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SUSTAINABLE FISHERIES MANAGEMENT PROJECT (SFMP)

Post Harvest Loss Reduction Study

October 2015

THE UNIVERSITY OF RHODE ISLAND
GRADUATE SCHOOL OF OCEANOGRAPHY
CRC COASTAL RESOURCES CENTER

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ACRONYMNS

CCM	Centre for Coastal Management
CPUE	Catch per Unit Effort
DA	District Authorities
DFAS	Department of Fisheries and Aquatic Sciences
EEZ	Exclusive Economic Zone
FAO	Food and Agricultural Organization of the United Nations
FASDP	Fisheries and Aquaculture Sector Development Program
FC	Fisheries Commission
FEU	Fisheries Enforcement Unit
FtF	Feed the Future
GDP	Gross Domestic Product
GNCFC	Ghana National Canoe Fishermen Council
HM	Hen Mpoano
GCLME	Guinea Current Large Marine Ecosystem
GIFA	Ghana Inshore Fishermen's Association
GIS	Geographic Information System
GNAFF	Ghana National Association of Farmers and Fishermen
GNCFC	Ghana National Canoe Fishermen’s Council
GoG	Government of Ghana
ICFG	Integrated Coastal and Fisheries Governance
ICM	Integrated Coastal Management
IUCN	International Union for Conservation of Nature
IUU	Illegal Unreported Unregulated
LI	Legislative Instrument
MCS	Monitoring, Control and Surveillance
MFRD	Marine Fisheries Research Division
MOFAD	Ministry of Fisheries and Aquaculture Development
MPA	Marine Protected Area
M&E	Monitoring and Evaluation
NGO	Non-Governmental Organization
NC	National Committee
NRM	Natural Resources Management
NICFC	National Inland Canoe Fishermen’s Council
OECD	Organisation for Economic Co-operation and Development
PPP	Public Private Partnerships
RPA	Rapid Partnership Appraisal
SFMP	Sustainable Fisheries Management Program
SMEs	Small and Medium Enterprises
SNV	Netherlands Development Organization
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
WR	Western Region

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INTRODUCTION AND BACKGROUND

1.1 Introduction

Ghana has significant and valuable fish stocks and a strong tradition and culture of fishing. As many as 2.2 million people are dependent on the fisheries sector for their livelihoods, including 135,000 fishers in the marine sector, of which 92 percent (124,200) are artisanal fishers. However, most of Ghana's fish resources are heavily overexploited and the sector's profitability is declining to the extent that fish production costs is approaching or even exceeding income in all inshore marine capture fisheries. The root cause of the loss of value seems to be too many vessels competing to catch too few fish, with little or no incentive to invest in management and value addition.

The United States Agency for International Development (USAID) has committed funds for the implementation of a Sustainable Fisheries Management Project (SFMP) in Ghana for five years with the objective of complementing Government's efforts at rebuilding the marine fisheries stocks and catches through adoption of responsible fishing practices. USAID/Ghana's SFMP aims to end overfishing of key stocks important to local food security through a multi-pronged approach. One of such approaches is to tackle handling of post harvested fish in a manner that the little that is taken off from the overharvested fishery can be handled cost-effectively by reducing losses emanating from post- harvest handing and in clean environment. One of the organizations selected by the USAID to handle this aspect of the fishery development, working through the SFMP, is the SNV Netherlands Development Organization.

SNV is an International Development Organization that provides Capacity Development Services to local institutions and organizations in Renewable Energy, WASH and Agriculture. As part of SNV responsibilities to the USAID's project on Sustainable Fisheries Management Project (SFMP) a Post-harvest loss reduction study must be carried out. In line with this broad objective, SNV instituted a short term study in August 2015 to design and carry out the post-harvest loss reduction assessment in the four coastal regions of Ghana; Western, Central, Greater Accra and Volta.

As part of SNV responsibilities to the USAID's project on Sustainable Fisheries Management Project (SFMP) a post-harvest loss reduction study must be carried out. In line with this broad objective, SNV instituted a short term study in August 2015 to design and carry out the post-harvest loss reduction assessment in the four coastal regions of Ghana: Western, Central, Greater Accra and Volta Regions to work towards fostering of the existing issues concerned with post-harvest losses and to explore opportunities to reduce the extent of losses, if any, along the fisheries value chain but emphasizing on all the processes fish undergoes from the time it arrives at the landing site to the stage it exchanges hands with the end user/consumer. This report outlines, among others, the issues relating to fishing, fish handling, processing and post-harvest losses in the four coastal regions of Ghana.

Fisheries practitioners were interrogated in six major areas using the assistance of eight research assistants in the following area: demographics; fishing techniques and methods; post-harvest handling of fish, transportation (load trucking); stages, types and nature of losses along the value chain and marketing. In all 48 landing beaches were studied in 13 districts of the four coastal regions.

The marine artisanal fisheries along the coast line of Ghana are practiced largely by the tribes along the coastal zone. There is no noticeable restriction to movement of the patrons of the trade so long as fisheries activities are concerned. Notwithstanding, because the various methods of fishing are heavily culture-linked, there are clear footprints in all the regions wherever non-regional tribes occur.

The demographic characteristics of the fisheries practitioners show aging male fishermen and equally aging but predominantly female fish processors with largely very low classroom educational background. Children of school going age get involved in the fisheries business at various points along the value chain with the boy-child activity skewed towards fishing while the girl-child straddles the beach activities and the processing chores. Activities of porters are evenly split between young to middle age men and women. While the males tend to push towards the physical aspect of boating activities and maintenance (e.g., carrying outboard engines, assisting in carrying and mending fishing nets, pushing trolleys etc.), the young women focus more on moving landed fish from the landing beaches to the processing plant, the in-town markets and beach fish mongering.

Fishing is done throughout the year but high fishing outputs are localized and linked to times of the year. The main fishing practices are the Ali, Poli, and Watsa (APW), beach seine and hook and line. In addition to these methods, light is used as a fish aggregating devise (FAD) to attract fish for capture. While use of other unorthodox methods of fishing like dynamite and chemical fishing did not appear on any of the administered questionnaires, focus group discussion during the validation clearly established the usage.

Post-harvest fish loss from the inshore fishing is not considered an issue as very little or no problems are encountered routinely. Any periodic occurrences are often attributed to attacks on fishing nets by dolphins and sharks and sometimes the activities of the industrial trawling fleet. Losses at the landing beaches are equally small and are perpetuated by the beach porters through pilfering. In rare instances, quality of fish catch may begin to deteriorate when the fishermen run out of ice or they encounter mechanical problems with their outboard engines while at sea. Losses arising from these occurrences manifest in only reduced ex-shore selling price with no additional difficulties of offloading them to the female salting/drying processor patrons.

Three major processing groups are involved in the value addition of the fish catches. These are the fish smokers, salting/drying processors and those that fry them. Fish frying is also practiced but on a comparatively small scale. Cold storage operation as a post-harvest value addition runs from very minimal to non-existent in all the landing beaches. The regional capitals may, in periods of bumper harvest, cold-store excess fish.

Haulage of processed fish is by relatively younger aged drivers using a variety of vehicles ranging from saloon car taxis to heavy duty trucks. Major destinations of processed fish are specialized markets scattered throughout the country and sometime, the neighboring countries like the Republics of Togo, Burkina Faso and La Cote d'Ivoire. Practitioners are generally pleased with the haulage arrangements made with the transporting drivers.

Marketing of fish, both fresh and processed, is done by largely female practitioners. Adequate arrangements are made for the hauled fish to be received by agents and kept in good storage facilities prior to the arrival of the owners or under some circumstances, the fish could be sent to some designated regular buyers, known as 'customers' for sales on behalf on the owners.

Losses occurring at the post-harvest handling and processing stages and other points along the value chain are difficult to quantify due largely to the inability of the practitioners to tie losses of specific activities to the generational costs. Notwithstanding, post-harvest losses are not regarded as major issue in the operations of the fisheries and if they do occur at all they are considered generally minimal and vary from district to district.

The main problem encountered by the artisanal fishers and the fish processors lean more towards poor fish catches and inadequate fish supply respectively. Secondly, the operations are too much tied up to knowledge bequeathed to practitioners by departing relatives and other peers. This practice does not lend itself to innovativeness. Some type of training for all the fisheries practitioners along the value chain will therefore be very helpful to getting them to ply their trade in a more cost effective and sustainable manner in a clean environment.

1.2 Background

The fishery resources of Ghana has been the economic backbone of the many fishing communities for centuries, especially the artisanal fishermen and fish processors and will continue to remain so as long as the fishery resources are managed sustainably (National Fisheries and Aquaculture Policy, 2008).

It is also noted that the fishing sector is relatively well organized with an increasing desire among Ghanaian fishers to play a role in managing their local fisheries. However, historic fisheries management settings have led to a situation where local fishers and communities have no real stake in the fishery. The *Fisheries and Aquaculture Sector Development Plan* seeks to rectify this by providing incumbent fishers with a genuine stake in their local fisheries through the issuance of long-term and transferable licensing and effort control. The Ministry of Fisheries and Aquaculture Development believes that once the number and identity of fishers at a particular site is stabilized, conditions are ripe for development of local rules governing fishing places, times and methods, as well as the potential for collective investments in added value (processing), fish handling and marketing.

Ghana's artisanal fishing sector includes 10,000 small, mechanized wooden boats that harvest 60–70% of the marine catches. About 170 larger semi-industrial ships with inboard motors are used for trawling in shallow waters during the offseason; and purse seining during upwelling seasons. Approximately 90 industrial vessels are used for shrimping, tuna lines and poles, purse seining and demersal pair trawling. The Ghanaian government has sought to expand the industrial sector in an effort to diversify exports since 1984. Inland fisheries exist on major rivers and lakes, and there is also some freshwater aquaculture of tilapia and other endemic species (FAO, 2008).

Ghana has significant and valuable fish stocks and a strong tradition and culture of fishing. The country produces around 440,000 tons of fish a year (worth in excess of US$1 billion annually) from its marine fisheries, inland waters and aquaculture. As many as 2.2 million people are dependent on the fisheries sector for their livelihoods, including 135,000 fishers in the marine sector, of which 92 percent (124,200) are artisanal fishers. However, most of Ghana's fish resources are overexploited and the sector's profitability is declining. In recent years, fish production costs approached or exceeded income in all inshore marine capture fisheries (the industrial, semi-industrial and artisanal canoe fisheries) and any remaining profitability in inland fisheries is being rapidly dissipated. The root cause of the losses stems

from too many vessels competing to catch the few fish, with no incentive to invest in management and value addition.

The fishing industry of Ghana is regulated by the Fisheries Act 2002 (Act 625 of 2002) which provides for, *inter alia*, regulations and management of fisheries resources, development of the fishing industry and sustainable development of the fishery. Furthermore, Sections 77 and 139 of the Act makes it possible to draw on other laws that address any inadequacies in the management of the fisheries. Thus the Government of Ghana's most urgent priority of putting in place a comprehensive *Fisheries management and compliance systems* are in place to allow for effective control of all commercial fishing effort including the artisanal fishery in Ghanaian waters. Government's proposed approach taken in the Plan is as follows:

- To freeze the capacity of the artisanal sector at current levels
- To reduce vessel capacity in the industrial and semi-industrial sectors

Once the capacity reductions are introduced and effective management systems are operating, value added investments can then be targeted at the artisanal sector and remaining industrial sectors. The ultimate objective of having benefits accruing primarily to the artisanal sector and local communities as a result of the phased effort reductions, allocation of long-term and transferable licenses and development of community based fisheries management programs will thus be on course and hopefully impact positively on post-harvest handling of fishes in the coastal communities.

1.3 Scope of Work

The scope of work covers the following areas: Design of study, design research instruments, conduct the study and reporting on findings.

1.3.1 Design of Study

The consultant shall design a Post-harvest study which will be discusses with SNV before initiating full implementation. The design should take into consideration the following areas:

a) The study will be carried out in the four coastal regions of Ghana, Volta, Greater Accra, Central and Western Region
b) The study shall focus on small pelagic fish but also give general information on all fish landed with respect to the survey sites selected.
c) The study shall identify problems associated with postharvest losses in the processing, commercialization and seasonality of these products and provide recommendations on how to manage these issues.
d) The study will identify all the major points along the chain from the landing site to the consumer that incurs losses and assess the causes of these losses.
e) The consultant shall quantify in mass and value (monetary) the amount of losses along the chain.
f) The study will identify all the stakeholders along the value chain and assess their activities and its impacts and recommend options for better quality outputs.
g) The study will identify local knowledge available for reducing losses along the chain; assess its impact and also recommend other options.
h) The consultant shall take into account gender concerns, throughout the study.

1.3.2 Design Research Instruments

The consultant will design questionnaires or necessary research instruments to undertake the survey. The research instruments shall be reviewed by SNV before active field work begins.

1.3.3 Conduct the Study

The consultant shall conduct this study along the coastal basin of Ghana (The Volta, Greater Accra, Central and Western regions). Eight field assistants will be provided by SNV to assist in the gathering of field data in all four regions. The consultant shall train the field assistants and coordinate their activities on the field.

1.3.4 Reporting

A draft and final report will be prepared by the consultant with outputs of the field survey. The report shall encompass every activity that has been carried out under the survey process including design, research instruments etc.

