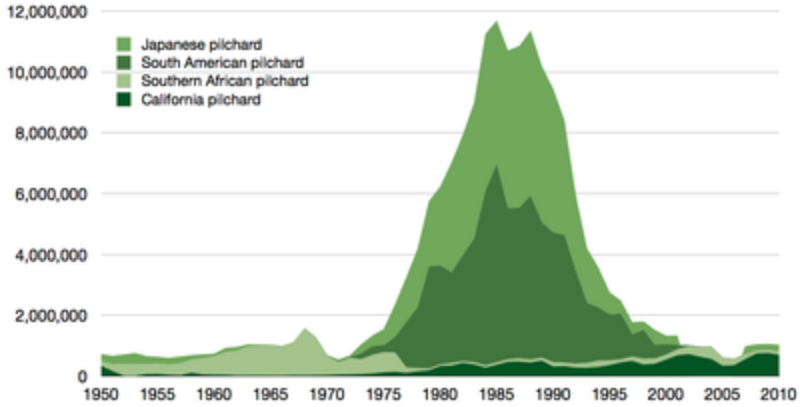

Figure 7 Sardines of the Sardinops genus, 1950–2010

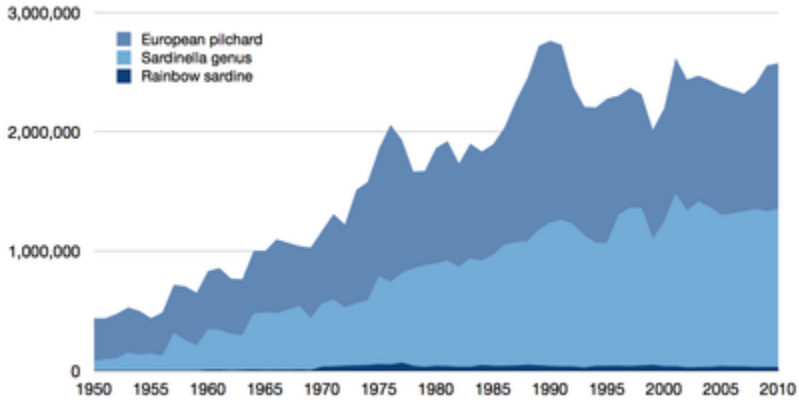

Figure 8 Sardines not of the Sardinops genus, 1950–2010

Standing (2012) explained that, patterns of production, trade and consumption of small-pelagic fish in Western Africa are complex and dynamic. One can distinguish between two distinct, but interrelated sectors – the small-scale sector which catches small-pelagics almost exclusively for local and regional consumption, and the industrial sector, comprising both nationally owned industrial boats and distant water fishing fleets, which supplies both West African and the international markets.

In Northwest Africa, the fleet of small-scale fishers from Senegal are clearly the most numerous and productive; there are approximately 59,000 Senegalese small-scale fishers and small-pelagics make up about 70% of their catch, or 430,000 tonnes in 2005. This in turn supplies fish for the post-harvest sector that employs an estimated 41,000 people, over 90% of whom are women. Mauritania has a much smaller artisanal sector that landed about 19,000 in 2005 increasing to nearly 60,000 by 2010. But almost all of this catch by the small-scale sector is consumed in local markets, or is processed and traded regionally. A study in 2005 by FAO, estimated that half the catch of sardinellas, the most abundant species of small-pelagics in the region, are sold in Senegal, Mauritania and the Gambia, while the other half is traded to other West African countries, with trade circuits stretching as far as Gabon in Central Africa.

Alongside this small-scale production system is the industrial sector, which is concentrated in Mauritania with annual catches of small-pelagics fluctuating from about 560,000 to over 800,000 tonnes. Until the early 1990s industrial fishing for small-pelagics in West Africa was

dominated by vessels from the Soviet Union, but with the collapse of the Soviet Union during the 1990s, their numbers in West Africa temporarily declined, to be replaced by an increasing number of European boats, particularly from the Netherlands, Lithuania, Latvia, Poland and Ireland, who began fishing under an EU fisheries agreement in Mauritania in 1996. The current EU FPA in Mauritania limits the number of fishing vessels targeting small-pelagics to 20, with a total allowable catch of up to 300,000 tonnes. It is likely that many of these former ex-Soviet boats make up the bulk of the small-pelagic Distant Water Fishing Fleet (DWFF) operating in Mauritania today, which number about 50.

Fish Catch Statistics

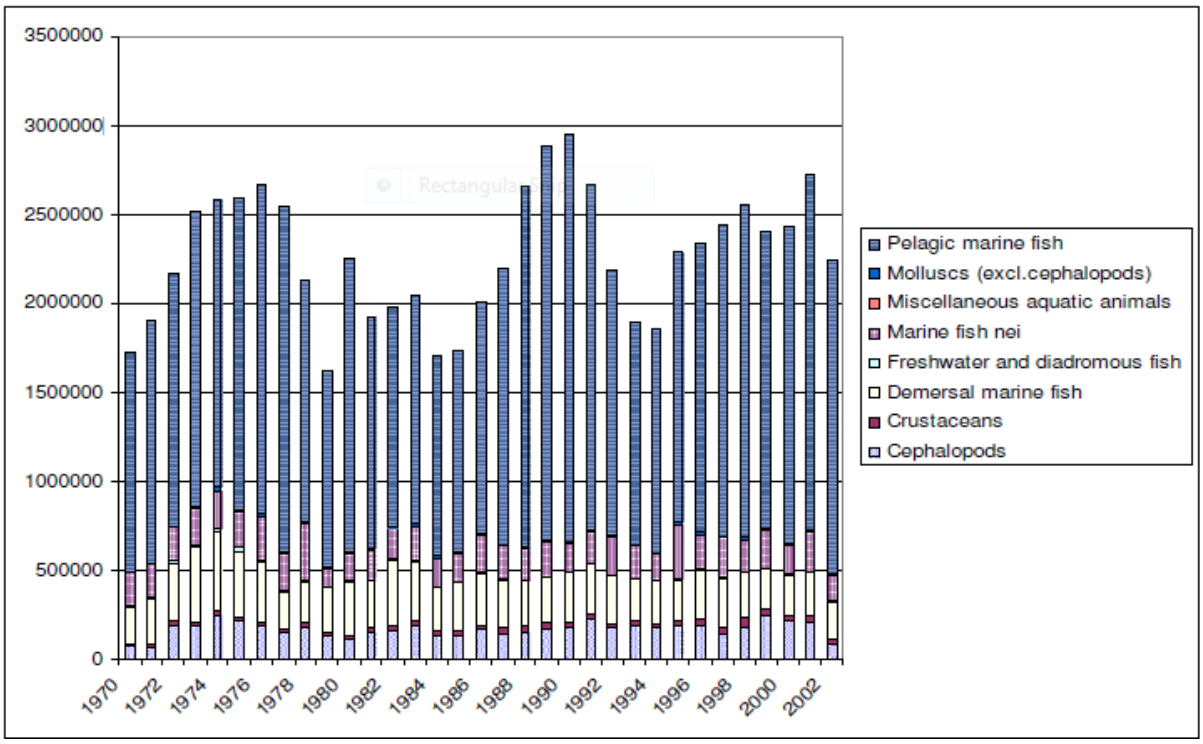

Figure 9 Landings per FAO group of species for divisions (FAO, 2004)

The growth in European trawling for African small-pelagics increased imports of African small-pelagics to West Africa - unlike the Soviet Union trawlers that exported comparatively little of its catch to West Africa, the Dutch trawlers in particular expanded export of small-pelagics caught in West Africa to African markets, with Nigeria being the most important. Nigeria's supply of small-pelagics from industrial fisheries therefore grew impressively since the end of the 1990s, nearly doubling from 1993 to 1998, almost all of which originated from Dutch companies. Nigeria is now the largest West African market for small-pelagics by far, with total imports being roughly 600,000 tonnes per year.

