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SUSTAINABLE FISHERIES MANAGEMENT PROJECT (SFMP)

Literature Review On Sardinella Value Chain



April 2015



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SNV SMART DEVELOPMENT WORKS



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ACRONYMS

ACP-EU	Africa, Caribbean, Pacific – European Union
AFRCD	Armed Forces Revolutionary Council Decree
AOR	Administrative Officer Representative
ASSESS	Analytical Support Services and Evaluations for Sustainable Systems
BOG	Bank of Ghana
CBFMC	Community Based Farmer Management Committees
CEMAG	Community Environmental Monitoring and Advocacy Group
CCLME	Canary Current Large Marine Ecosystem
CCM	Centre for Coastal Management
CDCS	Country Development Cooperation Strategy
CEWEFIA	Central and Western Region Fishmongers Improvement Association
COMFISH	Collaborative Management for a Sustainable Fisheries Future
CoP	Chief of Party
CPUE	Catch Per Unit Effort
CR	Central Region
CRC	Coastal Resources Center at the Graduate School of Oceanography, University of Rhode Island
CRCC	Central Regional Coordinating Council
CSLP	Coastal Sustainable Landscapes Project
CSO	Civil Society Organization
DA	District Authorities
DAA	Development Action Association
DAASGIFT	Daasgift Quality Foundation
DFAS	Department of Fisheries and Aquatic Sciences
DFID	Department for International Development
DO	Development Objective
DWFF	Distant Water Fishing Fleet
EBM	Ecosystem-Based Management
EEZ	Exclusive Economic Zone
EG	Economic Growth
EMMP	Environmental Mitigation and Monitoring Plan
EPA	Environmental Protection Agency
ERP	Economic Recovery Program
ERF	Environmental Review Form
ETP	Endangered, Threatened and Protected
FAO	Food and Agricultural Organization of the United Nations
FASDEP	Food and Agriculture Sector Development Program
FASDP	Fisheries and Aquaculture Sector Development Program
FC	Fisheries Commission
FCWCGG	Fisheries Committee for the West central Gulf of Guinea
FDB	Food and Drugs Board
FEU	Fisheries Enforcement Unit
FHI	Family Health International
FoN	Friends of Nation
FtF	Feed the Future
GDP	Gross Domestic Product
GEPC	Ghana Export Promotion Council
GNCFC	Ghana National Canoe Fishermen Council

GPS	Geographical Positioning System
GSS	Ghana Statistical Service
HM	Hen Mpoano
GCLME	Guinea Current Large Marine Ecosystem
GIFA	Ghana Inshore Fishermen's Association
GIS	Geographic Information System
GIZ	Gesellschaft für Internationale Zusammenarbeit
GLM	Generalized Linear Models
GNAFF	Ghana National Association of Farmers and Fishermen
GNCFC	Ghana National Canoe Fishermen's Council
GoG	Government of Ghana
GSA	Ghana Standards Authority
GSO	Graduate School of Oceanography, University of Rhode Island
ICFG	Integrated Coastal and Fisheries Governance
ICM	Integrated Coastal Management
ICT	Information, Communication Technology
IEE	Initial Environmental Examination
IR	Intermediate Results
IUCN	International Union for Conservation of Nature
IUU	Illegal Unreported Unregulated
JICA	Japan International Cooperation Agency
LEAP	Livelihood Enhancement Against Poverty
LI	Legislative Instrument
LOE	Level of Effort
LOGODEP	Local Government Development Program
LoP	Life of Project
MCS	Monitoring, Control, Surveillance
MCS	Monitoring, Control and Surveillance
METASIP	Medium Term Agricultural Investment Program
METSS	Monitoring, Evaluation and Technical Support Services
MFRD	Marine Fisheries Research Division
MOFAD	Ministry of Fisheries and Aquaculture Development
MOU	Memorandum of Understanding
MPA	Marine Protected Area
MSME	Micro Small and Medium Enterprises
MSP	Marine Spatial Planning
M&E	Monitoring and Evaluation
NAFAG	National Fisheries Association of Ghana
NGO	Non-Governmental Organization
NC	National Committee
NRM	Natural Resources Management
NICFC	National Inland Canoe Fishermen's Council
NRCD	National Redemption Council Decree
OECD	Organisation for Economic Co-operation and Development
PMEP	Performance Monitoring and Evaluation Plan
PMP	Performance Management Plan
PPP	Public Private Partnerships
RAVI	Rights and Voices Initiative
RCC	Regional Coordinating Council
RFA	Request for Application