1.4 The Study Area

The study area is the four coastal regions of Ghana; Western, Central, Greater Accra and Volta regions. The consultant shall select at least two communities in each region for the study based on prior knowledge of these areas. This must be justified.

1.5 Time Frame

This assignment will be carried out between July and September 2015 and shall be conducted in close consultation with the Renewable Energy Sector of SNV.

1.6 Deliverables

The consultant shall produce the following deliverables:

1) A study design
2) Research instruments
3) Field assistant training report
4) First draft report
5) Final report
6) A summary PPT of the final report

2.0 DATA COLLECTION INSTRUMENT

2.1 Developing Tools for Field Study

The main instrument used in the data gathering was a structured questionnaire aimed at capturing the practitioners along the fisheries value chain in 3 major areas: the fishermen; the fish processors/fish mongers; and the drivers conveying fresh and processed fish to the marketing and consuming centers. A copy of the questionnaire is presented in Annex 1.

2.2 Field Survey

Field survey was conducted in 48 landing beaches belonging to 13 Districts spread across the four coastal regions of Ghana (information on vessel volume per district at this juncture may be unreliable as registration of fishing vessels is currently underway nationwide). Interviews started in all the four regions by eight Research Assistants (RA's) on Wednesday August 12, 2015 and lasted for 15 day. This was followed by focus group discussion by the Consultant. The survey involved the collection of data using a structured questionnaire. For each RA, a minimum of 20 fishermen, 15 fish processors and 5 transporters were to be contacted. Slight variations in the administration of the questionnaires were introduced in a few locations with the approval of the Consultant. The summary of methodology used as applied to the three major areas (vessel owners; fish mongers, transporters) is presented in seven categories of Practitioners along the value chain. Choice of categories of fishing craft was informed by the major operating fishing vessels plying their trade in the four regions and the sample size determined by the time allotted for the field survey (15 working days). Details are presented as follows:

- Category 1: Industrial, semi-industrial semi industrial/local and canoes. Total: 40 vessels
    - 20 in Takoradi
    - 20 in Tema: spread questionnaire to capture all vessel types
        - 15 for industrial/ semi-industrial
        - 5 for canoes
- Category 2: Elmina, Apam, Axim, Shama. Total 60 vessels
    - 15 vessels each.
        - 5 for semi-industrial
        - 10 for canoes
- Category 3: Ningo Prampram, Keta, Denu. Total 60 vessels
    - 15 vessels per district.
- Category 4: Fishmongers. Total 120 fishmongers
    - 15 per location (i.e. 15 at each of the following places: Tema, Ningo Prampram, Keta, Denu Elmina, Apam, Sekondi, Half Assini)
    - Additional landing beaches with the potential to introducing variations were added as appropriate.

- Category 5: Drivers. Total 60 vessels
    - 5 per location (i.e. 5 at each at lorry stations of the following places: Tema, Ningo Prampram, Keta, Denu Elmina, Apam, Sekondi, Half Assini
- Category 6: Focus group discussions
    - Fishmongers
    - Fishermen
- Category 7: Key informant interviews

- GPRTU Chairmen/station masters
- Chief fishermen
- Leadership of fishmonger associations

In order to achieve the overall objective of the study the following characteristics and roles of fisheries practitioners were interrogated:

- Demographics
- Fishing techniques and methods
- Post-harvest handling of fish
- Transportation (load trucking)
- Stages, types and nature of losses along the value chain
- Marketing

2.3 Validation of Results

The Consultants engaged focus groups in all the regions to validate the data collected in the field by the Research Assistants. These groups included the leadership of the local fishing associations, e.g., executive members of the fish processing associations at selected landing beaches, Chief fishermen and the leadership of the transport unions and the drivers who are directly involved in the processed fish haulage.

Consultant also visited some marketing canters during market days to observe and interact with drivers and fishmongers; both the sellers and buyers

2.4 Data Analysis

Data gathered by the RAs on 73-question questionnaires for the 48 landing beached were initially collated at the district levels and analyzed statistically using the SPSS statistical package.

3.0 FISHERIES PRACTICES IN THE REGIONS: KEY FINDINGS

3.1 Western Region

There are six fishing districts and 96 landing beaches in the Western region. The SNV post-harvest loss reducing study was conducted in four districts and 11 landing beaches in this region. The four districts with the respective main fishing towns and number of landing beaches are: Jomoro – Half Assini, (2), Nzema East – Axim, (3), STMA – Sekondi (3) and Shama (3). A total of 20 fishermen, 30 fish processors and 10 drivers were interviewed in the region. Focus group discussions were held for chief fishermen, fish processors associations and some drivers in Half Assini and Denu in the Volta region.

3.1.1 Jomoro District – Half Assini

Half Assini is the biggest landing beach in the Jomoro district. It has two major landing sites respectively operated by the Nzema and Fante communities (New York beach) and the Ewe community (Bonglo beach). Cultural differences make the operations of the two landing beaches different in terms of taboo days, the gear used, fishing practices and consequently the catches landed. The general consensus is that the two factions co-exist peacefully; except in the distribution of Pre-mix fuel.

At the Banglo beach, the main fishing economic unit is the dug-out canoe (some of which may be motorized) and the seine net. The major fishing practice is thus the beach seining. At the New York landing beach, the main fishing economic unit is the dug-out canoe but they are all motorized. The fishing gear is more diverse which enable them to practice such fishing methods as Ali, Poli and Watsa, hook and line, monofilament (rubber) net. The use of light and other unorthodox methods of dynamite and DDT in fishing are thought not to be prevalent in these areas.

Demographic Characteristics

Age

The age structure of male and female practitioners in this district spans three decades and ranges from 31 to 57 years (Figure 1).

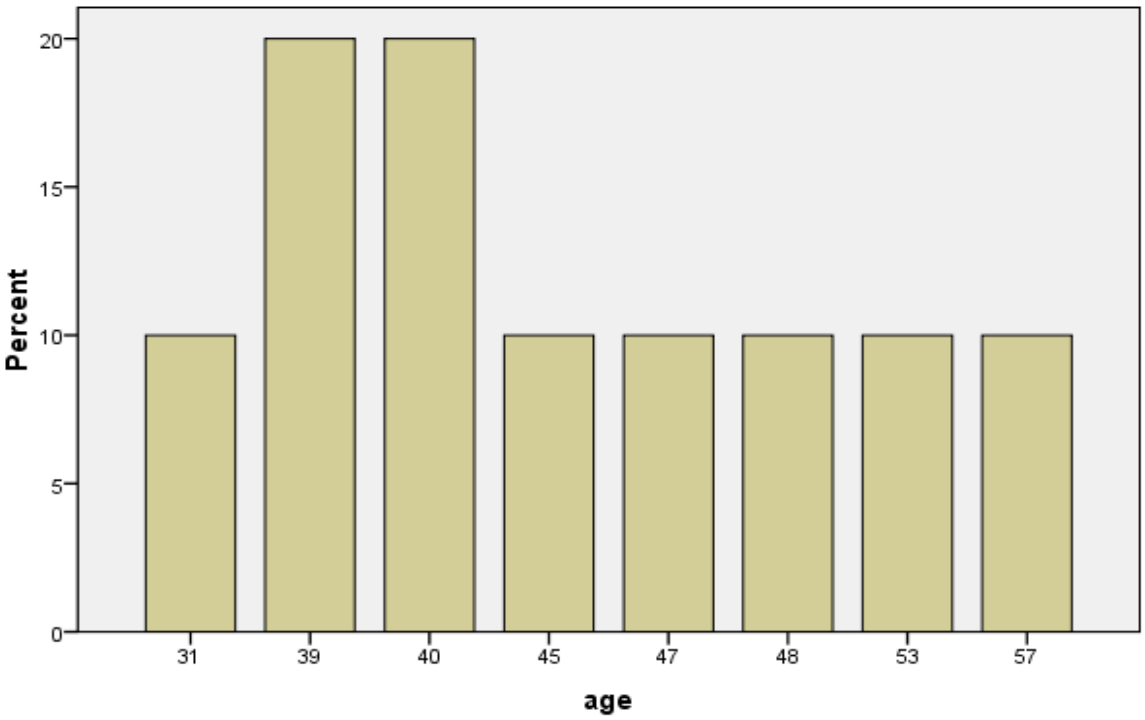

Figure 1 Age structure of fishermen in Jomoro District

Education

Classroom type of educational level is generally low. 50% of respondents have had no formal education. The remaining 50% schooled only up to the middle school level.

Fishermen do not change their fishing gear in the course of the year and tend to use the same gear at all times. The season of bumper harvest is variously stated as August, August and September and September. However the majority of fishermen perceive September as the period of highest catch (Figure 2).

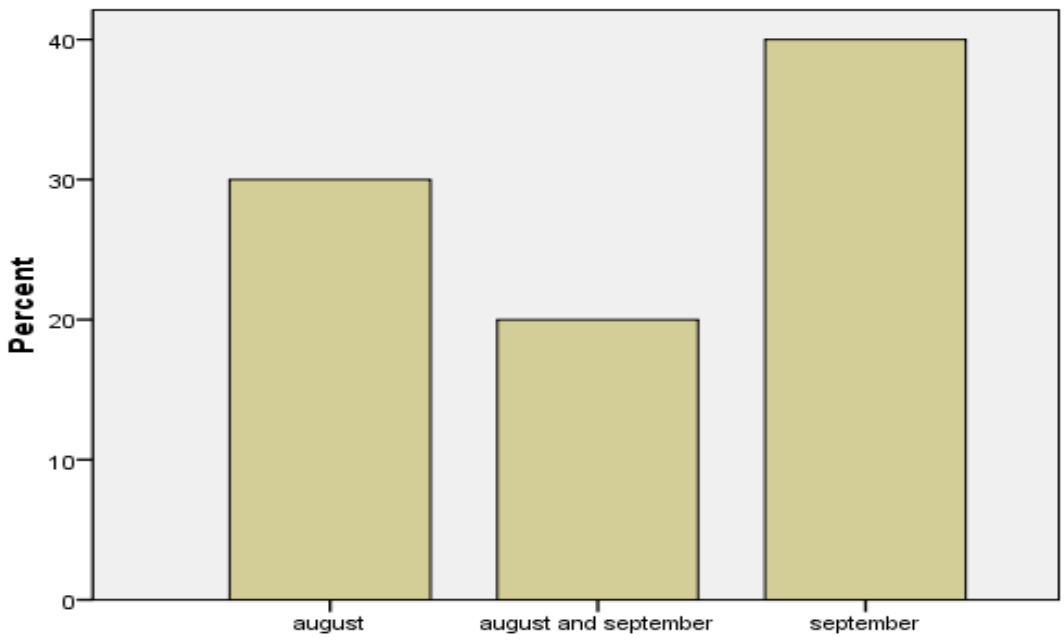

Figure 2 Period of peak fish harvest in Half Assini – Jomoro District

Period of stay at sea

Traditionally, the Ewe fishermen spend a few hours at sea plying the beach seining. The Nzema / Fante fishermen stay comparatively longer periods but up to a maximum of one day (overnight) (Figure 3). This type of fishing makes them less dependent on ice preservatives at sea.

Fish loss at sea has only a small proportion being attributed to spoilage and arises only when catches are sparse and fishing time is prolonged. Other causes of loses stem from such incidences as shortage of pre-mix at sea, outboard engine break down and breaking of fishing nets among others. The occurrences are rare and the quantities involved, on the average are negligible.

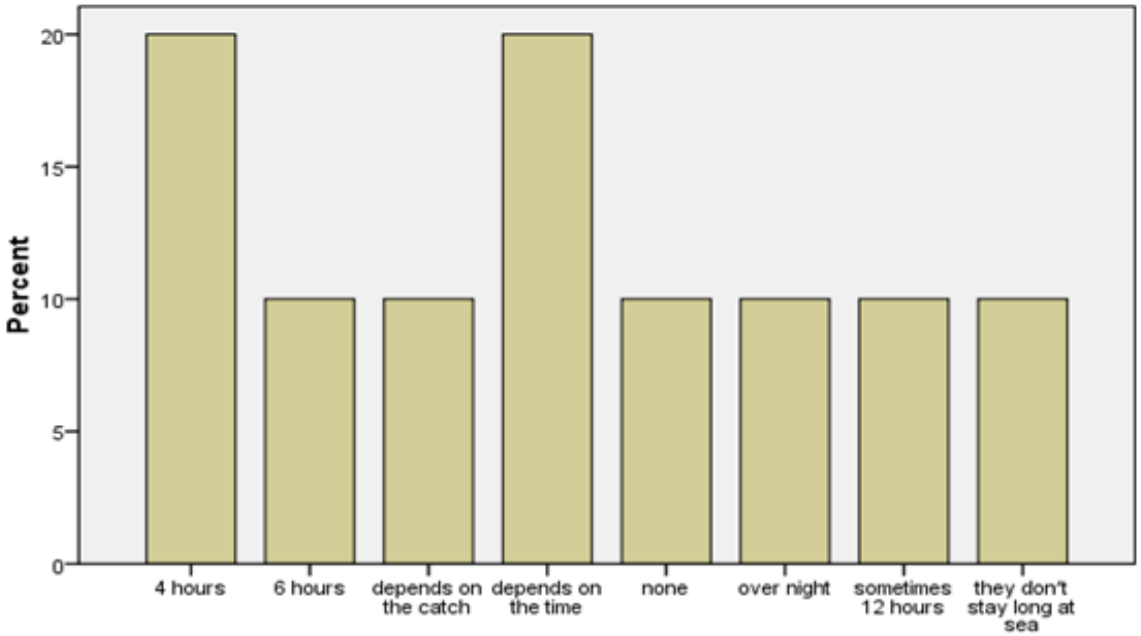

Figure 3 Period of stay at sea harvesting fish

Fish landings at the beach will not ordinarily stay too long between the time of discharge and sale. While the quantities landed by the boats are an important determining factor, it is estimated that within a period of 30 minutes of discharging from the boat all the fish would have been sold out (Figure 4). Because fish is rapidly offloaded and sold out also within relatively short periods, fish loss, according to the fisheries practitioners, is very minimal at the beach when it exists.