There is particular concern with rates of overfishing of sardinella, the main species caught by the small-sector and traded regionally. In 2009, total catches in the region were estimated at 1,268,000 tonnes.

Until recently the Pacific Andes group, including China Fisheries, had minimal involvement in African fisheries. However, in 2008 a capital injection of 190 Million USD from the multinational investment firm the 'Carlyle Group' was explicitly aimed to help expand China Fisheries into West Africa, described by China Fisheries in its 2010 annual report as 'largely

unexploited". China Fisheries reports that some of its vessels operating in Latin America are now being deployed in West Africa during the off-season in Chile and Peru. Information on exactly where China Fisheries is fishing, how many boats it has deployed from South America and what are its catches of small-pelagics in West Africa are unknown. However sales of fish products to Africa have increased significantly in the past two years, representing over 20 percent of their revenue in 2011, up from 3.2 percent in 2010.

Sardinella Catch Statistics

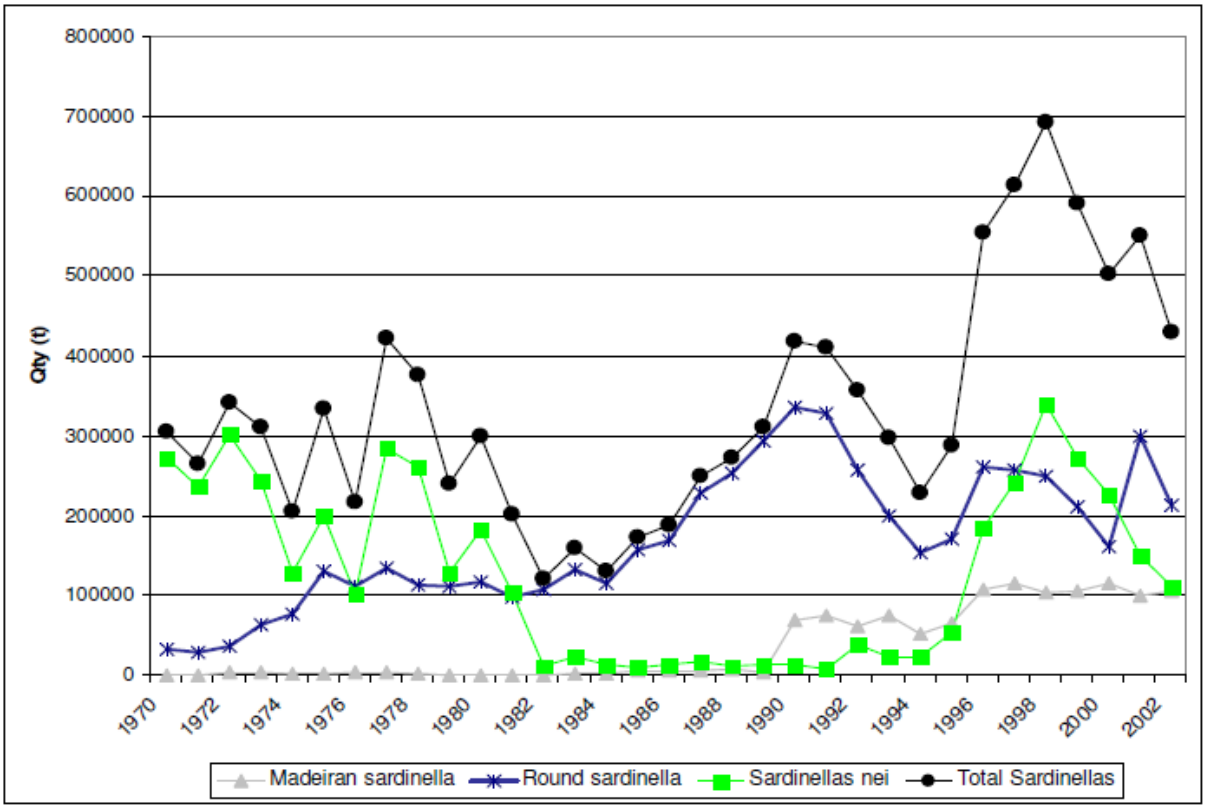

Figure 10 Catch analysis for 3 Sardinella species (FAO, 2004)

The global fleet of 'super trawlers' can therefore not afford to stop fishing, so decrease in fish stock in Peru; one area of the world where small-pelagics have been abundant, is likely to lead to increased fishing pressure in other parts of the world, such as West Africa.

POST HARVEST PROCESSING

In the West African Region, fish is processed mostly through smoking, salting, cannery and frying. Most of the processing activities are highly dominated by women especially the informal ones. Industrial canneries are more dominated by men.

In Gambia, Sardinellas, shad and other types of fish are sold fresh or smoked in their markets. Women are the predominant dealers and marketers of fresh and cured fish to domestic urban markets near landing sites, while long-distance trade involving relatively capital-intensive techniques and higher profit margins, including the export of frozen and smoked/dried fish products is carried out mainly by men. 80 per cent of fish processors and 50 per cent of small-scale fish traders are women in The Gambia (WTO, 2014). In Ghana about 80% of fish landed is smoked and the rest is either fried, sun dried or fermented (Mensah *et al.*, n.d.).

Small pelagics represent more than 75 percent of the artisanal catches and 55 percent of total marine catches. In the industrial fisheries these species are either frozen or canned, while in the artisanal fisheries they are mostly cured, for domestic consumption and for export. Owing to their low value, small pelagics are seldom refrigerated. Common processed products found in local markets were *'Kethiak'* (roasted, salted and dried *Ethmalosa*or *Sardinella*), *'tambadiang'* and *'yauss'* (whole dried *Ethmalosa*). However, in recent years, a semi-finished product made from minced fillets of small pelagics appeared in the fish utilization systems in Senegal and is increasing in importance in local beaches and markets. The product is also made in markets of Nouakchott (Mauritania) and recently (2002) also appeared in landing sites in Gambia. A variety of minced fish end-products have been reported, including fish balls, sandwich of cooked minced sardinella, cakes, attractive presentations for salad and for main dish, stuffed eggs and wrapped eggs. They are consumed within households, in restaurants and chop bars or within the premises of schools and colleges (Diei-Ouadi, 2005).

The FAO working group on small-pelagics off Northwest Africa described that in 2010 four fishmeal factories started operating in Nouadhibou (Mauritania). Originally, these factories were meant to use poor quality fish and discards, and also *'bonga'* that is fished near Nouadhibou. In practice, the FAO reports that these two sources of raw material are not sufficient to keep all fishmeal plants in operation. The new fishmeal plants therefore depend more and more on sardinella for raw material. All the flat sardinellas are thus processed into fishmeal as is the round sardinella of small size or poor quality.

POST HARVEST LOSS ISSUES

It has been estimated that 10 percent by weight of world fish catch is lost by poor handling, processing, storage and distribution. However, losses in small-scalefish processing are said to be particularly high and figures as high as 40% are sometimes reported (FAO, 1984; Mills, 1979; Moes, 1980).

A study carried out by Diedie–Quadi in 2010 for FAO in 5 countries; Ghana, Kenya, Mali, Uganda and United Republic of Tanzania indicates that post-harvest fish losses in small-scale fisheries occur at all stages in the fish supply chain, from capture to consumer. Huge physical and quality losses were found to occur in some supply chains assessed in all the countries, with quality losses reported to account for more than 70% of total losses.