RPA	Rapid Partnership Appraisal
SAMP	Special Area Management Plans
SFC	State Fishing Corporation
SFMP	Sustainable Fisheries Management Program
SMEs	Small and Medium Enterprises
SNV	Netherlands Development Organization
SS	Spatial Solutions
SSG	SSG Advisors
STEP	Sustainable, Transparent, Effective Partnerships
STWG	Scientific and Technical Working Group
UCAD	University Cheikh Anta Diop
UCC	University of Cape Coast
URI	University of Rhode Island
USAID	United States Agency for International Development
USG	United States Government
WA	West Africa
WARFP	West Africa Regional Fisheries Development Program
WASH	Water, Sanitation and Hygiene
WTO	World Trade Organisation
WR	Western Region

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EXECUTIVE SUMMARY

This report assesses various literatures on the fishery sector in general with more focus on small pelagics especially the Sardinella Fisheries. The report discusses information on the value chain and regional trade from a regional perspective and presents the current situation in Ghana.

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.

Neila, 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, where as Senegal and Mauritania are mostly producers.

The fishing industry in Ghana supports the livelihood of about 10% of the population. The importance of the fishing industry stems from the significant contribution of about 60% of the national 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 fishery sector, which targets the Sardinella fishery, a total of about 11,000 canoes operate actively from over 300 landing sites located along the 550 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). The target fish species for the artisanal fleet is round sardinella, although the flat sardinella, *S. maderensis*, is also caught (Bard and Koranteng, 1995). The country's Fisheries Bureau of Statistics estimates 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).

1.0 INTRODUCTION

Fish is the most valuable agricultural commodity traded internationally with annual sales of nearly US\$80 billion and increasing each year (FAO Fish Stat, 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 (Neiland, 2006).

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 per cent of the nation's gross domestic product (GDP) and 11 per cent of the Agriculture GDP (GSS, 2008 Budget). For a long time, fish has remained the preferred and cheapest source of animal protein with about 75 per cent 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, large head hairtail, meagre fish, 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).

2.0 OVERVIEW OF GHANA'S FISHERY INDUSTRY

The fishery sector in Ghana principally encompasses marine fishery, inland (fresh water) fishery and aquaculture fishery as well as related activities in fish storage, preservation, marketing and distribution. Fisheries constitute an important sector in national economic development. About 10 % of the country's population is engaged in various aspects of the fishing industry (BOG, 2008).

Marine fisheries account for over 80 % of the fish consumed in Ghana (BOG, 2008). However, fresh water 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 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 including 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) 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, most of which are RAMSAR designated sites.

2.1 Brief History of Ghana's Fishery 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 shortage of 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 (AttaMills 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 neighboring West African nations, overfishing and lack of adequate regulation 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 environments have been impacted by overexploitation of stocks and the use of destructive methods of fishing (Atta-Mills et al, 2014).

2.2 Institutions

The fishery 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 Resources Institute, NGOs, the Agricultural Development Bank, Rural Banks, Continental Christian Traders (a major dealer in fishing nets), 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 and local CBFMCs in various districts.

2.3 Policies and Regulations

Traditional legal systems especially, ways of allocating fish and days when there was no fishing have always been implemented. In all artisanal fishing communities, every Tuesday is a fishing holiday. In addition, in some parts of the Volta and Western region Thursday and Sunday were included.

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.¹ 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 AFRC D 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 current 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. A Draft Fisheries Regulations intended to give effect to the Fisheries Act of 2002 (Act 625) and to streamline activities and bring about uniformity in the fishing industry is also being prepared for approval by Parliament.

In terms of sanitary and health issues relating to fish handling and sales, Food and Drugs Board (FDB) 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 Board overlaps that of the FDB 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.

2.4 Ghana's Fishery Sectors

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

2.4.1 Artisanal Fishing

This is a type of fishery system with an open beach using very basic fishing methods such as the use of 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 11,219 traditional canoes and employs a wide range of fishing gear which includes purse seines (poli/Watsal), beach seines, drift gill nets (DGN),

and surface set nets. Artisanal fishermen also use various forms of bottom set-nets, hook and line (lagas^l). The lagas and 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 per cent 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 (Marine Fisheries Research Division, (Ministry of Fisheries)

2.4.2 The Marine Fishery

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 1.