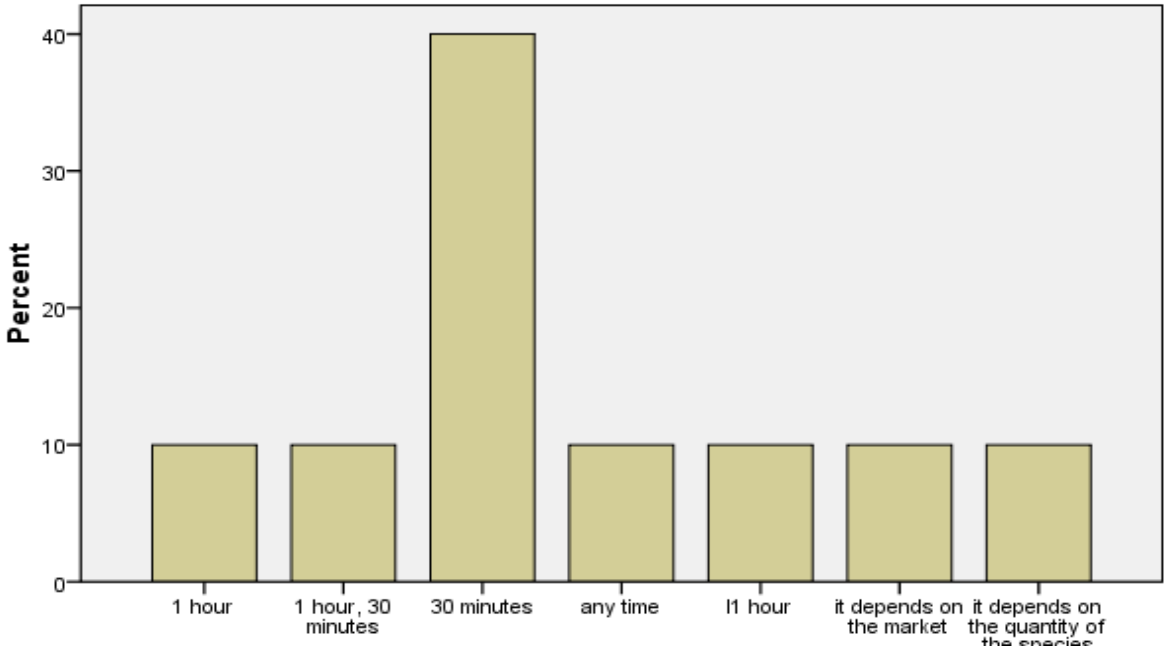

Figure 4 Time lapse on fish discharge at beach before it is sold out

The instrument of measure of landed fish varies widely and may depend on the type and quantity of fish landed. These include the enamel bowl, rubber buckets and rubber bowls. The main type in use is however the enamel bowls. 30% of respondents use the enamel bowl, commonly referred to as pan (Figure 5).

Fish by-catch

The major source of fish loss indirectly encountered by the fishers is the by-catch (usually non-target juvenile fish). The reaction of fishermen to by-catch is variable and includes outright release back into the sea, some being sold or sale at the landing beach. Over 60% of all by-catch is sold out (Figure 6).

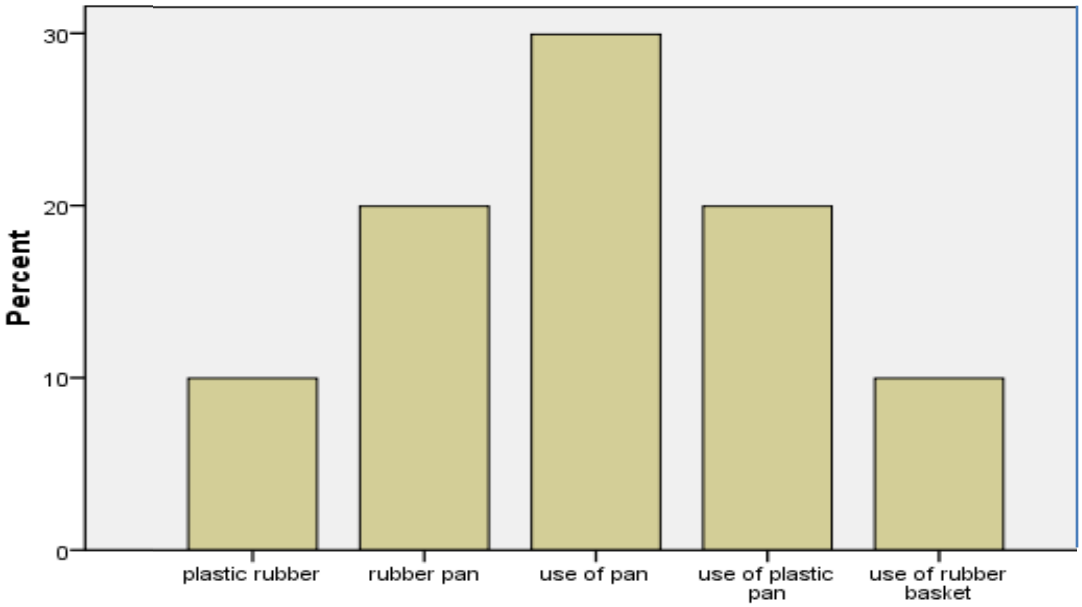

Figure 5 Instrument of measure of fish at landing beaches in Jomoro

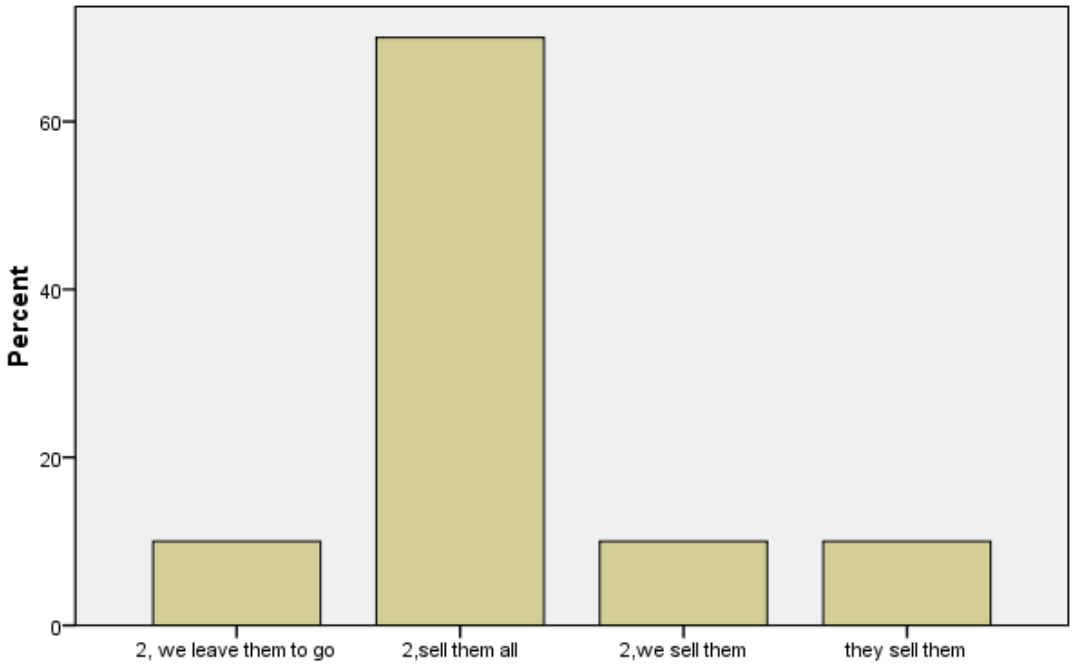

Figure 6 Way of dealing with fish by-catch in Jomoro District

Fish processing, packaging and haulage, and marketing

Fish processing

Fish processing in the Jomoro district is dominated by the women in Nzema / Fante and Ewe communities. Where males get involved in the processing, they are perceived as helping their spouses. Like their male fishermen counterparts, the educational levels of the female processors are generally low and do not go beyond middle school level. Most of them inherited the businesses from their parents after they had passed on while others operate side by side with their mothers. One significant observation is that the daughters who are in school or have acquired some education beyond the Junior High school are usually exempted from full time participation in the processing business.

There are three major fish processing methods in the Jomoro district. These are: smoking; salting / drying; frying. By far the most popular method in use is smoking and it is followed by salting/drying, frying and frying in that order. All types of fish can be used for processing and any type is able to be processed using the available techniques. Plate 1 shows mixed species of small pelagics left in treatment baskets to facilitate complete drain of water ahead of smoking.

On choice of fish for processing, 30% of the respondents thought the question was not applicable to them as they would select any type available on the fishing day to process. 20% of them held that *Sardinella aurita* (round sardine) locally known as Eban were the preferred fish for smoking. The remaining comprised of several other species (Figure 7).

Plate 1 Treatment of mixed small pelagics for smoking in Jomoro District

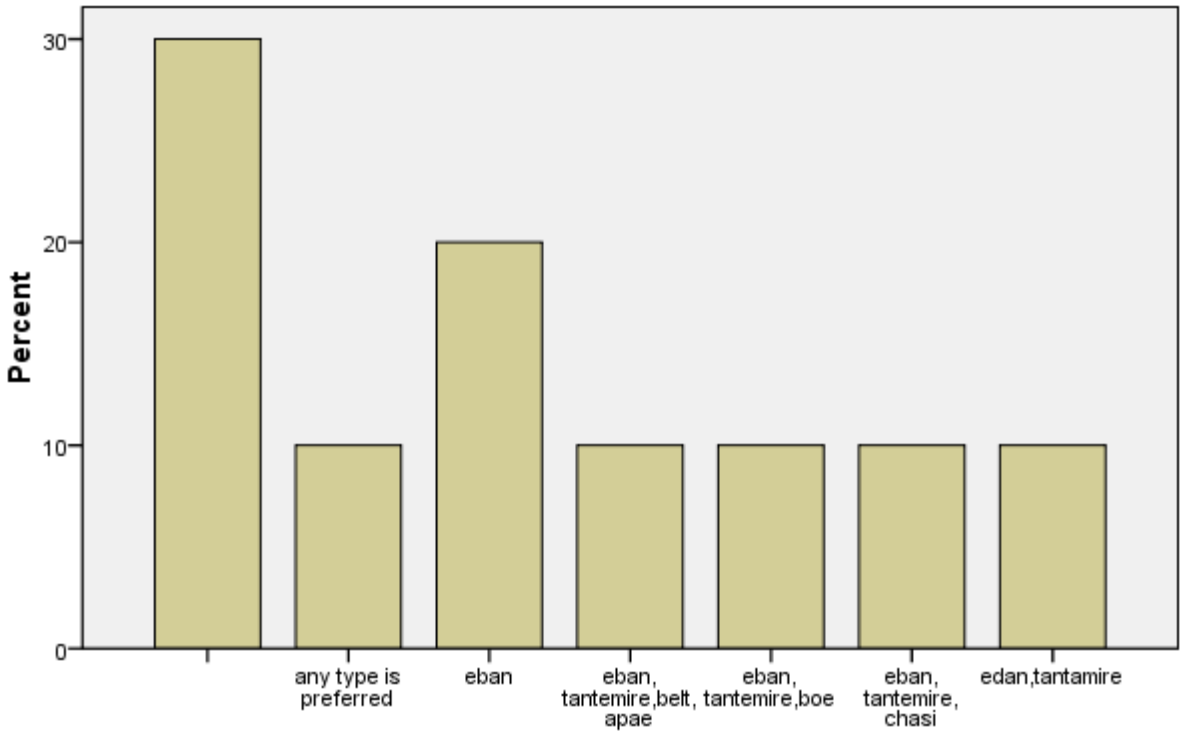

Figure 7 Preferred fish for processing in Jomoro District

Fish processing associated losses

Traditionally the effort required to process different species of fish are about the same, and the fishing method in this region does not have effect on the processing time or quality. Losses incurred during processing are thus about the same.

On the whole loss of fish during processing is not significant, according to majority of the respondents. Similarly, about 40% of the respondents held that losses during preservation were not an issue as they will ordinarily not preserve fish before they processed them. Notwithstanding, some processors held that some element of losses may occur depending on the preservation method adopted. In this wise, freezing as a means of preservation prior to processing has the highest potential of incurring losses. This is followed by salting/drying and smoking in that order (Figure 8).