Concurring data are that physical losses seldom exceed 5 percent in some fisheries, but the findings from assessments of the Lake Victoria sardine (*Rastrineobola argentea*) fishery indicate that much higher losses are occurring during the rainy season when poor drying conditions prevail. Physical losses in this fishery account for more than 20 percent, sometimes higher during the main fishing season. Much of the fish is processed as fishmeal and is lost for direct human consumption, but also substantial quality nutrients are lost for the poultry industry. This remark underscores the need for proper handling of fish products regardless of their intended use (for direct human consumption or animal feed). In the fresh tilapia and fresh Nile perch fisheries quality losses were found to affect all stakeholders significantly; however, fresh tilapia traders were less affected compared with other operators because they bargained prices according to the freshness of fish collected from the fishermen. The frequency of losses is also lower among the fresh Nile perch traders because most of them use ice and handle the fish hygienically, which is sold to factories for export purposes. In Mali, quality loss in fresh fish during the main and lean seasons was put at 17% and 25.7%, respectively. For smoked fish, 21% is lost during the main fishing season (302.4

tonnes dry weight) as against a negligible loss during the lean season because of the capacity of the processing facilities to cater for the volume of catches. The quality loss in smoked fish is a result of uneven smoking thereby leading to downgrading of the price.

The study in United Republic of Tanzania showed that there is significant quality deterioration of Lake Sardine if it rains before the drying process is completed. It is estimated that during rainy days 5% of sardine is discarded as physical loss and another 80% is sold at less than 20 percent of the best price for good quality sardine because of wash off and spoilage. At the macro level, it is estimated that losses incurred run into millions of United States dollars annually in each country. For example, in Ghana US$60 million and US$9.4 million were recorded as monetary losses in the smoked fish processing and *Watsa* (purse seine) fishery, respectively. Smoked fish losses were due to droppers (fish falling into the fire during processing), burning, insect infestation and rancidity. Multiple hauls of fishing gear, catch exposure to high temperatures, lack of storage facilities onboard canoes, and long distances from fishing grounds were the causes of losses in the '*Watsa'* fishery. Although the nutritional losses and human health problems were not the focus of the study, it can be easily admitted that these financial losses add to the food safety and quality concerns in small pelagic species (such as anchovies in Ghana), which form a noticeable part of the landings in question and are known to be prone to histamine accumulation under conducive uncontrolled time/temperature conditions.

Fishermen, processors and traders perceive that there is need for immediate interventions and that some losses are a serious socio-economic problem because highly nutritious fish are lost from human consumption and discarded despite widespread food insecurity among the people of Africa. To try and reduce or prevent losses various coping strategies are used by fishermen, processors and traders with varying degrees of success.

Sardine Losses Related to Processing and Pricing

According to the study quoted above by Diedie-Quadi in 2010, the Lake Victoria sardine (*Rastrineobola argentea*) is a very important resource supporting thousands of livelihoods in the region and beyond. According to the Department of Fisheries Resources in Uganda, 80% of the estimated 76 587tonnes of sardine landings are processed for animal feed and only 20% are marketed for human consumption. Lake Victoria sardine for human consumption is usually dried on raised racks, properly handled and sold according to the quality grade. There is a negligible physical loss. Fishmeal is dried on bare sand, rocks and grass and is mishandled during storage, packaging and distribution, resulting in quality losses of 26 to 36%. Pricing is not related to quality, but rather to the weight of the consignment or batch. This leads to fewer loss control measures during processing (e.g. chasing the birds and animals, preventing the drying fish from being washed back into the lake during rain) and encourages careless practices such as not sorting out sand and stones from the dried product.

In the United Republic of Tanzania, sardine processors know that fish dries faster on raised platforms and the end products are free from sand. The buyers see that the quality is good and are prepared to pay a good price but, unlike in Uganda, the same product does not attract a better price. This may be due to limited awareness among consumers of the quality and safety advantages of rack dried versus ground-dried fish. Sardine losses are high during the rainy season. The poor practices in fishmeal production are leading to continuous losses. There is now a social stigmatization of sardine among middle- and upper-class consumers in Uganda.

As such, sardine is usually associated with low-income consumers who, by virtue of their limited economic outlay, rarely demand high-quality products.

Trade

The West African region is perhaps unique in the extent to which trade is such an integral part of the daily lives of so many people. Trade is an arena where women are especially active, be they women from urban or rural areas or women employed in the private or public sector. In this region, women of fishing communities have historically been active in fish processing and trade. In many countries in the region, especially in Ghana, Benin, Togo, Gambia, Guinea, Conakry and Senegal, women have been known to dominate on-shore handling, processing and marketing of fish.

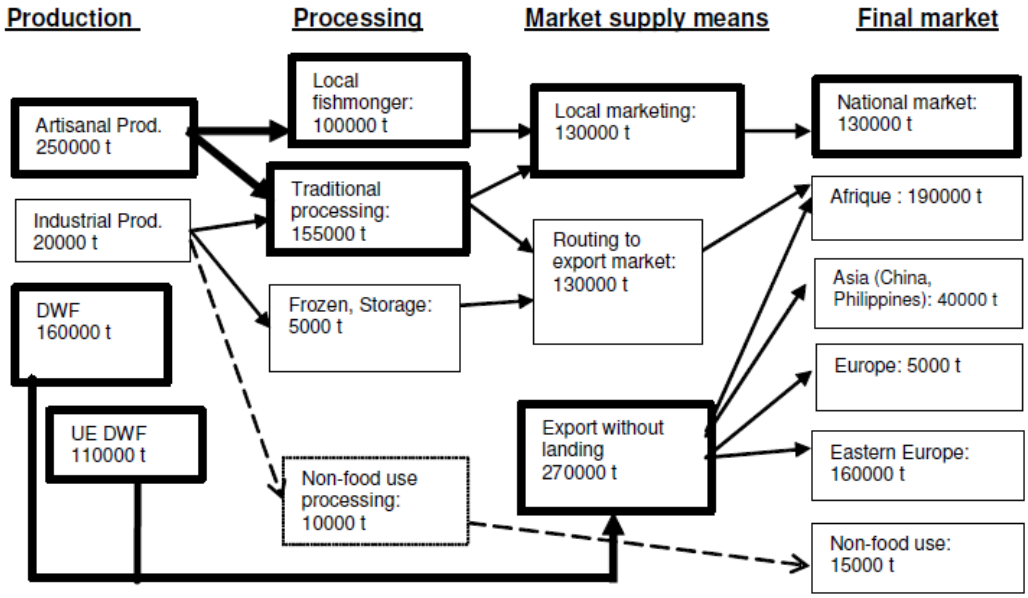

Figure 11 Average yearly (1996-2000) Sardinella production, processing and distribution (FAO, 2004)

A report on fish trade in West Africa (uncited) informed that exports of fish from West Africa to EU were worth €642 million in 2003. This equals 5% of all exports to EU and includes fresh fish as well as processed. This is spread out by country in Figure 11:

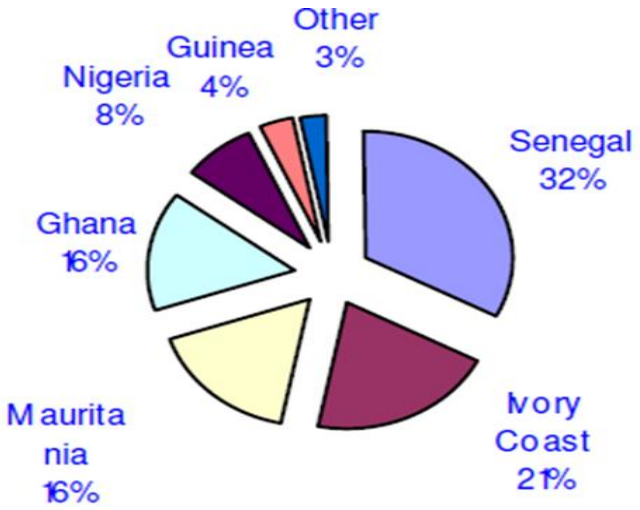

Figure 12 Importance of Fisheries products in West African trade (FAO, 2004)