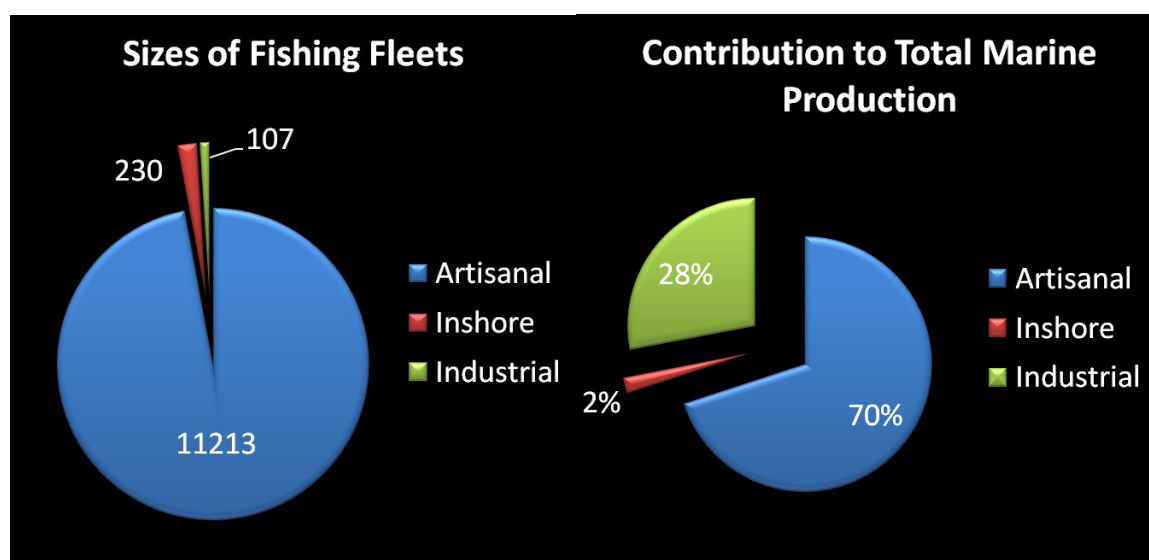


Figure 1 Total marine fishery catch as at 2007

2.4.3 Inshore Fisheries

The number of inshore vessels for the period of 2000-2009 is presented in table 3, where the number of inshore vessels increased from 236 to 268 in the ten year time.

Table 1 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 et al 2011

The operators in inshore fishery used 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 deep

water ports), the old Sekondi fishing harbour 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 30-90hp diesel engines. They fished during the upwelling seasons using purse seines mainly in the inshore waters between 30-50m 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 2, 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) – (Asare-Antwi & Abbey, 2011).

2.4.4 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 6, 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 2 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 mackerel	5.14	119.46	149.93	14.49	13.43	29.236	71.29	190.259	62.34	71.01	59.51
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 et al, 2011

Table 3 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 et al, 2011

3.0 SARDINELLA FISHERY INDUSTRY

According to a report by Wikipedia, Sardines, or pilchards, are common names used to refer to various small, oily fish within the herring family of Clupeidae. The term *sardine* was first used in English during the early 15th century and may come from the Mediterranean island of Sardinia, around which sardines were once abundant. Wikipedia defines *Sardinella* as a genus of fishes in the family Clupeidae, the herrings and sardines. This genus currently contains 21 recognized species. They are abundant in warmer waters of the tropical and subtropical oceans. *Sardinella* are generally coastal, schooling marine fish. Juveniles are often found in lagoons and estuaries, and adults are more common off the coast.

Consumption patterns may be altered following impacts on specific species. Small pelagic species such as sardinella, anchovy, chub and horse mackerel commonly consumed in Ghana are sensitive to changes in ocean conditions (Katikiru & Macusi 2012). The small pelagic resources have become of even greater strategic importance for food security. The sardinellas that we fish provide proteins and other nutrients at affordable prices to the most disadvantaged groups of the population. It provide numerous jobs; from the fisher to the fish processors and fishmongers to the traders.

According to a report on a meeting by FAO and COFI, in 2012; Issues on the importance and challenges associated with sardinella fisheries was discussed. It is imperative that the regions small pelagic resources, and the issue of food security, may be in danger. The number of factory trawlers that exploit small pelagics is increasing. Some of them can be over 120 m long. Their activities are increasing further the pressure on stocks, particularly on sardinella, which is showing signs of overexploitation. These ships also pose serious threats to ecosystems, as the fishing gears they use are not selective and take large amounts of bycatch, including sharks and rays, sea turtles, as well as large quantities of the demersal fish, the artisanal fishermen, also target.