Quantification of losses is extremely difficult for the fishers and processors to make; except that they know money that ought to have accrued to them was not realized.

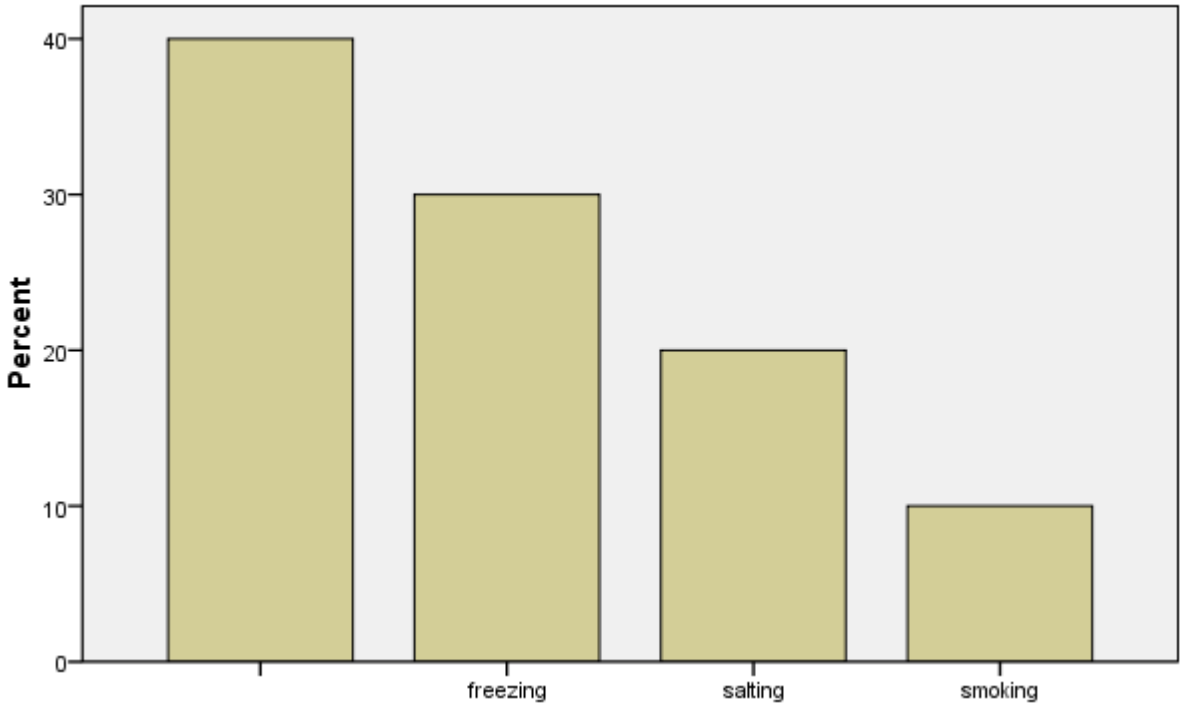

Figure 8 Processing / preservation – type associated losses in Jomoro District

Fish preferences for salting / drying processing

Generally, salting/drying processing can be made with all type of fish and under any condition. However some species of fish are thought to sell better and earn good margins of profit when processed. These include the deep body fish *Caranx hippos* (horse mackerel) *(*Epae); *Chloroscombrus chrusurus* (Atlantic bumper) (Tantemire), *Scomberomorus tritor* (Spanish mackerel king fish (Saforo) among others (Figure 9).

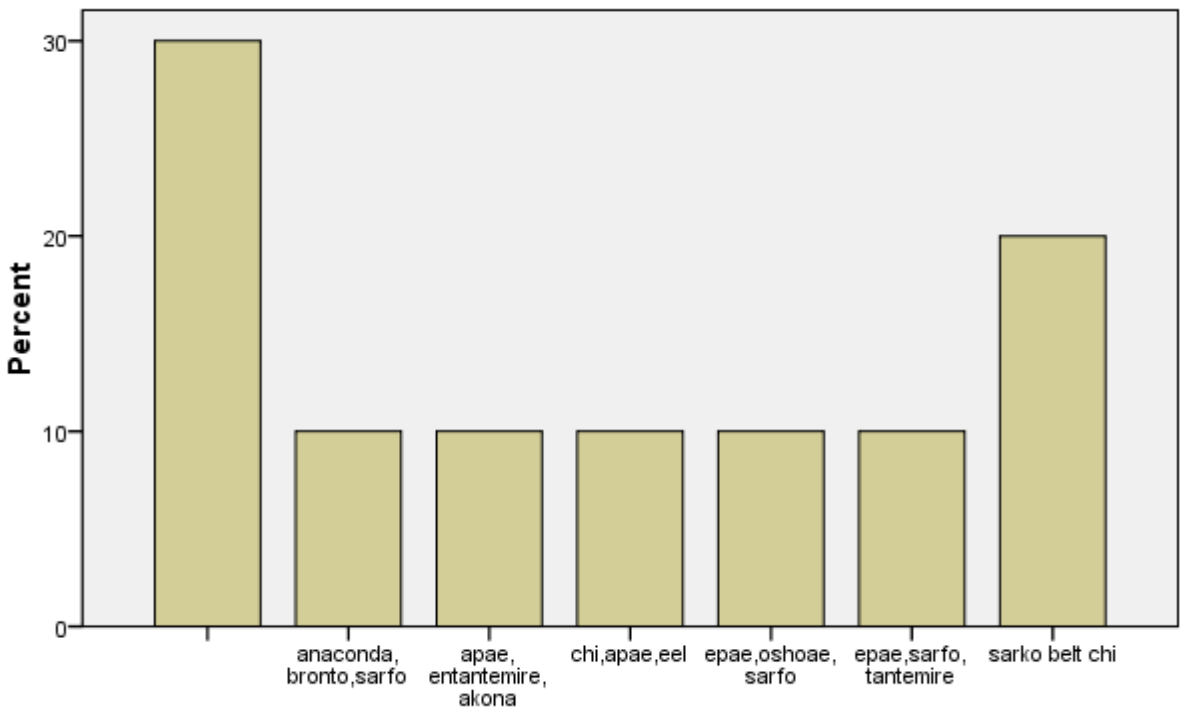

Figure 9 Preferred fish for salting / drying (momoi) processing in Jomoro District

Fish packaging and haulage

Processed fish is packaged in large enamel bowls lined with brown paper and secured using ropes or heavy duty nets. Packaged height is normally three feet but this can be increased depending on the type of fish and the extent of hardness.

Transportation of processed fish is by arranged transporters. Where to move to and when to move is determined by marketing days of the major marketing centers in Ghana. For the processors in this community, haulage days are usually Mondays, Tuesdays, Fridays and Saturdays. The marketing centers include Elubo, Jeways Warf, Tikobo No. 1 Asankragua, Sefwi Bekwai, Bogoso Kumasi, Accra and Aflao.

The fish smokers may or may not accompany the vehicles to the marketing centers. Where goods are moved unaccompanied, adequate arrangements are made for ‘customer porters’ to receive, store and in some cases even distribute the goods on behalf of the processor for an agreed fee. Vehicle charges are on the basis of ‘per packaged item’ and payment may be made to driver before or after discharge of goods. Charges range between GHc 3- Ghc 7 depending on the destination and also size of the packaged item.

For the salting/drying processors, haulage of the goods is dove unaccompanied. They board passenger vehicles to follow-up to collect their wares at the designated destinations. In some cases, designated agents may be commissioned to collect wares on behalf of the momoi processors.

Losses incurred during the transporting process are deemed negligible and even when a vehicle breaks down on the way, the only losses incurred may be loss of time. Anyhow, it

becomes the responsibility of the driver to lift the goods to the designated destination as quickly as possible.

Marketing

Wares are sold in bulk at the marketing centers to customers (Plate 2). In extreme cases, the processors may retail the fish. Any unsold fish is kept in safety at local ware houses at agreed fee of GHc 1- 2 per basket per day.

Plate 2 Packaged processing fish displayed for marketing

3.1.2 Nzema East District – Axim

Axim and its environs, three landing beaches were studied. These are Supom, also known as Russia Commandos; Boatase or Italy and Antoampusika landing beaches. There are no industrial vessels in these landing beaches but the inshore vessels are capable of staying at sea up to four days. Others stay for 24 hours while the ‘one-man’ canoes last for around 12 hours and more. The different vessels land different fish species.

Demographic Characteristics

The age structure among the randomly sampled fishermen spans six decades and ranges from 22 years to 70 years. Educational level of the respondents is low and range from no formal class room education to middle school certificate holders. Only one diver had secondary education. All the boat owner/fishermen and drivers were males while all the fish mongers were females (Table 1). Majority of the practitioners were married.

Table 1 Educational levels of fisheries practitioners in Nzema East

	Fishermen (Males)		Fishmongers / Buyers (Females)		Drivers of vehicles (Males)	
Education.	No. of Responses	Percent (%)	No. of Responses	Percent (%)	No. of Responses	Percent (%)
None	5	50	8	80	1	20
Middle/JSS	5	50	2	20	3	60
Secondary					1	20
Tertiary						
Totals	10	100	10	100	5	100

Fishing is done through the year with almost all of them not changing their fishing gear. Fishes landed include the following*: Illisha Africana* (long fin herring) (Kanfena); *Caranx hyppos* (horse mackerel) Epae; *Sardinella eba* (flat sardines) Eban; *Sardinella aurita* (round sardines) Eban kankama; *Pseudotolithus typus* (Cassava fish) Ekan.

Fish harvest

Period of bumper harvest varies widely among respondents; presumably corresponding to the preponderance of the various fishery. Majority of respondents nonetheless hold the bumper harvest to be in August. This period also corresponds to the period of highest fist haulage from the processing centers to the consuming centers (Figure 10).

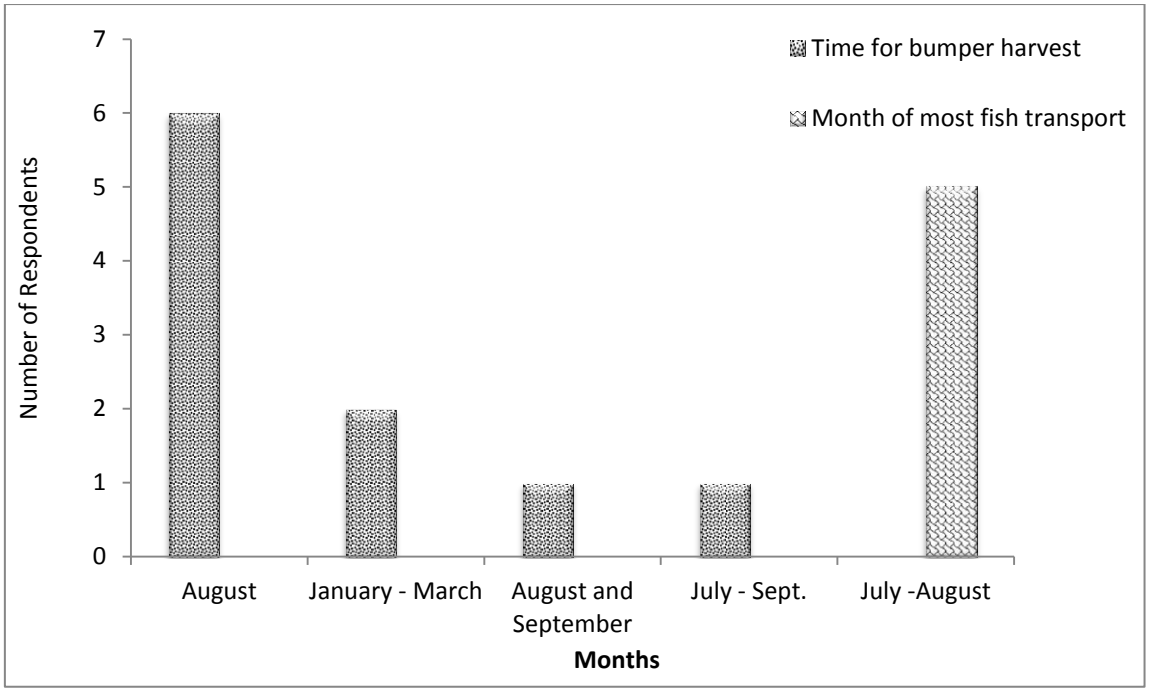

Figure 10 Fish dominance during the bumper harvest season

During the period of bumper harvest, the catches are dominated by the sardinella with *Sardinella aurita* (round sardines) at 80% of the catches while *Sardinella eba* (flat sardines) constitute the remaining 20% of the landings (Figure 11).