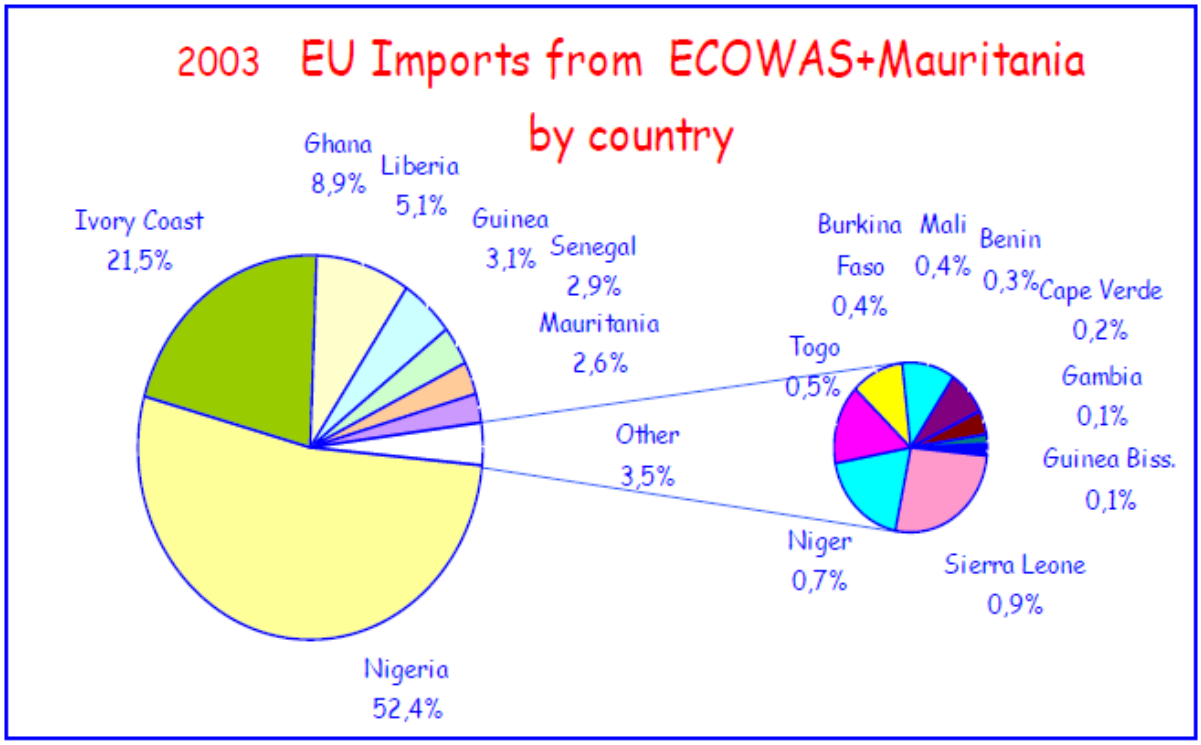

Figure 13 EU imports from ECOWAS and Mauritania (FAO, 2004)

According to a report by FAO in 2007, General trade data masks the complexities of trade routes and products: Senegal and Mauritania have an export surplus, while Côte d'Ivoire, Ghana' Nigeria, and the major regional market imports more than they export. In West and Central Africa, fish exports are dominated by Côte d'Ivoire, Mauritania, Morocco and Senegal which rank also among the African top ten fish exporters. The main trading partner is the European Union, to whom West and Central Africa supplies 12% of its total fish imports. Typically, high-value species (prawns, tuna, and squid) are exported while cheaper fish (pelagics such as sardines, mackerel) are imported.

The major coastal fishery resources in West Africa are concentrated in the north, from Morocco, through Mauritania to Senegal and Guinea Bissau, and in the South, off Namibia and Angola. The major fish consuming countries, on the other hand, are in the Gulf of Guinea

area where population densities are higher and marine resources relatively lower. Senegal, for example, is an important supplier of fish and fish products while Nigeria, Côte d'Ivoire, Benin, Ghana and Togo are important markets. In this context, intra-regional trade in artisanally processed fish products can and does play an important role in ensuring a better and more balanced supply of fish throughout the region, with important implications for food security. However, it remains constrained by several factors, including infrastructure, capital, technology and information-linked bottlenecks, as well as tariff and other barriers that hinder the flow of fish and fish products within the region.

It is worth noting that Nigeria, the largest importer of fish in the region, meets most of its import requirements from outside the West African region. In 1996 Nigeria imported an estimated 400,000 tonnes of frozen fish, worth US$289 million from Netherlands, Norway, United Kingdom, Switzerland, United States of America, Canary Island, Mauritania, Senegal and Morocco. The main suppliers within the region were Mauritania (153,000 t) and Senegal (1,372 t). In other words, less than 40 per cent of Nigeria's requirements were being imported from within the region.

Failler and Samb, 2005 explained that the impact of foreign competition on regional and local fish trade in West Africa is growing. Small pelagics (sardinellas) are traded through three routes: local, national and regional trade based on small-scale fisheries, regional trade from industrial fisheries and international trade based on distant water fleets under fishing agreements. Trade with Asia, particularly China, is increasing. This could affect fish supplies in local markets by reducing the supply of inexpensive fish in local markets. There are concerns that this would have negative impacts on the food security of poor people.

Efforts to Promote Intra-Regional Trade in West Africa

In a study on cross-border trade issues in Ghana (Morris and Dadson, 2000), of the 105 traders interviewed, 24% ranked government inspections, 18 per cent numerous police blocks and 15% extortion by customs officials, as the most important obstacle to cross-border trade. Some initiatives have been taken at the regional and sub-regional level to harmonize tariff structures to promote intra-regional trade. Efforts by ECOWAS to streamline trade policy and to adopt a common duty and tax schedule in West Africa, date back to the 1970s (Tettey, 1987). The members of ECOWAS are Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo.

However, member states failed to incorporate these special provisions, preferring to apply their own regulations. Similarly, non-tariff barriers were to have been removed within 4 years from May 1981 under the stipulated common policy. Economic difficulties in the individual member states made it impossible to put this into effect as member States demanded a compensation budget be made available to make up for any losses to customs revenue. These initiatives got a new impetus after the 1992 revision of the ECOWAS Treaty and have since gained some momentum. The trade liberalization scheme of ECOWAS aimed at a progressive reduction, culminating in the elimination of all tariff and non-tariff barriers against intra-ECOWAS trade. Although, by the agreed implementation schedule, total elimination of all trade barriers was expected to occur by the end of 1999, this in fact did not happen, as at that point in time, only one country, i.e. Benin, was able to operate in compliance with the agreed obligation. However, the fact of the matter eight years after is that Benin is the only country that applies lower tariffs on goods originating from within the

Community. Overall, the level of intra-regional trade is extremely low, accounting for a paltry 11% of total trade.