Small pelagic fish are the basis of the food chain – The decline in small pelagic fish stocks; many other species that feed on them, including species targeted by artisanal fishers, will decline as well. What is needed today is the transparent application of limits on catches of small pelagic fish, and also the application of clear access rules. According to Gueye, 2012, the sector's participation is essential for sustainable management of shared small pelagic resources. An example of the fishing agreement between Senegal and Mauritania, which for many years, is allowing Senegalese artisanal fleet to get nearly 300 fishing licenses to catch small pelagics in Mauritanian waters. Since 2008, artisanal fishing organizations from Senegal and Mauritania have partnered to promote sustainable artisanal small pelagics fisheries. The role of professionals in these negotiations, now recognized by the respective governments, is to facilitate the negotiation, execution and monitoring of the fisheries agreement protocol between the two countries. These efforts led in particular to the establishment of a joint committee made up of professionals for monitoring the implementation of the agreement, particularly in terms of landings and marketing, resolving potential conflicts and discuss improvements. This experience could be replicated in other countries where people are fishing on shared stocks.

The interaction between aquaculture development and exploitation of small pelagics needs further attention. Large scale Aquaculture, in reality, requires the exploitation of wild stocks of small pelagic fish as its feed source. Particularly where there are signs of overexploitation and the need to ensure food security in the region (Gueye, 2012; FAO CFAO meeting report).

3.1 Harvesting Methods

Typically, sardines are caught with encircling nets, particularly purse seines. Many modifications of encircling nets are used, including traps or weirs. The latter are stationary enclosures composed of stakes into which schools of sardines are diverted as they swim along the coast. The fish are caught mainly at night, when they approach the surface to feed on plankton. After harvesting, the fish are submerged in brine while they are transported to shore. Sardines are commercially fished for a variety of uses: for bait; for immediate consumption; for drying, salting, or smoking; and for reduction into fish meal or oil. The chief use of sardines is for human consumption, but fish meal is used as animal feed, while sardine oil has many uses, including the manufacture of paint, varnish and linoleum.

3.2 Nutrition

Sardines are commonly consumed as food by human beings. Fresh sardines are often grilled, pickled or smoked, or preserved in cans. Sardines are rich in vitamins and minerals. A small serving of sardines once a day can provide 13 percent of vitamin B2; roughly one-quarter of niacin; and about 150 percent of the recommended daily value of vitamin B12. Also, sardines are high in the major minerals such as phosphorus, calcium, potassium, and some trace minerals including iron and selenium. Sardines are also a natural source of marine omega-3 fatty acids, which reduce the occurrence of cardiovascular disease. These fatty acids can also lower blood sugar levels. They are also a good source of vitamin D, calcium, vitamin B12, and protein. Because they are low in the food chain, sardines are very low in contaminants such as mercury, relative to other fish commonly eaten by humans.

3.3 Cannery Industry

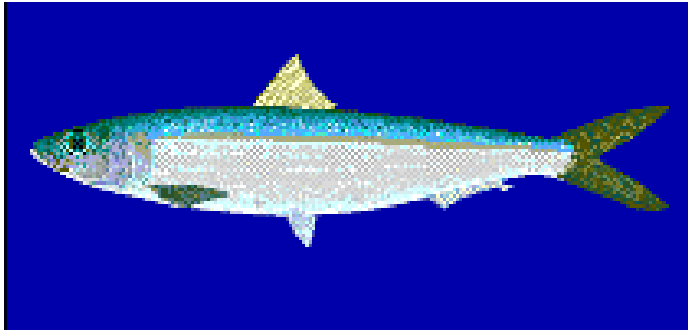
In the United States, the sardine canning industry peaked in the 1950s. Since then, the industry has been on the decline. The last large sardine cannery in the United States, the Stinson Seafood plant in Prospect Harbor, Maine, closed its doors on 15 April 2010 after 135 years in operation. Since 1997, sardines from Cornwall have been sold as "Cornish sardines", and since March 2010, under EU law, Cornish sardines have Protected Geographical Status. (Wikipedia, 2015)

3.4 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 of 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, and are overexploited. A large part of the fishery resources of the West African Region undertake trans boundary migrations: the smaller pelagic fishes (typically sardines, sardinellas, mackerels and horse-mackerels) remain relatively close to shore but migrate between EEZs (CCLME project document).

3.4.1 *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 2.1.1). It is locally called ‘Eban’ or ‘Kankama’. It is usually found in marine pelagic waters of 0-350m 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 CECAF. The size distribution in Ghana has been estimated as 5-15cm for the beach seine and 18cm for the ring net (Anakwah and Santos, 2002). It is fished mainly by beach seines and to some extent, poly 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).

3.4.2 *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 2.1.2). 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 80m 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).

3.4.3 *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. 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 5-41ppt and in certain regions, migrate into lagoons, estuaries and lakes during spawning. It is also classified by the FAO as highly commercial.

3.4.4 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).