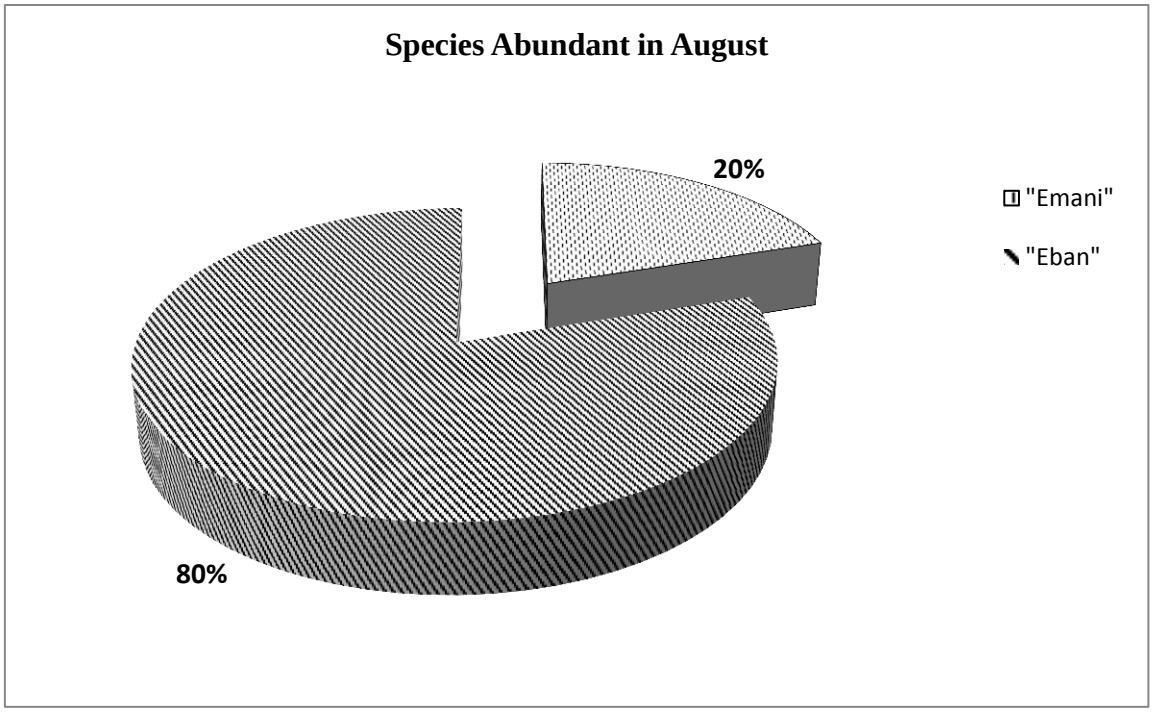

Figure 11 Dominant fish landings at bumper harvest in Axim

Fish preservation at sea

Majority of fishermen do not preserve their catches at sea. Those that preserve their catches are those that stay for longer periods of time (i.e., from 1 to 4 days).

At the landing beaches, catches are removed from the boats fairly rapidly with about 50% being emptied within one hour. In the same manner, within one hour of emptying the boats the evacuated fish would have been sold out. 60% of respondents believe that their landed fishes are sold off almost immediately (Figure 12).

Ways of losing fish

Fish loss is not a big issue with the fishermen. Nonetheless, any losses incurred may stem from delay at sea or shortage of ice for preserving the catch and others (Figure 13). Suggested remediation measures aimed at reducing fish loss include the following: access to plentiful supply of ice, not going too far offshore or getting deteriorating fish processed into momoi (salting / drying) (Table 2).

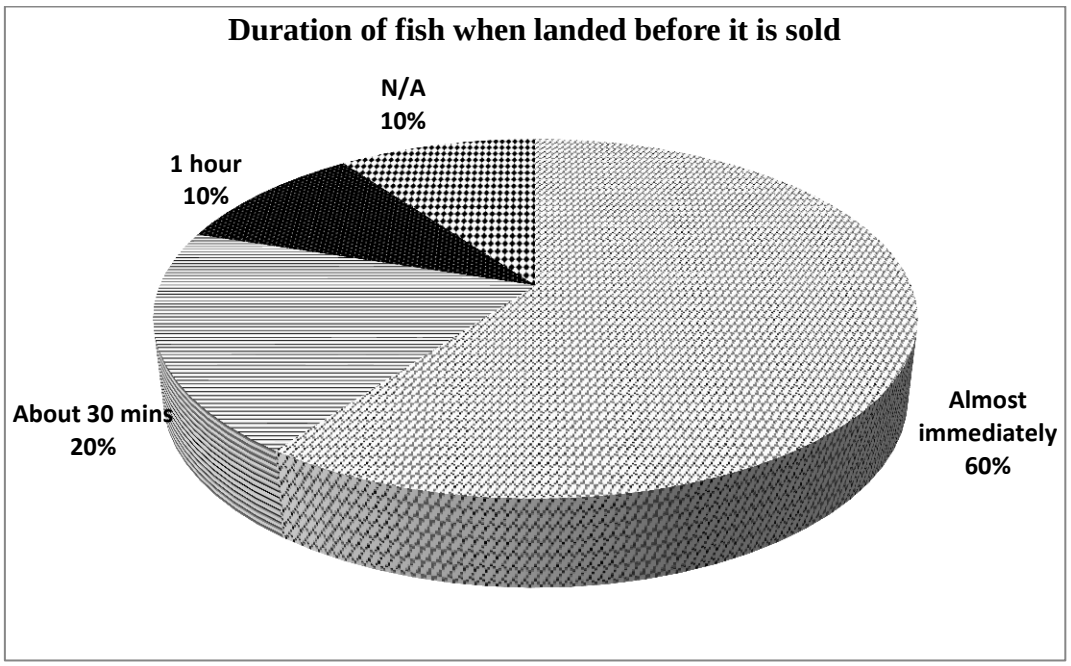

Figure 12 Duration of landed fish at beach prior to selling off

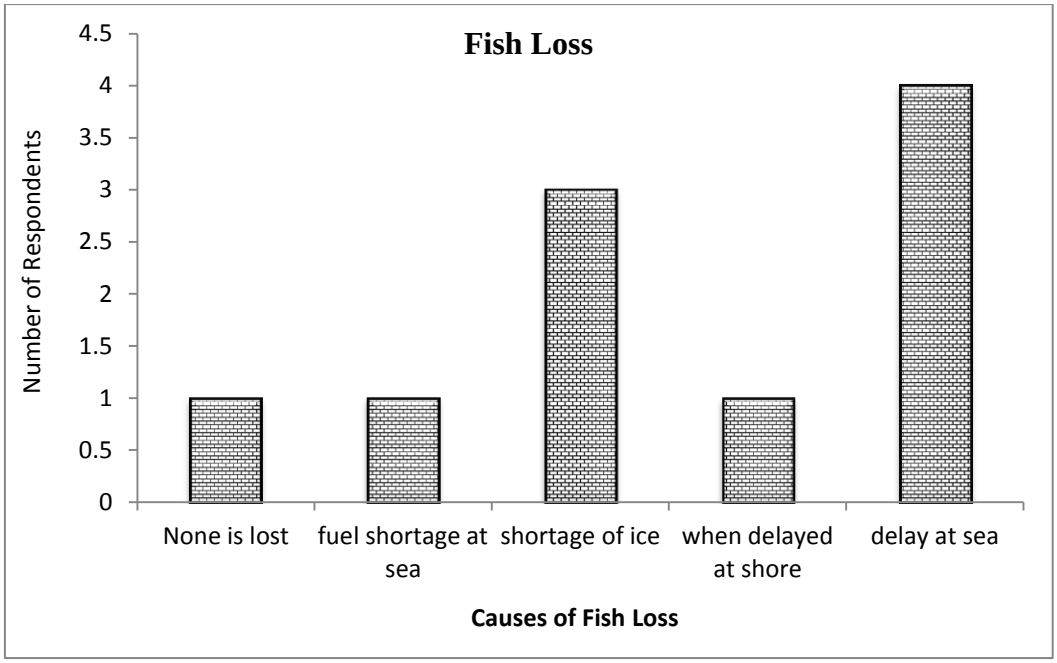

Figure 13 Potential causes of fish loss at sea in Nzema East

Table 2 Ways of reducing fish loss and incidence of spoilage

Strategy of reducing fish loss	Number of Respondents	Percentage (%)
Further processed into “Momoi”	3	30
Use of more ice blocks	3	30
Sell as well	3	30
Do not go far at sea	1	10
Total	10	100

Fish processing

Fish processing is the preserve of women and it may be through smoking, salting and drying, or frying. Fish may be put in cold storage, in rear circumstances, for preservation ahead of processing. In the Nzema East District, the main processing technique practiced is smoking. 50% of respondents are into fish smoking because they find it more profitable. 30% of them believe that smoked fish sells faster hence their choice of that fish processing technique. The remaining 20% attribute their choice of fish smoking practices to lack of storage facilities, presumably cold stores, in their location (Table 3).

Table 3 Reason for preferred fish processing technique

Reason for Choice of Processing Technique	Number of Respondents	Percentages (%)
Sells faster	3	30
Profitable	5	50
Because of no storage facility	2	20

Stages of processed fish loss

Fish in this district is smoked using a variety of hard wood as a source of energy. The hard wood is ordered from the hinterland. Dry coconut husks may also be used. Crushed and dried sugarcane peels (bagasse) are sometimes used to enhance preservation and to improve taste and general aesthetics. It is to be noted that in this district mangroves plants are never used as sources of energy to process fish. The perception on avoidance of mangrove plants is that it does not give the finished product the necessary good looks.

Generally, losses attributable to fish processing is not considered a major setback in the processing business. Notwithstanding, it is acknowledged that if the smoking is not done properly some losses may occur from time to time. The majority view, however, is that losses incurred may be right at the landing site where pilfering by boat attendants and porters is very rife. Others believe that losses occur during processing and at the point of sale. Losses before processing and in storage are considered minimal (Figure 14).

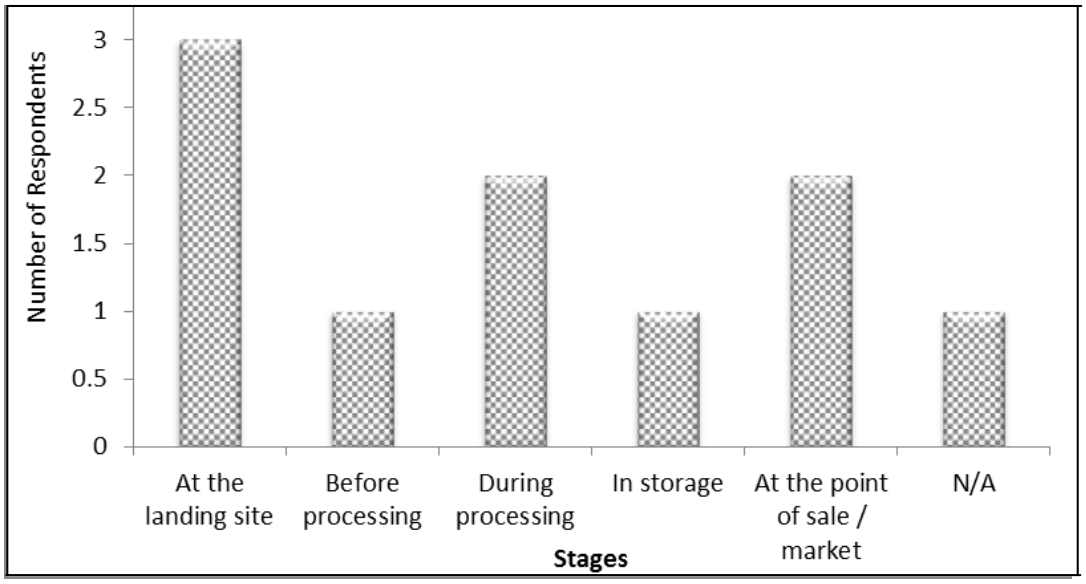

Figure 14 Stages of fish loss in Nzema East District

Packaging, haulage, and marketing

Packaging

Smoked fish is packaged in large aluminum bowls lined with brown paper and securely tied with nets. Special efforts are made to pack the fish in such a manner that leaves no room for movement within the bowls once they are tied. Packaged height is about two or three times the height of the aluminum bowl.

Haulage

Transportation of processed fish to the commercial centers is by trucks. The drivers are called in as and when a group of fish processors have enough wares to fill the trucks. During peak periods of fish harvest, the wares of only one processor may fill a whole haulage truck. The marketing centers patronized by processors in the District are diverse but a particular destination selected by a processor may be informed by such market forces are scarcity of the product, willingness of buyers (customers) to accept the desired quantities being sent and availability of storage space, in the event that the wares are not sold out. Fish mongers may stay at the marketing centers for as long as one week in order to sell off their wares.

Marketing

As it pertains in other districts of the region, the fish smokers may or may not accompany the vehicles to the marketing centers. Where goods are moved unaccompanied, adequate arrangements are made for ‘customer porters’ to receive, store and in some cases even distribute the goods on behalf of the processor. Remuneration due such porters is usually by negotiations. The major commercial markets patronized by the processors include Elubo, Jeways Warf, Tikobo No. 1, Sefwi Bekwai, Tarkwa, Kumasi, Kintampo and Bolgatanga Aflao, Denu and Aflao.

Fish processing and loss analysis

While some of the processors are of the view that fish losses are no major issues in the business, majority of respondents believe that the processing techniques that returns the biggest profit margin is smoking. In the same vein freezing, for preservation ahead of processing, returns the biggest loss of revenue (Figure 15).

Another window of revenue loss is through forced sales. Forced sales are interpreted as a situation where the fish monger is forced to sell without any profit or at times sell below production cost in order to realize some cash to solve some pressing issues that may or may not be directly related to the business but necessary to keep the business running. Example may include payment of school fees, settling of medical bills, among others.