Efforts to harmonize existing trade policies and regulations have met with more success at the sub-regional level. L'Union Economique et Monétaire Ouest Africaine (UEMOA, erstwhile Communauté économique de l'Afrique de l'Ouest, CEAO), a eight-member francophone group comprising Benin, Burkina Faso, Cote d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo, established preferential duty on some goods, including fish and fishery products, at the sub-regional level in the 1980s. Prior to 1983, Mauritania and Senegal, two CEAO major fish suppliers, benefited from this special tax concession. However, due to fraudulent practices on the part of producers outside the CEAO who managed to benefit from the system, Ivory Coast abolished its special tax concession in 1984. This non-compliance by Ivory Coast, UEMOA's most important fish importer, diminished the benefits from this measure (FAO/ Globefish, 1994). Much progress has subsequently been made. UEMOA has a common currency and has already achieved customs union—this came into force on 1 January 2000—with a common external tariff. UEMOA's supplementary bill No. 04/96 instituted a preferential tariff regime applicable to trade within the Union. It is noteworthy that ECOWAS and UEMOA are working together to harmonize their efforts and programmes towards the establishment of a single and viable monetary zone in West Africa, towards the creation of a common West African market.

Fish trade policy concerns

Fish is the most valuable food commodity traded internationally, reaching a record export value of US$71.5 billion in 2004 – an increase of 51% since 1941. For many developing countries, the fisheries sector represents a major source of foreign exchange revenue through trade with developed countries and through foreign fishing licence agreements. Fish exports can strengthen income and employment opportunities for local people in domestic fisheries in coastal and inland regions. However, in many countries, policy related to fish trade cannot keep pace with this rapidly growing and evolving sector. Inappropriate policy frameworks put at risk the benefits of increased trade for national development and local communities. Weak governance in the presence of expanding fish trade could aggravate overexploitation of vulnerable fish stocks and diminish access of local markets through traditional trading links and market chains (FAO, 2007).

In the national Poverty Reduction Strategy Papers of at least 12 West and Central African countries, the fisheries sector is considered important for foreign exchange generation, employment, income and food security – but only three countries (Ghana, Guinea, Senegal) have so far adopted sectoral mainstreaming. Policy-making processes for economic development and poverty reduction have overlooked the fisheries sector and fish trade, indicating a general weakness in the policy process. Fisheries and trade-related government institutions often lack capacity, finances and support from central government to develop strong policy processes to support the contribution of fish trade to development, evaluate investment options and make appropriate decisions, including investments in new forms of trade (FAO, 2007).

So far, West and Central African fish exports have benefited from preferential access to international markets through agreements such as the European Union-African, Caribbean, Pacific State (EU-ACP) Trade Agreements. In the scope of trade liberalization, such agreements will be renegotiated to comply with World Trade Organization (WTO)

provisions. Major exporters such as Mauritania and Senegal have overcome some constraints, i.e. domestic supply, by investing in infrastructure and fishing fleets. Other countries still have unrealized fish trade potential (Guinea, Liberia, Sierra Leone).

On the basis of a recent survey of National Poverty Reduction Strategies in Africa, Thorpe *et al*. (2005) undertook an evaluation of the extent to which fisheries have been mainstreamed into development and poverty reduction approaches. They reached the following conclusions:

- Although the fisheries sector is deemed to be highly significant in trade/consumption and/or poverty employment terms in 12 countries, such significance only translates into effective sectoral mainstreaming in 3 of the accessed PRSPs (Ghana, Guinea and Senegal).

- There is larger group of nine countries, Cape Verde, Chad, Gambia, Madagascar, Mali, Mozambique, Sao Tome and Principe, Sierra Leone, and Tanzania for whom the sector is significant, yet this significance is not properly reflected in contemporary PRSPs.

- There is a smaller sub-set of three countries, Cameroon, Malawi and Mauritania who have managed to effectively mainstream fisheries into the PRSP, despite the sector being relatively less/ unimportant in trade/consumption and/or poverty/employment terms.

Annex 2 Questionnaires

Questionnaire: Regional Partner (Duly filled from Liberia)

NB: Small pelagics = Sardinella sp., Engraulis encrasicolus (Anchovy), and Decapterus, Scomber or Caranx spp. (mackerels)

Fish production, trade volumes and values, 2010-2014

Indicator	**2010**	**2011**	**2012**	**2013**	**2014**
Fish production **(Tonnes)**	3,028.00	2,454.40	1,963.52	1,570.82	204
Fish production value **(000 $)**	$4,239,200.00	$3,436,160.00	$2,748,928.00	$2,199,148.00	$285,600.00
Import Volume **(Tonnes)**	20,671.67	23,719.32	29,620.73	11,198.13	22,694.3
Import Value **(000 $)**	$5,879,654.76	$6,512,256.78	$6,791,340.97	$3,456,970.10	$6,312,476.54
Import Unit Value **($/kg**)	$0.28	$0.27	$0.23	$0.31	$0.28
Export Volume **(Tonnes)**	0	0	0	0	0
Export Value **(000 $)**	0	0	0	0	0
Export Unit Value **($/kg)**	0	0	0	0	0

Sardinella production, trade volumes and values, 2010-2014

Indicator	**2010**	**2011**	**2012**	**2013**	**2014**
Sardinella production **(Tonnes)**	160	139	111.2	88.96	20

Sardinella value **(000 $)**	$112,000.00	$97,300.00	$77,840.00	$62,272.00	$14,000.00
Imported *Sardinella* Volume **(Tonnes)**	9,987.05	7,845.90	10,235.03	6,345.02	8141.54
Imported *Sardinella* Value **(000 $)**	$3,894,949.50	$3,059,901.00	$3,991,661.70	$2,474,557.80	$3,175,200.60
Imported Unit Value of *Sardinella* **($/kg)**	0.39	0.39	0.39	0.39	0.39
Exported *Sardinella* Volume **(Tonnes)**	0	0	0	0	0
Exported *Sardinella* Value **(000 $)**	0	0	0	0	0
Exported Unit Value of *Sardinella* **($/kg)**	0	0	0	0	0

Small Pelagics production, trade volumes and values, 2010-2014

Indicator	**2010**	**2011**	**2012**	**2013**	**2014**
Small pelagics production **(Tonnes)**	2,868.00	2,315.40	1,852.32	1,481.86	184.00
Value of Small pelagics **(000 $)**	$4,127,200.00	$3,338,860.00	$2,671,088.00	$2,136,876.00	$271,600.00
Imported Volume	10,684.62	15,873.42	19,385.70	4,853.11	14,552.76

of Small pelagics **(Tonnes)**					
Imported Value of Small pelagics **(000 $)**	$1,984,705.26	$3,452,355.78	$2,799,679.27	$982,412.30	$3,137,275.94
Imported Unit Value of Small pelagics **($/kg)**	$0.20	$0.20	$0.20	$0.20	$0.20
Exported Volume of Small pelagics **(Tonnes)**	0	0	0	0	0
Exported Value of Small pelagics **(000 $)**	0	0	0	0	0
Exported Unit Value of Small pelagics **($/kg)**	0	0	0	0	0

Sardinella import/export from/ to Ghana, 2010-2014

Indicator	**2010**	**2011**	**2012**	**2013**	**2014**
Imported *Sardinella* from Ghana **(Tonnes)**	0	0	0	0	0
Imported *Sardinella* from Ghana **(Value) (000 $)**	0	0	0	0	0
Unit Value of *Sardinella* imported from Ghana **($/kg)**	0	0	0	0	0
Exported *Sardinella* to Ghana **(Tonnes)**	0	0	0	0	0
Exported *Sardinella* to Ghana Value **(Value) (000 $)**	0	0	0	0	0
Unit Value of Exported *Sardinella* to Ghana **($/kg)**	0	0	0	0	0

Small Pelagics import/export from/to Ghana, 2010-2014

Indicator	2010	2011	2012	2013	2014
Imported Small pelagics from Ghana **(Tonnes)**	0	0	0	0	0
Imported Value of Small pelagics from Ghana **(000 $)**	0	0	0	0	0
Imported Unit Value of Small pelagics from Ghana **($/kg)**	0	0	0	0	0
Exported Volume of Small pelagics to Ghana **(Tonnes)**	0	0	0	0	0
Exported Value of Small pelagics to Ghana **(000 $)**	0	0	0	0	0
Exported Unit Value of Small pelagics to Ghana **($/kg)**	0	0	0	0	0

- What species of small pelagics do you export to Ghana?
- What processing methods do you use in processing *Sardinella* and other small pelagics? Indicate percentages.....