4.0 OVERVIEW OF REGIONAL SARDINELLA FISHERIES SECTOR

4.1 Production

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

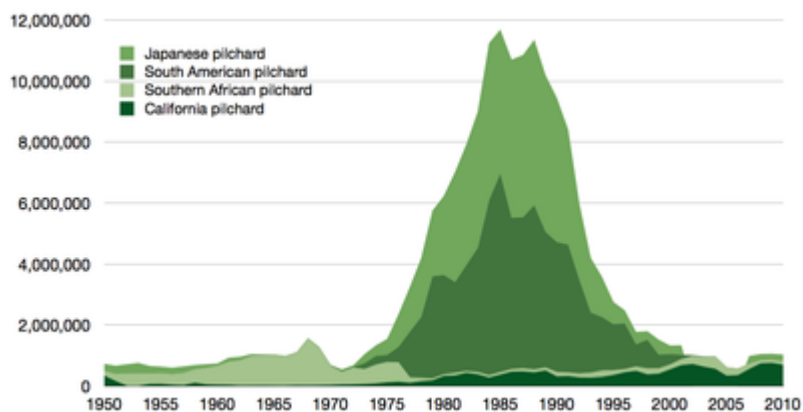


Figure 2 Sardines of the *Sardinops* genus, 1950–2010

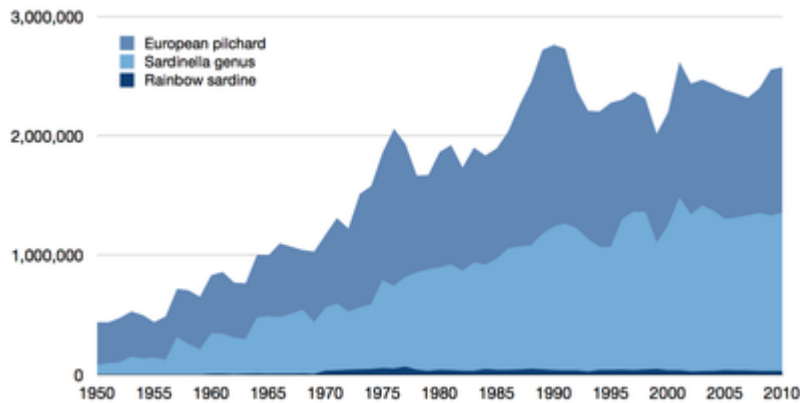


Figure 3 Sardines not of the Sardinops genus, 1950–2010

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

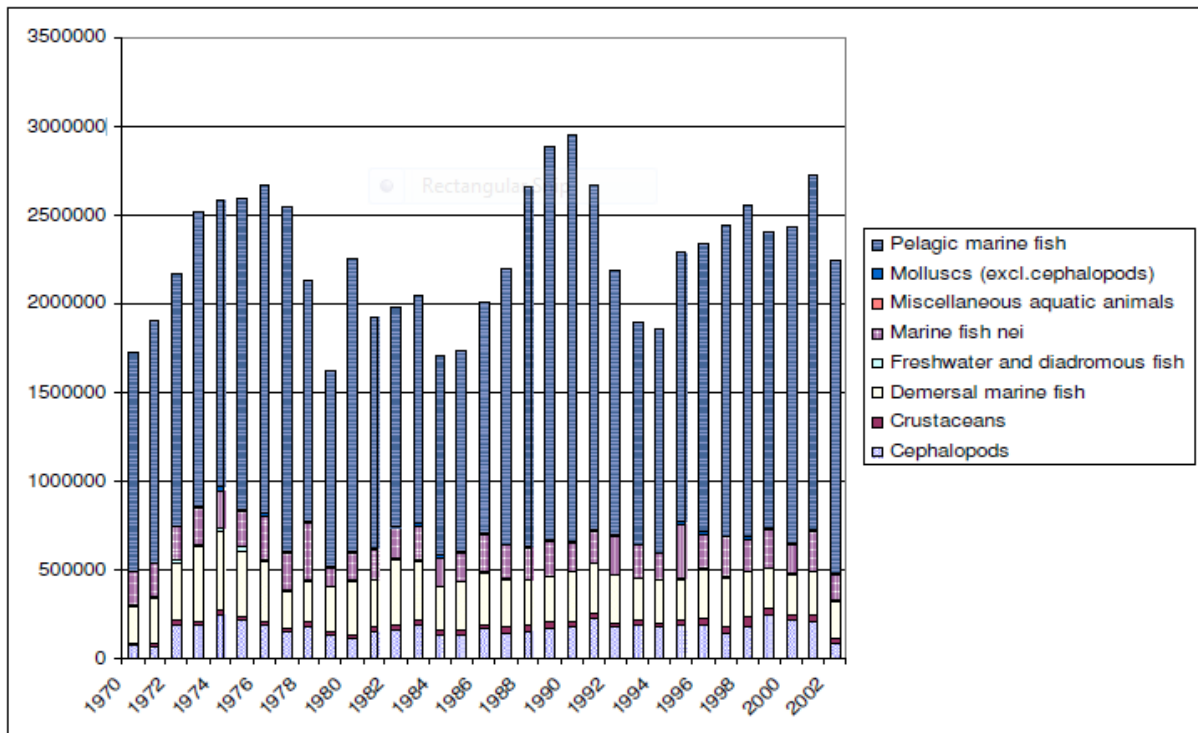


Figure 4 Landings per FAO group of species for divisions (FAO, 2004)

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

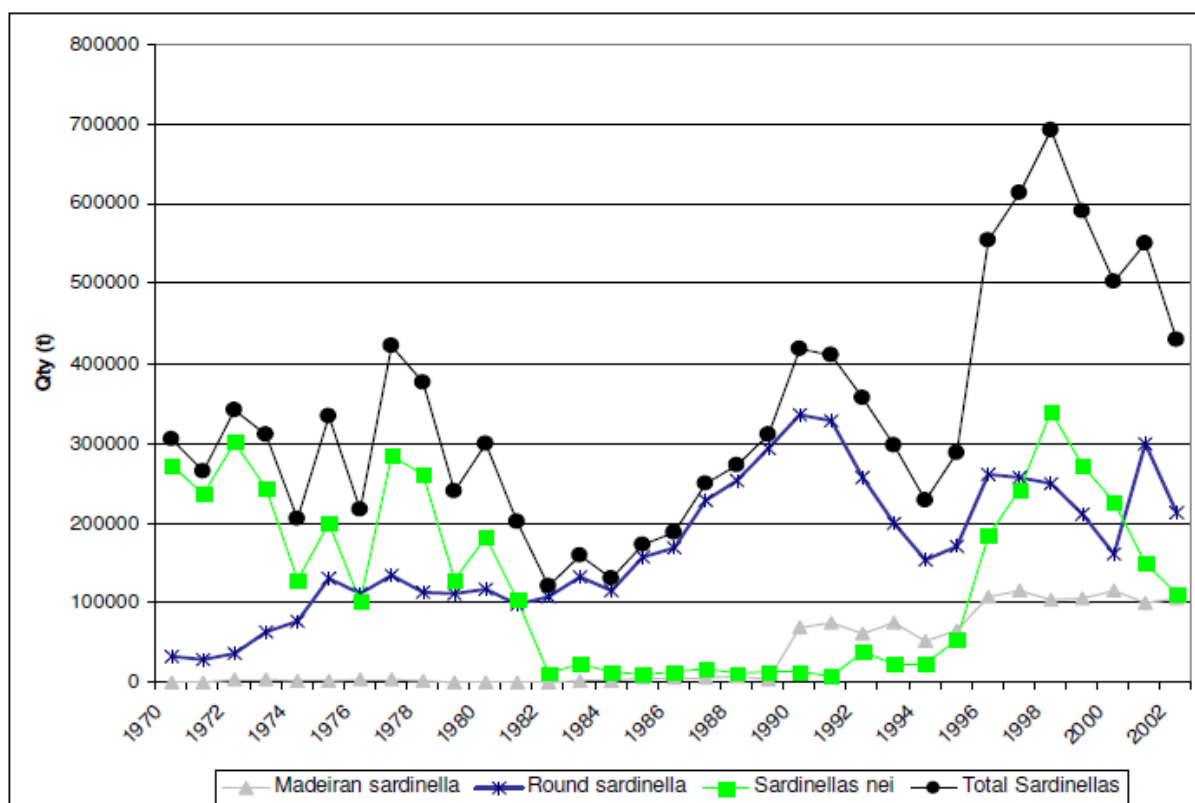


Figure 5: Catch analysis for 3 Sardinella species (FAO, 2004)

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.

4.2 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, and 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).

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.

4.3 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-scale fish processing are said to be particularly high and figures as high as 40 percent are sometimes reported (FAO, 1984; Mills, 1979; Moes, 1980).

A study carried out by Diei–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 percent 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 percent and 25.7 percent, respectively. For smoked fish, 21 percent 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 percent of sardine is discarded as physical loss and another 80 percent 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 on board 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.

4.3.1 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 percent of the estimated 76 587 tonnes of sardine landings are processed for animal feed and only 20 percent 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 percent. 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.