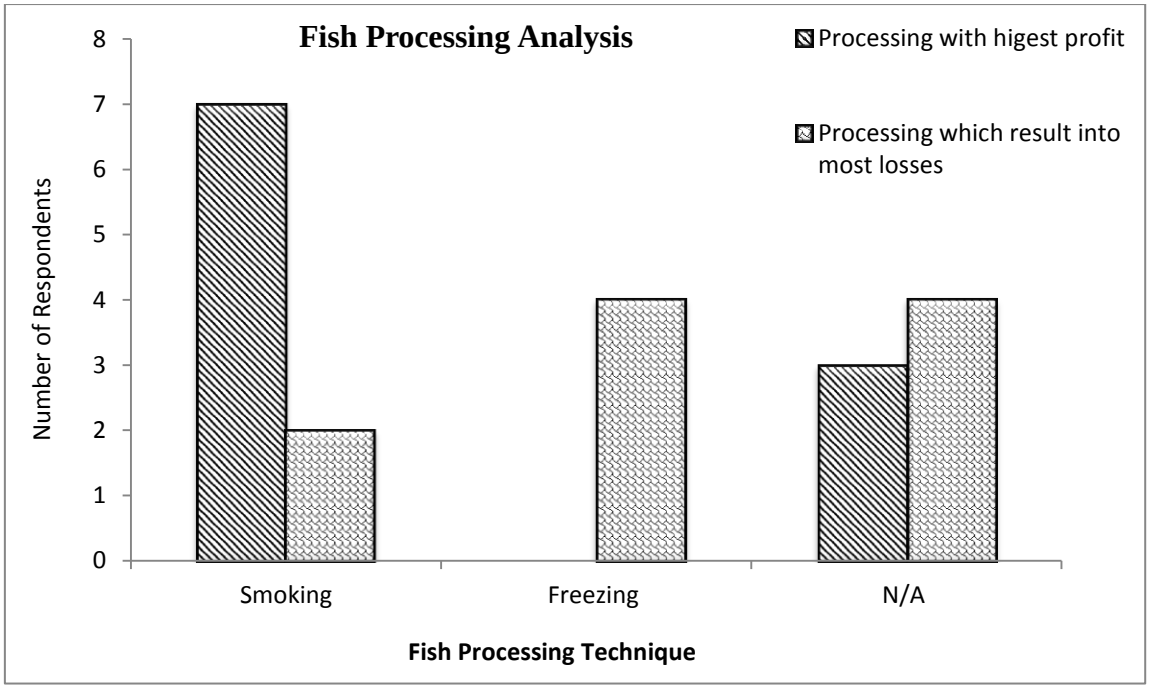

Figure 15 Dominant stage of fish loss

3.1.3 Sekondi / Takoradi Metropolitan Assembly (STMA) and Sham District

Data from the two districts of STMA and Shama were combined and analyzed together. The study areas comprised two landing beaches in the STMA Albert Bosumtwi-Sam (ABS) fishing harbor, New Takoradi beach and four landing beaches in Shama district (Shama beach, Aboadze beach, Aboasi beach, Ngyasia beach).

Fishing in these areas is done by male patrons while fish processing is performed predominantly by females. Males who take part in the processing business are normally regarded as offering assistance to their spouses.

All the major fishing methods, i.e., APW, hook & line, set net (monofilament net/rubber net fishing) and the inshore semi-industrial trawling are practiced in the two districts. In addition to this, five trawlers belonging to one fisheries practitioner are thought to be servicing the landing beaches with supplies of demersal fishes. These trawlers are also thought to be the main source of 'syco' fishing in the area. Also prevalent in this area are the practice of light fishing and 'bomb' or dynamite fishing.

Demographic Characteristics

Age

The age profile of both fishermen and the fish processors spans only three decades (37 years to 67 years) and dominated by those in the ages 37, 38, 40 and 47 at 12.5% (Figure 16).

Education

About 60% of the fisheries respondents had no formal education. The highest number of educated people were middle school/JSS scholars and represented 20% of the respondents. Secondary school and tertiary levels educated fisheries practitioners were equally represented at 7.5% (Figure 17).

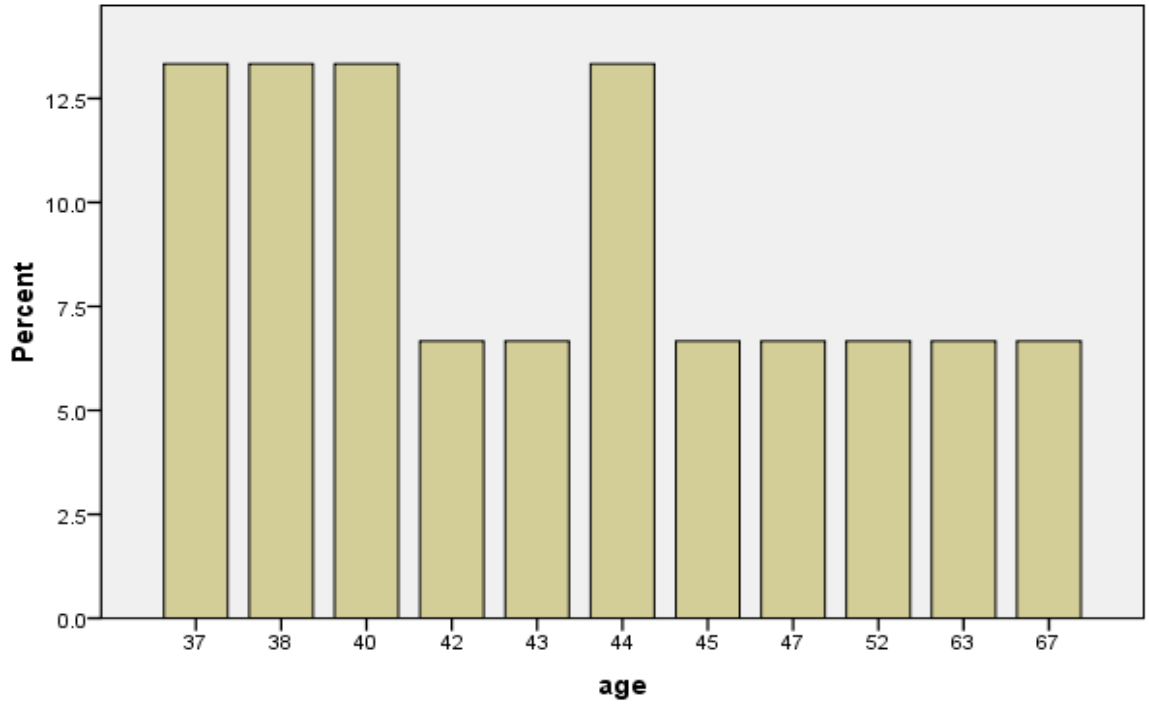

Figure 16 Age profile of fisheries practitioners in STMA and Shama District

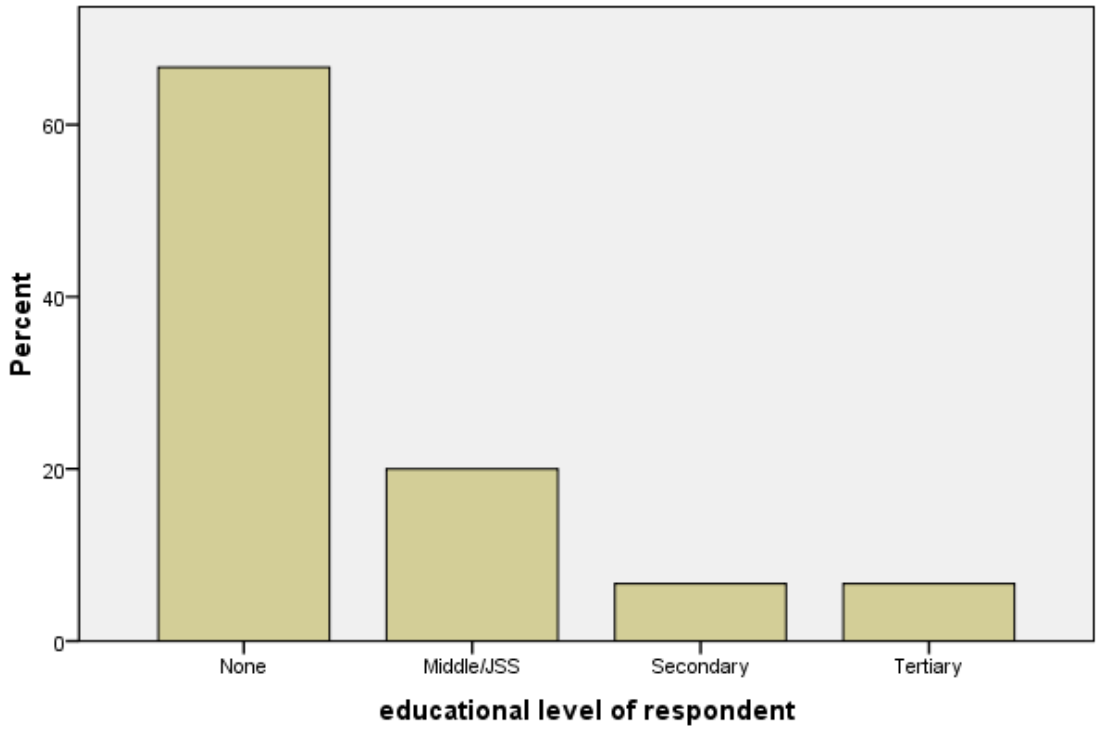

Figure 17 Educational levels of fisheries practitioners in STMA and Shama District

Period of bumper harvest

Period of highest harvest in this area is adjudged to be between July and October. While some respondents (10%) thought that the season of maximum fish harvest have ceased in recent years, about 50% of respondents held that August is the month in which fish harvest peaked (Figure 18).

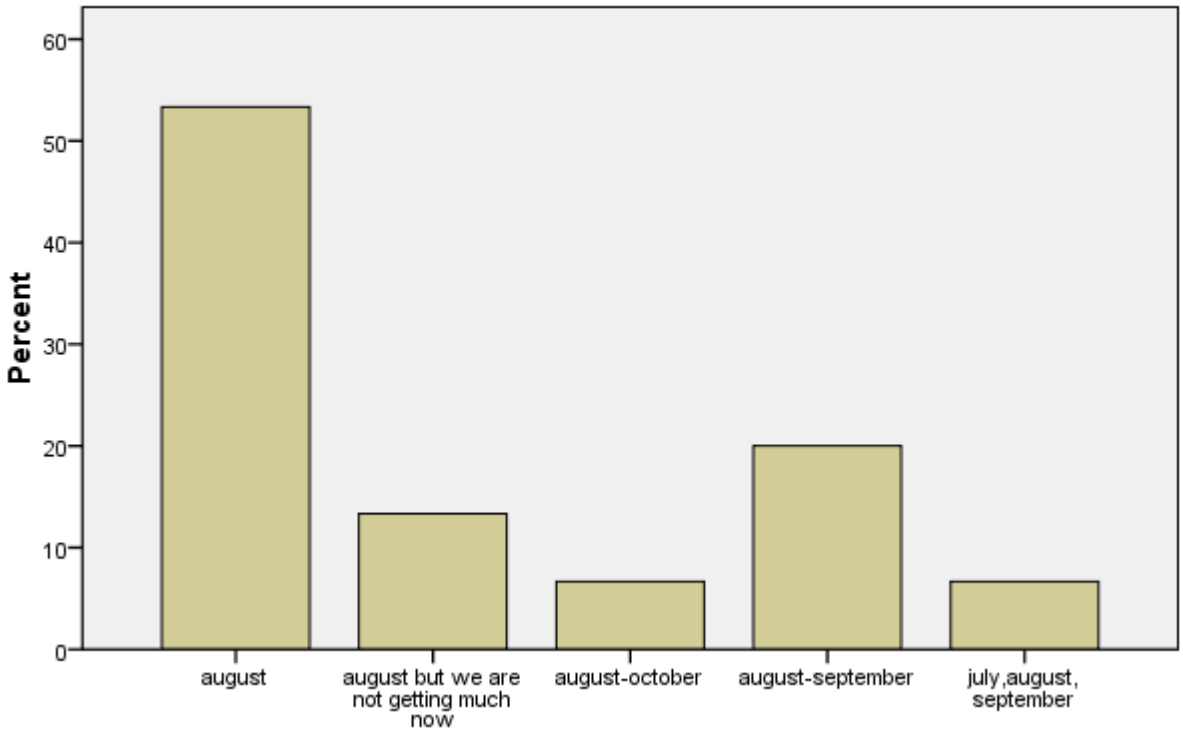

Figure 18 Period of peak fish harvest in STMA and Shama District

Period of stay at sea

Periods spent at sea range from four hours to five days and depends of the type of craft being used. The one-man canoe operators spend the least time at sea operating largely in the nearshore areas. They do not carry any for of preservatives with them. The Ali, poli and watsa operators spend variable times with thie operation lasting between 12 hours and one to two days. They donot carry much ice with them so in the event of much catch or decimated catches, they often run out of ice. The main uses of ice preservatives are the semi-industrial vessels and the trawlers. Depending on the quantum of catch and the fishing season, time spent at sea may last from one day to five days. The monofilament net ussers usually set their nets at night and remove them at dawn or early hours of the day. Thus their stah at sea also lasts for less than 12 hours in any typical fish in day.