  ……
  ……
  ……
- How are these small pelagic species marketed?.....

4.2 Questionnaire: Regional Countries (Duly filled from Guinea)
Questionnaire: Pays de la Région

NB: Small pelagics = Sardinella sp., Engraulis encrasicolus (Anchovy), and Decapterus, Scomber or Caranx spp. (mackerels)

Fish production, trade volumes and values, 2010-2014

Production de poisson, volume de commerce et valeur 2010- 2014

Indicator	Indicateur	2010	2011	2012	2013	2014
Fish production **(Tonnes)**	Production de poisson (en tonnes)	22438T903	35426T875	51 800T921	71626T941	71242T433
Fish production value **(000 $)**	Valeur de la production (000$)			2 336T675	9297T905	5 436T194
Import Volume **(Tonnes**	Volume des importation	IN GUINEA THIS FISH IMPORT IS DONE BY FISHING PRIVATE COMPANY THEY DO NOT ACCEPT TO SHARE THIS INFORMATION WITH GOVERNMENT. IT IS OWEN				

)	s (en tonnes)	BUSINESS				
Import Value **(000 $)**	Valeur des des importations (000$)	LIKE A BOVE SITUATION THE FISH EXPORT IS MADE BY KOREAN AND CHINESE FISHIG COPANY THEY DO NOT ACCEPT TO GINE ANY INFORMATION TO ANY BODY BETWEEN THEM OR TO GOVERNMENT OFFICERS OR ADMINISTRATION				
Import Unit Value **($/kg**)	Valeur de l'Unité d'import ($/kg)					
Export Volume **(Tonnes)**	Volume des exportations (tonnes)	2838T340	9 551T178	9 944T101	17 503T692	3 988T510
Export Value **(000 $)**	Valeur de l'exportation (000$)					
Export Unit Value **($/kg)**	Valeur de l'unité d'exportation					

NB: 1. the statics given are harvest from Airport and the Conakry Auto Nome Port by the service in charge of Quality fish product.

1. There is no individual data collected (I mean that it is not by fish species)
2. It is not possible to collect all fish product exported because of the fishing vessels some time transfers product on the sea without any control

Sardinella production, trade volumes and values, 2010-2014

Production de sardinella volume commercial et valeur 2010-2014

Indicator	**Indicateur**	**2010**	**2011**	**2012**	**2013**	**2014**
Sardinella production **(Tonnes)**	Production des sardinelles (en Tonne)					
Sardinella value **(000 $)**	Valeur des sardinelles (000$)					
Imported *Sardinella* Volume **(Tonnes)**	Volume des Sardinelles importés (tonnes)					
Imported *Sardinella* Value **(000 $)**	Valeur des sardinelles important (000$)					
Imported Unit Value of *Sardinella* **($/kg)**	Valeur de l'unité d'importation de sardinelle ($/kg)					
Exported *Sardinella* Volume **(Tonnes)**	Volume de sardinelles exportés (tonnes)					

Exported *Sardinella* Value **(000 $)**	Valeuur de sardinelles exporté (000$)					
Exported Unit Value of *Sardinella* **($/kg)**	Valeur unitaire de sardinelles exportés ($/kg)					

Small Pelagics production, trade volumes and values, 2010-2014

Valeur et Volumes de la Production des petits pelagiques commercialisés

Indicator	**Indicateur**	**2010**	**2011**	**2012**	**2013**	**2014**
Small pelagics production **(Tonnes)**	Production des petits pelagiques (Tonnes)					
Value of Small pelagics **(000 $)**	Valeur des petits pelagiques (000$/kg)					
Imported Volume of Small pelagics **(Tonnes)**	Volume des importations des petits pelagiques (en Tonnes)					
Imported Value of Small pelagics **(000 $)**	Valeur des impotations des petits pelagiques (000$)					
Imported Unit Value of Small pelagics **($/kg)**	Valeur de l'unité d'importation des petits pelagigiques ($/kg)					
Exported Volume of Small pelagics **(Tonnes)**	Volume des exportations des petits pelagiques (Tonnes)					
Exported Value of Small pelagics **(000 $)**	Valeur des exportations des petits pelagiques (000$)					
Exported Unit Value of Small pelagics **($/kg)**	Valeur de l'unité exportée des petits pelagiques ($/kg)					

Sardinella import/export from/ to Ghana, 2010-2014

Import et export des des sardinelles au Ghana

Indicator	**Indicateur**	**2010**	**2011**	**2012**	**2013**	**2014**
Imported *Sardinella* from Ghana **(Tonnes)**	Volume des Sardinelles importées du Ghana (en Tonne)					
Imported *Sardinella* from Ghana **(Value) (000 $)**	Valeur des importation de sardinelles du Ghana					
Unit Value of *Sardinella* imported from Ghana **($/kg)**	Valeur de l'unité importee du Ghana					
Exported *Sardinella* to	Volume de sardinelles					

Ghana **(Tonnes)**	exportés du Ghana (en Tonnes)					
Exported *Sardinella* to Ghana Value **(Value) (000 $)**	Valeur des sardinelles exportées (000$)					
Unit Value of Exported *Sardinella* to Ghana **($/kg)**	Valeur de l'Unité exportée au Ghana ($/kg)					

Small Pelagics import/export from/to Ghana, 2010-2014

Import et export des petits pélagiques au Ghana

Indicator	**Indicateur**	**2010**	**2011**	**2012**	**2013**	**2014**
Imported Small pelagics from Ghana **(Tonnes)**	Petits pelagigiques importés du Ghana (Tonnes)					
Imported Value of Small pelagics from Ghana **(000 $)**	Valeur d'importation du Ghana des petits pelagiques (000$)					
Imported Unit Value of Small pelagics from Ghana **($/kg)**	Valeur de l'unité imprtée du Ghana des petits pelagiques ($/kg)					
Exported Volume of Small pelagics to Ghana **(Tonnes)**	Volume des des exportations des petits pelagiques au Ghana (Tonnes)	-	-	75 T	111 T	114 T
Exported Value of Small pelagics to Ghana **(000 $)**	Valeur de l'exportationdes petits pelagiques au Ghana (000$)					
Exported Unit Value of Small pelagics to Ghana **($/kg)**	Valeur de l'unité exportée au Ghana des petits pelagiques ($/kg)					

- What species of small pelagics do you import from Ghana?
- Quelles sont les espéces des petits pelagiques que vous importez du Ghana

  Answer:

  THERE IS NO OFFICIAL LINE TO EXPORT OR TO IMPRPORT FISH FROM GHANA OR TO GHANA. BUT NOT THAT THIS ACTIVITY IS VELLE DONE BETWEEN THE TWO COUNTRIES WITHOUT ANY CONTROL BY:

1. FISHERMEN USIG BIG CANOES PRACTICING SEMI -INDUSTRIAL FISHERY (THEY BYE ICE PUT IN THE BOAT GO TO FISHING AND BRING THE HARVEST TO GHANA; COMING BACK IN GUINEA THEY DO THE SAME ACTIVITY). I JUST WANT TO MEAN THAT IT IS IMPOSSIBLE TO HOLD THAT SITUATION AT THIS WAYWHICH IS VERY FREQUENT

2. BY PRIVATE COMPANY

- What species of small pelagics do you export to Ghana?
- Quelles sont les espéces des petits pelagiques que vous exportez au Ghana
  Answer
  IN GENERAL ALL PELAGICS SPECIES

  What processing method s do you use in processing *Sardinella* and other small pelagics? Indicate percentages?
- Quelles sont les methodes de traitement que vous utilisez pour les sardinelles et les petits pelagiques, indiquez les %?
  Answer:
  a) -- Cooling (fresh)
  b) -- Frozen
  c) -- drying and
  d) -- smoking
- How are these small pelagic species marketed?.
- Comment est le marché des espèces des petits pelagiques
  Answer:
  BECAUSE OF THE HIGH PRICES OF AUTHERS SPECIES REGARDING THE LOW SALARIES AND THE LOW INCOM FOR GUINEAN CITIZEN? THE SMALL PELAGIC FISH IS THE BEST CELLER IN THE MAKET.

Thank You!!
Merci

Year 2013													
Months		J	f	m	a	m	j	J	agut	sept	oct	nov	dec
	total												
fresh fish	120	18	-	11	13	23	4	20	0	10	10	-	18
Frozen	17.127	8t501	4t232-	238	909	352-	372	230	348	250	277	481	332
smoked fish	38	-	-	-	13	-	-	-	-	10	15	-	-
		48	-	-	39		-	24	-	-	-	-	
dryed fish	111	48	8332	-	-	-	-	-	-	-		-	

exported		8t567	4t332	249	974	375	376	274	348	270	295	481	350

NB not the box without number does not mean no exported fish; but it is a luck of data collected

QUESTIONNAIRE TARGETED AT: FISHING INPUTS SUPPLIERS

A team of consultants are carrying out investigations of Sardinella Products Value and Supply Chain Analysis. Your assistance is needed to answer these questions to provide information for the study. Thanks very much in advance!

Date:

Interviewee name:

Location:

Interviewee contact no:

Interviewer:

Interviewee Gender:

A. SOCIO-DEMOGRAPHIC BACKGROUND OF RESPONDENTS

1. How old are you?
   i = 21-25, ii = 26-30, iii = 31-35, iv = 36 – 40,

   v = 41- 45, vi = 46- 50, vii = 51 –55, viii = 56 – 60, ix = above 60
2. How long have you been involved in the fishing inputs supplying business? a) less than 5 years b) 5-15 years c) 15-20 years d) More than 20 years
3. What benefits do you gain by engaging in fishing inputs supply? Please list:

B. FISHING INPUTS SUPPLYING/ VALUE CHAIN ANALYSIS

4. Fishing input suppliers

Fishing input	Price	Subsidized?	Place obtained	Remarks
Canoe				
Nets				
Cork				
Weights				
Fuel				
Outboard motors **(HP)**				
Ropes				
Others				

5. Sources of inputs
   a. Local sources:…….
   b. Foreign sources:……..
6. Where do the buyers or suppliers come from?.....
7. What gender is your buyers or suppliers?…….
8. What kind of relationship exist between you and people who buy/supply your inputs?

9. Who is your main competitor? ……

10. What are your constraints? ……

11. What do you suggest are the best ways to improve your profit and the general business?

4.4 QUESTIONNAIRE TARGETED AT: FISH TRADERS

A team of consultants are carrying out investigations of Sardinella Products Value and Supply Chain Analysis. Your assistance is needed to answer these questions to provide information for the study. Thanks very much in advance!

Target species: Sardinella, Herrings, Mackerel, Anchovies

Date:

Interviewee name:

Location:

Interviewee contact no:

Interviewer:

Interviewee Gender:

C. **SOCIO-DEMOGRAPHIC BACKGROUND OF RESPONDENTS**

How old are you?

i = 21-25, ii = 26-30, iii = 31-35, iv = 36 – 40,

v = 41- 45, vi = 46- 50, vii = 51 –55, viii = 56 – 60, ix = above 60

12. How long have you been involved in the fish trading? a) less than 5 years b) 5-15 years c) 15-20 years d) More than 20 years

13. What benefits do you gain by engaging in fish trading business? Please list:

D. FISH TRADING/ SUPPLY/ VALUE CHAIN ANALYSIS

4. Name of *Sardinella* species you trade:……..

5. Do you get enough *Sardinella* to trade?.....

6. Where do you get your supplies from? (Fishermen, Wholesalers, Imports, etc.)

7. When *Sardinella* is in short supply do you switch to other species? Name them?

8. What types of products do you trade? (Smoked, Frozen, Fresh, Canned)

9. Average quantity traded last year (2014) (tons)……..……

10. Value of fish traded last year (2014)(GH¢)……..……

11. Who do you sell your fish to & where do they come from? (Individuals, Processors, Retailers, Institutions: *specify*….. ……, Others…….…, Rural/Urban…….....)

12. How do buyers pay for fish they buy from you?.....

13. What means do you transport your products?.....

14. Number of people working for you?…….

15. Gender of workers……

16. Who is your main competitor? ……

17. What are your constraints? ……

18. What do you suggest are the best ways to improve your profit and the general business?

19. Where do you get credit to finance your business?.....

20. Do you have plans for further expansion? 1= Yes 2= No

21. What are your intended sources of funds for expansion/investment? 1=Savings 2= Profits 3=Bank 4=Money lenders 5=family and friends 6= Co-operative 7= Others .....

22. What kind of relationship exists between you and people who buy or supply your fish?

23. Indicate the level of expenditure last year (2014):

Item	**Value (**GH¢)	**Remarks**
Storage		
Transport		
Packaging/labelling		
Workers salaries		
Market tolls		
Interest		
Others		

24. Complete the table below

Fish trading operation	**Major Season**	**Minor Season**
QUANTITY of each species that is traded**(kg)**		
VALUE of each species that is traded**(GH¢)**		
General account of running a *Sardinella* trading company		

25. Other small pelagics traded: complete the table below

Species	**Average quantity traded (kg)**	**Value (GH¢)**	**Season**

4.5 QUESTIONNAIRE TARGETED AT: FISHERMEN

A team of consultants are carrying out investigations of Sardinella Products Value and Supply Chain Analysis. Your assistance is needed to answer these questions to provide information for the study. Thanks very much in advance!