4.4 TRADE

(ICSF, 2002) 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.

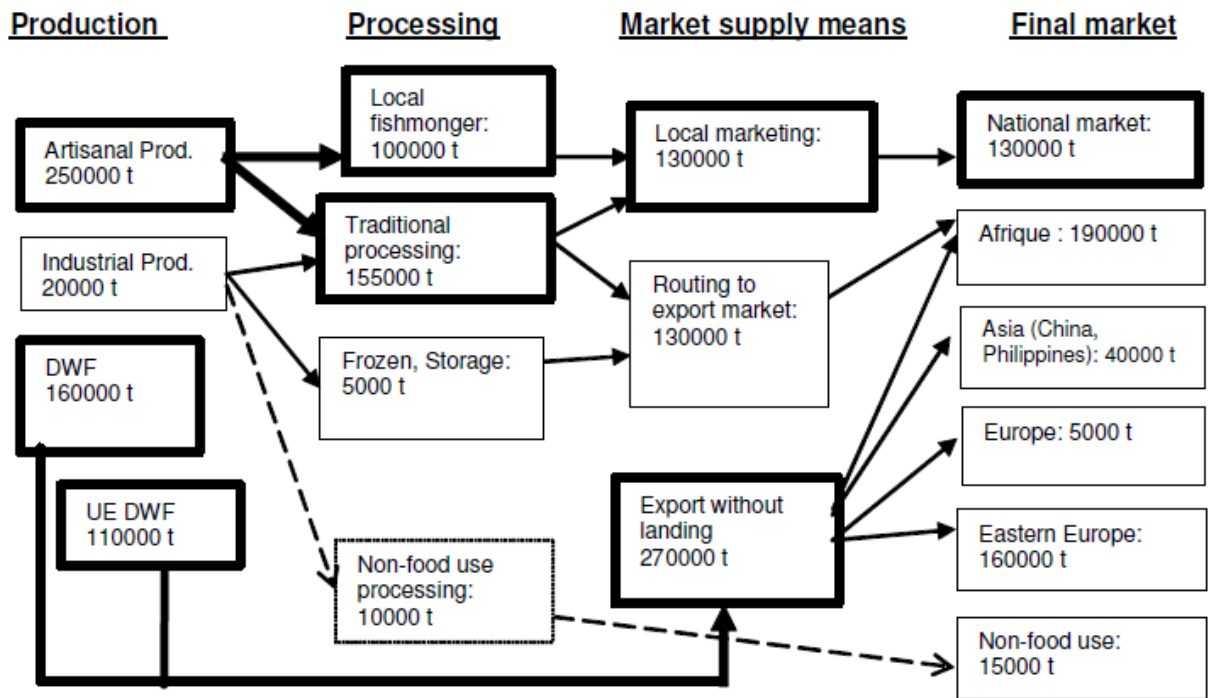


Figure 6 Average yearly (1996-2000) Sardinella production, processing and distribution (FAO, 2004)

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 6:

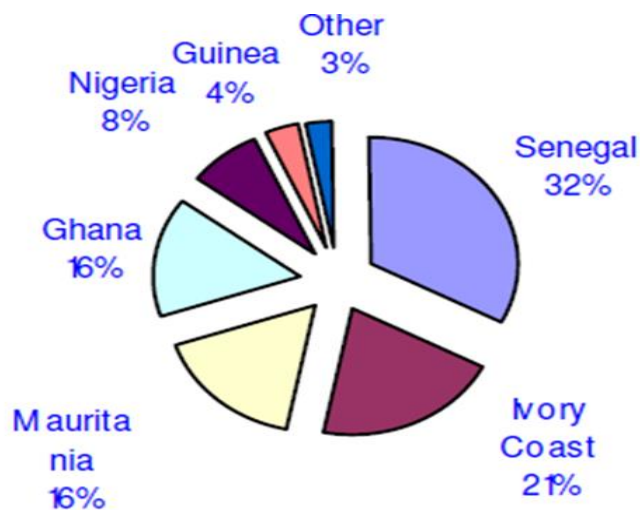


Figure 7 The Importance of Fisheries products in West African trade (FAO, 2004)