Way of losing fish

Fish loss at sea comes from three major ways: when fishing nets of two different fishing groups get entangled ususlly as a result of receeding waves of storms; when fishing nets are overrun by the trawling nets of the industrial fleet; when there is an attack on fishing nets by dolphins and shacks. In all these instances, fish loss is only quantified in terms of loss of man-hours or canoe hours. In cases where the fishing group runs out of ice, the catches may begin to show signs of deterioration but usually do not get to the extent of being discarded. Such fishes are offloaded at a lower price to the momoni processors to be salted and dried. Thus real-time fish loss at sea is considered negligible.

<u>Fish processeing, packaging, and marketing</u>

Processing

There are three major processing methods being practised in the STMA and Shama districts. These are smoking, drying/salting and frying. Freezing as a preservation method is considered as pre-treatment technique for processing and occurs when catches are in plentiful supply. Such treatment lasts for only a few days. The large scale fresh fish sellers do employ refrigeration as a preservation method and release fish to the processors and other buyers on demand. When cold storage becomes a problem and fish begins to show signs of deteroration, the salting/drying fish processors are sought for by the frozen fish mongers and the fish off loaded to them, usually at a reduced cost but not to the exent of incuring losses.

Packaging

Processed fish packaging is done in a variety of vessels including pans, baskets and basins. They are normally arranged in the vessels lined with paper and tied up with ropes. The most commonly used vessel in the two districts is the pan (Figure 19).

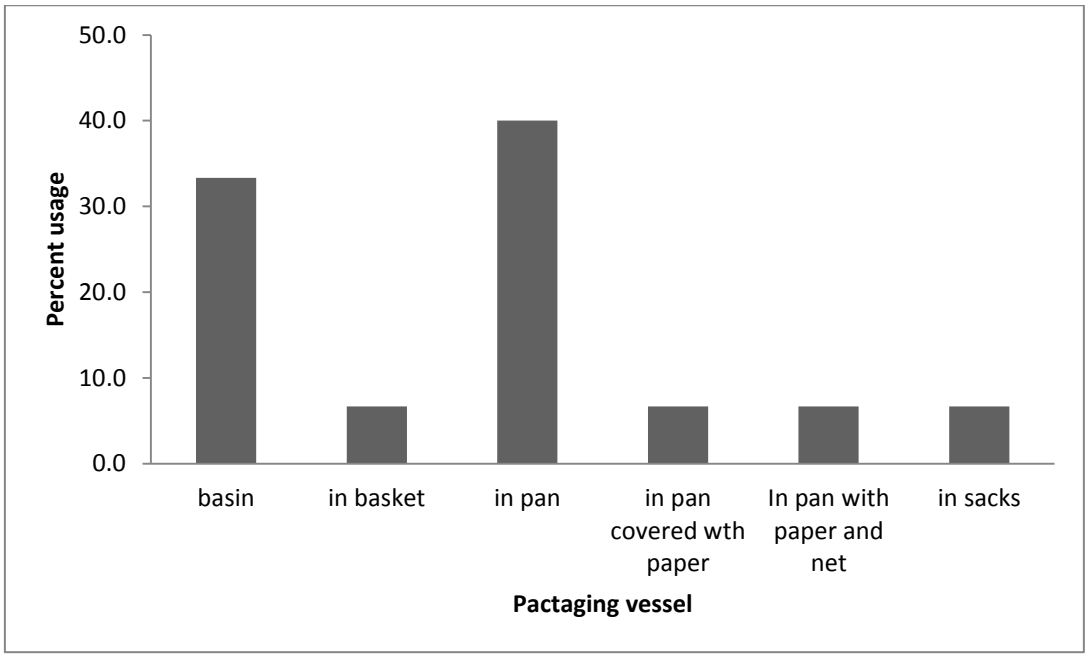

Figure 19 Processed fish packaging vessels in us at STMA and Shama District

Marketing

The Albert Bosomtwi-Sam (ABS) fishing harbour at Sekondi is one of the largest fish marketing centers for both fresh and processed fish in these districts. Other marketing centers include Techiman, Joaboso, Kumasi, Sewhi-Wiaso and Tarkwa.

Haulage

Road transport is the main means of conveying the processed fish from the processing towns to the marketing centers. For the long distance haulage, the larger mummy trucks are used while short distance marketing destinations employ smaller haulage trucks, urvan busses and commercial saloon cars.

3.2 Central Region

Central region has 47 landing beaches spread across nine coastal districts. The study in this region covered 13 landing beaches in the districts of Kommenda/Edna/ Eguafo/Abirem

(KEEA) and Gomoa West. The 13 beaches were located in three major fishing towns of Elmina, Kommenda and Apam, within two districts (Table 4).

Table 4 Studied landing beaches in Central Region

District	Major towns	Landing beach
Kommenda/Edna/ Eguafo/Abirem (KEEA)	Elmina	Elmina
		Abisisim
		Asamanpom
		Boatase
		Marine park
		Nyankyifom
	Kommenda	British komenda
		Dutch Komenda
		Sesam
Gomoa West	Apam	Abra mpoano
		Akodaa ahenegwe
		Apam main
		Atlata mpuano
		Nana apaaenim

3.2.1 KEEA – Elmina

<u>Demographic Characteristics</u>

Age

The age group of respondents spans a period of four decades in the range of 30 – 65 years. The fishermen had modal ages in the age group of 40-59. The corresponding age groups for the fish processors and the drivers were 60 years and above and 30-39 years respectively (Table 5).

Table 5 Age profile of fisheries practitioners

	Fishermen		Fishmongers / Buyers		Drivers of Vehicles	
Age	**No. of Responses**	***Percent (%)***	**No. of Responses**	***Percent (%)***	**No. of Responses**	***Percent (%)***
20 -29 years						
30 - 39 years	2	*11*	2	*11*	3	
40 - 49 years	8	*42*	4	*21*		
50 -59 years	8	*42*	4	*21*		
above 60years	1	*5*	5	26	1	
N/A			4	21		
Totals	**19**	***100***	**19**	***100***	**4**	100

Gender

Gender specific activities are prevalent in the fisheries business in this region. There were no females participating directly in the fishing activities. Similarly, all the processing was done by women while the drivers were all males.

Education

Educational level of the fisheries practitioners in this district is generally very low. 84% of the fishermen either had formal class room education up to the middle school or had no formal education. Notwithstanding, 11% and 5% respectively possessed secondary school and tertiary institution qualifications. Among the processors, 68% of them had no formal education while 11% only managed up to the middle school. The remaining 21% just attempted primary school l. All the fish haulage drivers were Middle school / JSS graduates (Table 6).

Table 6 Educational levels of fisheries practitioners in KEEA District

	Fishermen		Fishmongers / Buyers		Drivers of Vehicles	
Educ. Level	**No. of Responses**	***Percent (%)***	**No. of Responses**	***Percent (%)***	**No. of Responses**	***Percent (%)***
None	9	*47*	13	*68*	-	-
Middle/JSS	7	*37*	2	*11*	4	*100*
Secondary	1	*5*				
Tertiary	2	*11*	-	-	-	-
N/A			4	*21*		
Totals	**19**	***100***	**19**	***100***	**4**	***100***

Months of bumper harvest, type of fish, and high fish transport

The commonest fish species landed during this period were the sardines *Sardinella aurita* (round sardines) and *Sardinella eba* (flat sardines) locally called eban. Other fish species landed were Edae - *Thunnus albacore* (Yellow fin tuna), Nkafona -, *Ilisha africana* (long fin herring) Tatamire- *Chloroscombus chrysurus*) – jack mackerel, Epo mpatowa - *Chromis lineatus* (striped chromis) Efim – *Argyrosoma reguis* (cassava fish) Wrewrew / sika sika(Redfish) *Dentex angolensis* (sea bream), Efin – *Epinephelus aeneus* - grouper, *Engraulis encrasicolus* - Amoni, *Selene dorsalis* (African moonfish) - Tatamire. All the fishermen interviewed were unanimous in their thoughts that the main fish harvest season was in August.

Time spent at sea and preservation methods

Majority of the fishermen (57%) spend between six hours and fifteen hours at sea on any typical fishing day. There is a split in the use of ice blocks for preserving fish at sea. 47% of the respondents did not use ice at sea while those who used ice at sea were also 47%. The remaining 6% were not consistent in use or nonuse of ice blocks while at sea (Table 7).

Table 7 Fishing time and preservation schedule at sea

	Duration on sea		Maximum fish preservation time on sea	
Time	No. of Responses	Percentages (%)	No. of Responses	Percentages (%)
4 hours			1	5
6 hours	1	5		
10 hours			1	5
12 hours	9	48		
15 hours	1	5		
1 day	5	27	-	-
2 days	1	5		
3 days			4	21
4 days	1	5	1	5
N/A	1	5	12	64

Time lapse of emptying boat at full boat load

Evacuation of boats at full capacity lasted between 30 minutes and five hours. 37% of the respondents would off load all fish within 2 hours. The time lapse between offloading the fish and selling off the catch was equally short at times not exceeding two hours. 37% of the respondents disposed of their catches almost immediately (Table 8).

Table 8 Time lapse for emptying boat at full boat load

Time	Number of Respondents	Percentage (%)
30 minutes	2	11
1 hours	4	21
2 hours	7	37
3 hour	3	16
4 hours	1	5

5 hours	1	5
N/A	1	5
Total	19	100

Ways of losing some of the catch

Fish loss stems from a variety of ways including such events as accidents at the landing beaches, shortage of ice at sea, broken nets etc. The ingenious ways by which the losses are ameliorated include maintaining vigilance while approaching the landing beaches to berth their boats and canoes, making adequate budgetary allocations for pre-mix fuel and regularly maintaining their outboard engines (Figure 20). On the average these losses were not considered major issues as they rarely occurred.

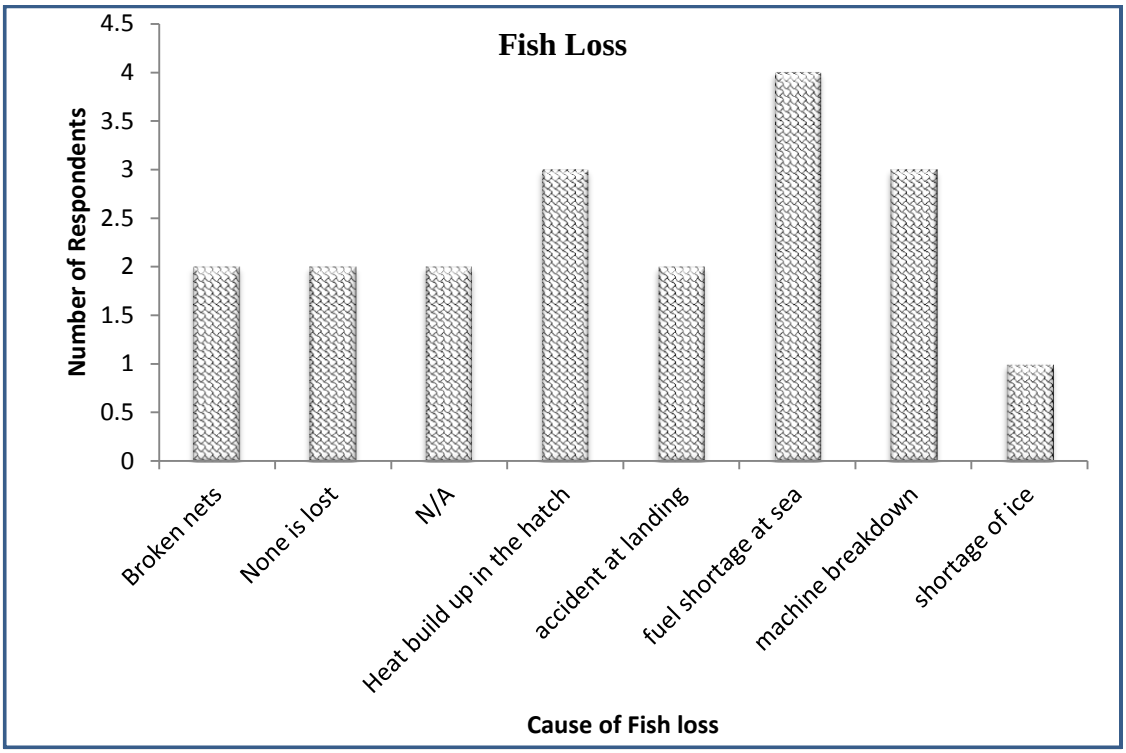

Figure 20 Causes of fish loss

Duration of fish when landed before it is sold

Offloading landed fish at the beach took between 30 minutes and one hour. 37% of respondents said they offloaded their boats immediately. 21% could not attach any time frame to the activity while 21% thought they took up to one hour (Figure 21).