Date:

Interviewee name:

Location:

Interviewee contact no:

Interviewer:

Interviewee Gender:

E. SOCIO-DEMOGRAPHIC BACKGROUND OF RESPONDENTS

14. How old are you?

i = 21-25, ii = 26-30, iii = 31-35, iv = 36 – 40,

v = 41- 45, vi = 46- 50, vii = 51 –55, viii = 56 – 60, ix = above 60

15. How long have you been involved in the fishing business? a) less than 5 years b) 5-15 years c) 15-20 years d) More than 20 years

16. What benefits do you gain by in engaging in fishing? Please list:

F. FISHING ACTIVITIES/ VALUE CHAIN ANALYSIS

17. Please complete the table below:

Fishing operation	**Artisanal fisheries**	**Semi-industrial fisheries**	**Remarks**
Operational cost per trip (fuel, nets, ice, food) **(GH¢/)**			
Crew size **(number)**			
Amount paid to crew **(GH¢/)**			
Average weekly fishing trips **(days)**			
Average catch per fishing trip **(kg)**			
Species caught?			
Quantity of by-catch **(kg)**			
Average quantity sold and value **(kg) (GH¢/)**			
Average quantity for home consumption and value			

(kg) (GH¢/)			

18. Who do you normally sell your catch to?Indicate the proportion.....

19. Where do the buyers come from?.....

20. What kind of relationship exists between you and people who buy your catch?

21. What gender is your buyers?……..

22. How do buyers pay for your catch?.....

23. How much of your catch do you normally processed (%)?……..

24. Do you obtain credit for your business activities and source(s)?.....

25. Who is your main competitor? ……

26. What are your constraints? ……

27. What do you suggest are the best ways to improve your profit and the general business?

28. Please complete the table below:

Fishing operation	**Artisanal fisheries (M1)**	**Semi-industrial fisheries (M2)**	**Semi-industrial fisheries (M1)**	**Semi-industrial fisheries (M2)**	**Remarks**
Sale prices of *Sardinella* species to processors **(GH¢/)**					
Quantity of each species that go to the processors per trip **(kg)**					
Sales prices of *Sardinella* species as bulk export per month **(GH¢/)**					
Quantity of each species that are exported as bulk per trip **(kg)**					

Sales prices of *Sardinella* species to local market per month **(GH¢/)**					
Quantity of each species that go to the local market per trip **(kg)**					
Quantity & Value of each species of *Sardinella* landed per trip**(kg/ GH¢/)**					
General accounts of running a *Sardinella*fishing company					

M1: Minor season
M2: Major season

29. Other small pelagics: please complete the table below

Species	Average quantity catch (kg)	Value (GH¢)	Season

4.6 QUESTIONNAIRE TARGETED AT: KEY STAKEHOLDERS

- Ghana Standards Authority (GSA)
- Ministry of Trade and Industry (MoTI)
- Ghana Exports and Promotion Authority (GEPA)
- Food and Drugs Authority (FDA)
- Customs Excise and Preventive Service (CEPS)
- Federation of Association of Ghanaian Exporters (FAGE)
- Ghana Chamber of Commerce & Industry
- National Fisheries Association of Ghana (NAFAG)
- Ghana National Fish Processors and Traders Association
- The Ghana National Association of Farmers and Fishermen (GNAFF)

- Fisheries Commission/Ministry of Fisheries and Aquaculture MoFAD

A team of consultants are carrying out investigations of Sardinella Products Value and Supply Chain Analysis. Your assistance is needed to answer these questions to provide information for the study. Thanks very much in advance!

Date:

Interviewee name:

Location:

Interviewee contact no:

Interviewer:

Interviewee Gender:

Please complete the table below in relation to *Sardinella* imports, exports and taxes *etc*.

Indicator	**2010**	**2011**	**2012**	**2013**	**2014**
Sardinella imported **(unprocessed) (Tonnes)**					
Sardinella imported **(canned) (Tonnes)**					
Sardinella exported **(Tonnes)**					
Import Duties & other taxes **(GH¢)**					
Export Duties & other taxes **(GH¢)**					

4.7 Questionnaire: Fisheries Commission/MoFAD

A team of consultants are carrying out investigations of Sardinella Products Value and Supply Chain Analysis. Your assistance is needed to answer these questions to provide information for the study. Thanks very much in advance!

3. **Economic importance of fisheries and Sardinella**

3.1.Ghana fish production, trade volumes and values, 2010- 2014

Indicator	**2010**	**2011**	**2012**	**2013**	**2014**
Fish production **(Tonnes)**					
Import Volume **(Tonnes)**					
Import Value **(000 $)**					

Import Unit Value **($/kg**)					
Export Volume **(Tonnes)**					
Export Value **(000 $)**					
Export Unit Value **($/kg)**					

3.2.Sardinella production, trade volumes and values, 2010- 2014

Indicator	**2010**	**2011**	**2012**	**2013**	**2014**
Sardinella production **(Tonnes)**					
Import Volume **(Tonnes)**					
Import Value **(000 $)**					
Import Unit Value **($/kg)**					
Export Volume **(Tonnes)**					
Export Value **(000 $)**					
Export Unit Value **($/kg)**					

3.3.Small Pelagics production, trade volumes and values, 2010- 2014

Indicator	**2010**	**2011**	**2012**	**2013**	**2014**
Small pelagics production **(Tonnes)**					
Import Volume **(Tonnes)**					
Import Value **(000 $)**					
Import Unit Value **($/kg)**					
Export Volume **(Tonnes)**					
Export Value **(000 $)**					
Export Unit Value **($/kg)**					

1.4.Actors in the Sardinella Industry

2. Total number of fishing operators (artisanal and semi-industrial):
3. Number of *Sardinella* canoe operators:
4. Number of *Sardinella* inshore operators:
5. List of active *Sardinella* vessels and information about them (Lengths, tonnages, year built):
6. Specific regulations governing *Sardinella* (Ghana Fisheries Act 625 2002, Ghana LI 1968 2010 Ghana LI 1968 2010):
7. National Fisheries Association of Ghana (NAFAG)
8. Ghana National Fish Processors and Traders Association
9. Others: (Accept, reject or add to *list*):
    - Ghana Standards Authority (GSA)
    - Ministry of Trade and Industry (MoTI)
    - Ghana Exports and Promotion Authority (GEPA)
    - Food and Drugs Authority (FDA)
    - Customs Excise and Preventive Service (CEPS)
    - Federation of Association of Ghanaian Exporters (FAGE)
    - Ghana Chamber of Commerce& Industry
    - The Ghana National Association of Farmers and Fishermen (GNAFF)
    - Marine and Fisheries Students Association (MaFiSA

Annex 3

SAMPLE CALCULATION OF FISHERMAN, TRADER, PROCESSOR AND RETAILER PROFIT

Sample calculation of fisher's profit

Item	**Value (**GH¢)
Food	200
Net	400
Ice	200
Fuel	400
Bills	50
Others	100
Total Cost	**1300**
Total Revenue	**2000**
Profit	**600**

Sample calculation of fish trader's profit

Item	**Value (**GH¢)
Storage	500
Transport	1000
Packaging/labelling	200
Workers salaries	500
Market tolls	100
Others	200
Total Cost	**2500**
Total Revenue	**3300**
Profit	**800**

Sample calculation of fish processor's profit

Item	**Value (**GH¢)
Smoker	200
Fuel wood	400
Water	10
Transport (means)	500
Packaging/labelling	100
Workers salaries	200
Others	200
Total Cost	**1610**
Total Revenue	**2600**
Profit	**990**

Sample calculation of fish retailer's profit

Item	**Value (**GH¢)
Transport	200
Packaging/labelling	200
Workers salaries	100
Market tolls	50

Others	100
Total Cost	**600**
Total Revenue	**1300**
Profit	**700**

Calculation of Percentage Profit of Actors

Actors	**Total Cost (**GH¢)	**Total Revenue (**GH¢)	**Profit (**GH¢)
Fisherman	1300	2000	600
Fish Trader	2500	3300	800
Fish Processor	1610	2600	990
Fish Retailer	600	1300	700
Total	**4660**	**9200**	**3090**

Percentage Profit of each actor = (Profit of the actor/Total Profit of actors) * 100

Fisherman's % profit = (600)/3090 * 100= 19.4%

Fish trader's % profit = (800)/3090 * 100= 25.9%

Fish processor % profit = (990)/3090 * 100= 32.0%

Fish retailer % profit = (700)/3090 * 100= 22.7%

Total % value added to sardinella = (Fisherman's % profit + Fish trader % profit + Fish processor % profit + Fish retailer % profit) = (19.4% + 25.9% + 32.0% + 22.7%)= 100%