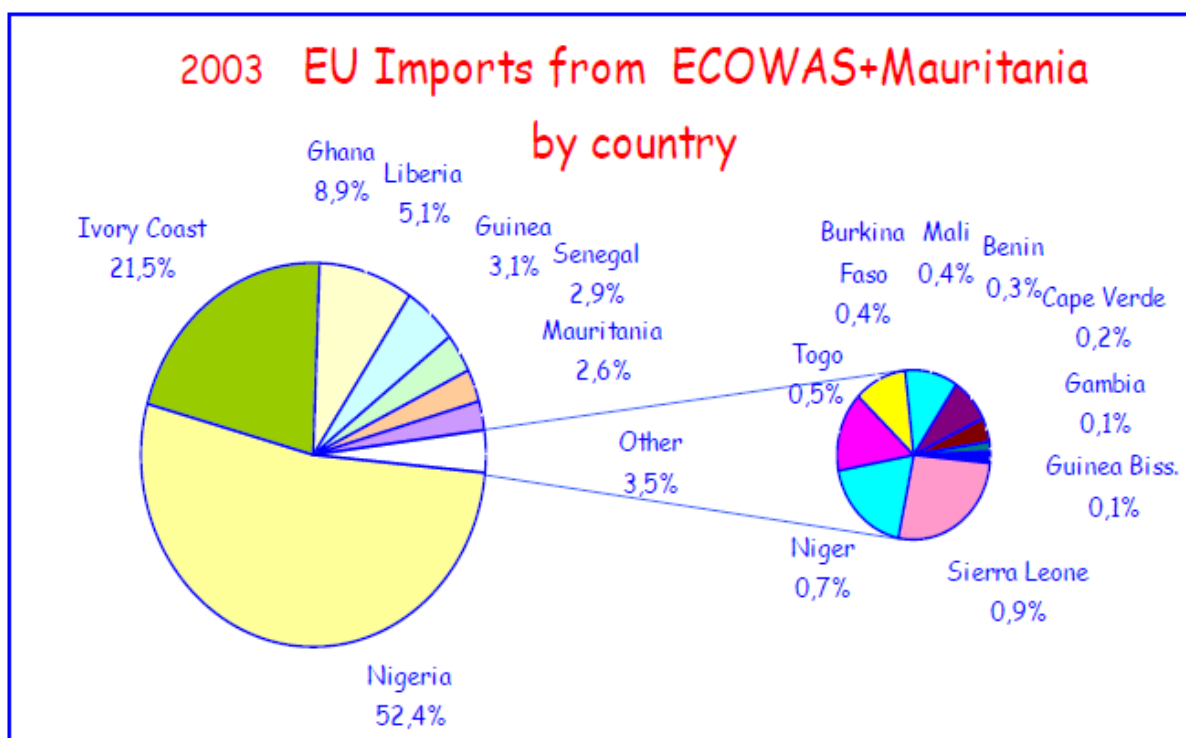


Figure 8 EU imports from ECOWAS and Mauritania (FAO, 2004)

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 and the major regional market, Nigeria, import 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 percent 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 (1,372t). In other words, less than 40 per cent of Nigeria's requirements were being imported from within the region.

Failor 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.

Neila, 2006 sums up this section. The 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 do not.

4.4.1 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 per cent ranked government inspections, 18 per cent numerous police blocks and 15 per cent 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 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.

4.5 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/un important in trade/consumption and/or poverty/employment terms.

5.0 SARDINELLA FISHERY IN GHANA

5.1 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. These 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. The round sardinella is more important than the flat sardinella in terms of total landings. 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 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 played 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.

5.1.1 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 and ali nets to catch sardinellas almost all 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 37m, 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.

5.1.2 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 10mm stretched mesh, the inshore purse seine net has 25mm mesh made of thicker twine.

5.1.3 The 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 this is the coastal upwelling. Relationships between the upwelling and the availability of sardinellas in the Ivoir-Ghanaian ecosystem have been described by Oren and Ofori-Adu (1973), FRWORSTOM (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 Ivoir-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 work (Koranteng, 1989; Pezennec and Bard, 1992) has shown that the minor upwelling is as important as the major upwelling for the sustenance of sardinella resources in the Ivoir-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 Ivoir-Ghanaian ecosystem.

5.1.4 Catch Effort and Performance of Fishing Fleets

Like all 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. For example in 1972, the fishery for *Sardinella aurita* recorded its highest yield since records of landings were kept in Ghana (Table 1; Figure 2). 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 WV Dr. Fridtj of 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.

5.2 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 eba*) and the anchovies (*Anchoa guineensis*). According to Antwi, 2006, various traditional methods are employed to preserve and process fish for consumption and storage. These include smoking, drying, salting, frying and 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 anchovies, 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).

5.3 Trade and Markets

The fisheries sector contributes 3% 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 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, Kpandu-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).

6.0 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).

Overall (1998), who did her research in Ghana, notes, 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).

7.0 CONCLUSION

Bailey et al (undated) in their study on meeting socioeconomic objectives in Ghana's Sardinella Fisheries 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.

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