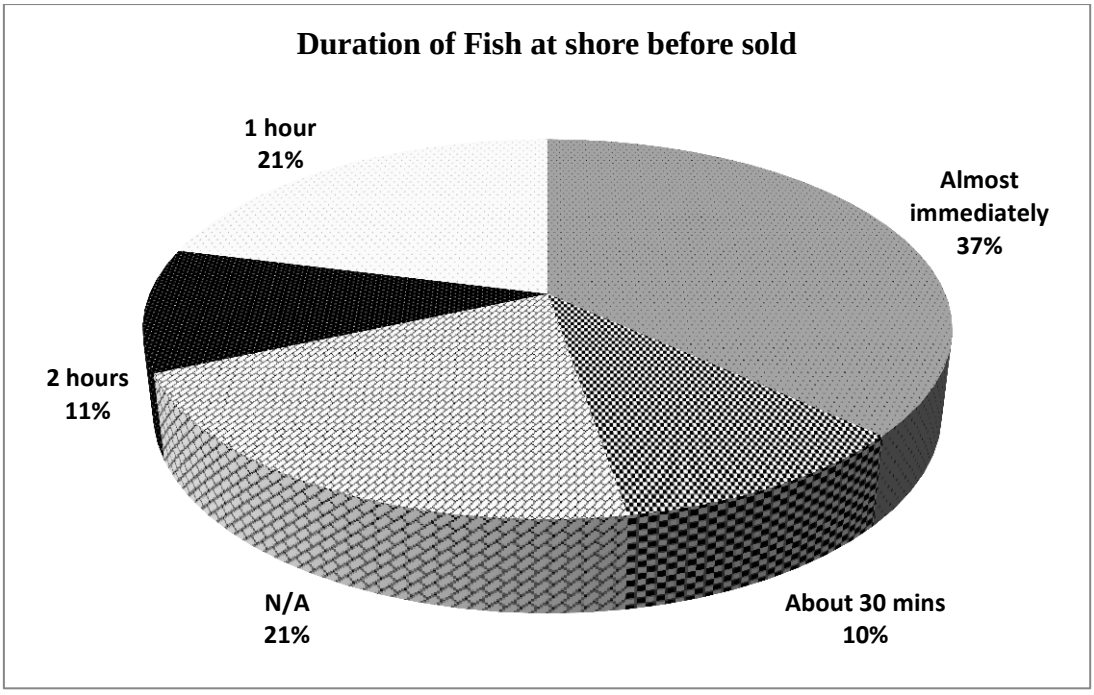

Figure 21 Time lapse for offloading landed fish at beach

Reduction of fish loss and incidence of spoilage by fishermen

Twenty six percent of respondents were of the view that fish loss was not an issue and therefore did not contribute to measures loss reduction measures. Another 26% thought that if they had extra pre-mix fuel on their fishing expeditions, losses could be minimized. 21% thought additional ice blocks could facilitate better fish preservation and minimize loss. Other suggestions made on possible reduction of fish loss included acquisition of new out board engines (5%); good maintenance schedule (5%) good landing sites (5%) and spreading catches evenly in the boat (5%) (Table 9)

Table 9 Ways of minimizing fish loss

Strategy of reducing fish loss	Number of Respondents	Percentage (%)
N/A	5	26
use more ice	4	21
good landing site	1	5
take extra fuel	5	26
new machine	1	5
evenly spread the fish	1	5

machine maintenance	1	5
Do not go far on sea	1	5
Total	19	100

Fish processing, trucking, and marketing

Types of fish processing activity

Fish smoking, salting/drying and frying are the three most important fish processing methods in the KEEA district and tend to assume near equal proportions ranging from 21% to 27% (Figure 22).

In terms of profitability on processed fish types, most respondents were not sure which of the major processing techniques yielded the highest profit margin. That aside, fish salting/drying and frying were seen as being a bit more profitable (Figure 23).

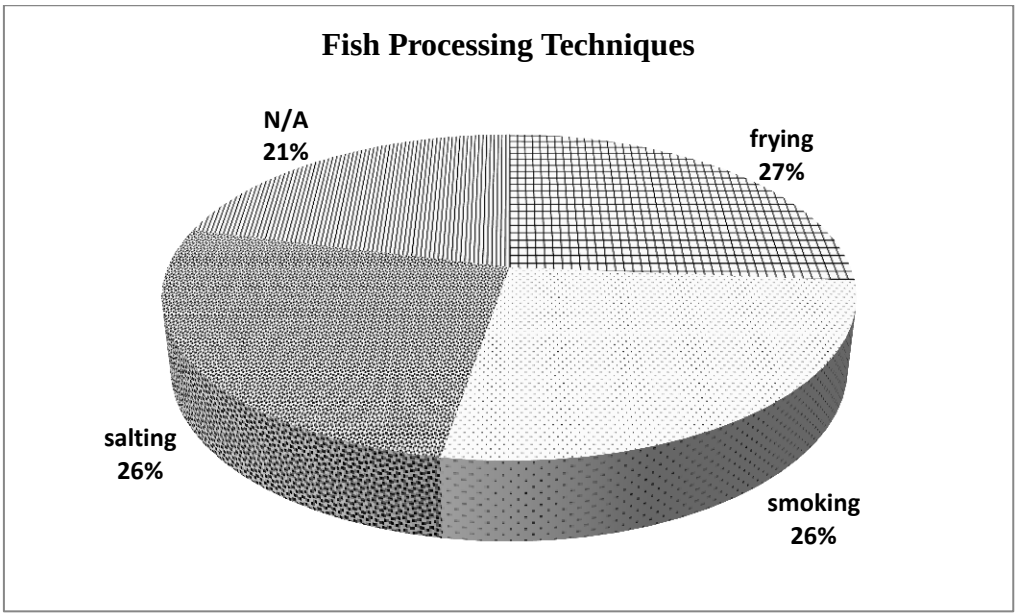

Figure 22 Fish processing techniques in KEEA

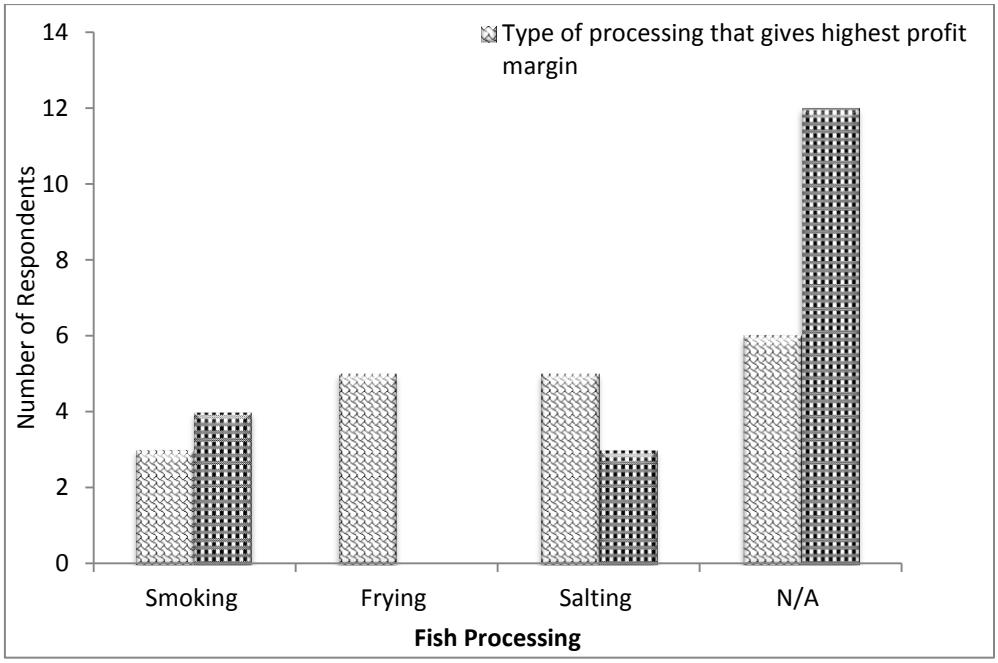

Figure 23 Profitability of differently processed fish

Processed fish loss

Dominant forms of fish loss were spoilage resulting from mainly defective processing (47%), breakages (21%) and discoloration (11%). Another 21% of respondents did not see fish loss in any significant way. The causes of the losses were attributed to theft, and a combination of theft and rain (Figure 24).

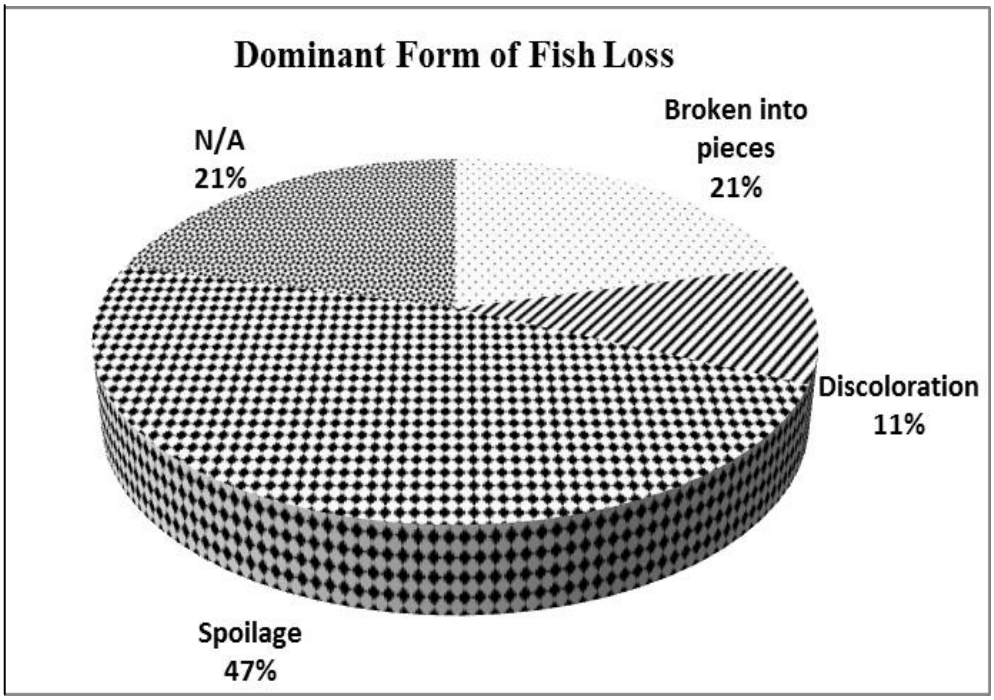

Figure 24 Type of processed fish loss at KEEA

Stages of fish loss

Majority of respondents (42%) were of the view that the losses occur duing the processing stages. 16% attributed the losses to packaging while 11% of them thought that the losses occurred through handling at the point of sale. Those who could not attribute losses to any particular event constituted 26% of the respondents (Table 10).

Table 10 Stages of fish loss

Stage of Fish Loss	Number of Respondents	Percentages (%)
Before processing	1	5
During processing	8	42
In packaging	3	16
At the point of sale / market	2	11
N/A	5	26
Total	**19**	**100**

Fish packaging, trucking, and marketing

Packaging

Baskets and sacks are the two most important containers used for packaging fish in the district. The additional precautions taken may include lining the baskets with paper and, or wrapping the basket with ropes and nets.

Major markets for fish are Agona Nkwanta, Kumasi, Bogoso, Prestea, Accra and Sefwi Bekwai. The fish is packaged in large, tagged aluminum pans and taken to the market in trucks. The transport cost is paid in cash or on credit.

If the fishmonger decides to go to the market, she stays in the market town till the fish is sold out. The fish can also be stored in the warehouse in an event of prolonged stay at the marketing destination. Fish mongers always buy or sell to or from their customers, as the case may be. When the quality of fish is not very good, they reduce the prices in order to always retain loyalty of their clientele. If the fish is delivered to the clientele unaccompanied, the purchased cash may be sent through mobile money transfer, other designated fish mongers or the delivering driver.

Trucking

The fish haulage drivers also play other important roles in the marketing besides hauling the products to the desired destinations. They recommended that packaging of fish to market be painstakingly done to minimize losses. According to them, the most dominant form of fish loss during transporting is breakages. Other recommendations from the haulage drivers

include advice on the need to have the fish designated for very far destinations to be well smoked and packaged well to avoid spoilage and losses.

Cost of transportation is always negotiated ahead of conveying the products. Agreed charges, based on the number of parcels may be paid upfront in cash or on pro rata basis. It could also be done on credit bases, although at such instances, the driver may request for money to fuel the vehicle.

Marketing

Marketing of fish begins at the beach with the Konkohemaa (legally authorized chief negotiator of prices at the landing beach). Thereafter the processors manage their own sales at designated fish marketing centers. Markets availed to processors include Praso, Agona, Fumso and Mankessim. Processed fish is usually sold at wholesale prices to customers. Processors exercise the option of staying on to market any unsold fish by retailing over several days or locking it up in safe storage and come back to it at a later time. They may also sell it at reduced prices or even on credit depending on their schedules of activities at home.

3.2.2 Gomoa West District – Apam

There are five landing beaches in the Gomoa West district. The current study covered all the five landing sites. They include the following: Apam main, Abra mpoano, Akoda ahenegwe, Alata mpuano and Nana apaaenim. Two major fishing vessels operating from this location are the canoes and the semi-industrial vessels. The industrial trawlers are not resident here but they support the illegal vibrant by-catch trade popularly known as ‘sycho’.

<u>Demographic Characteristics</u>

Age

The ages of the fishers span five decades (22 – 60 years) with the modal class in the 4th decade.

Education

Educational level of all practitioners is generally low along the values chain with majority of them being middle school leavers (40%) and 26% not having had any formal classroom education at all (Figure 25).

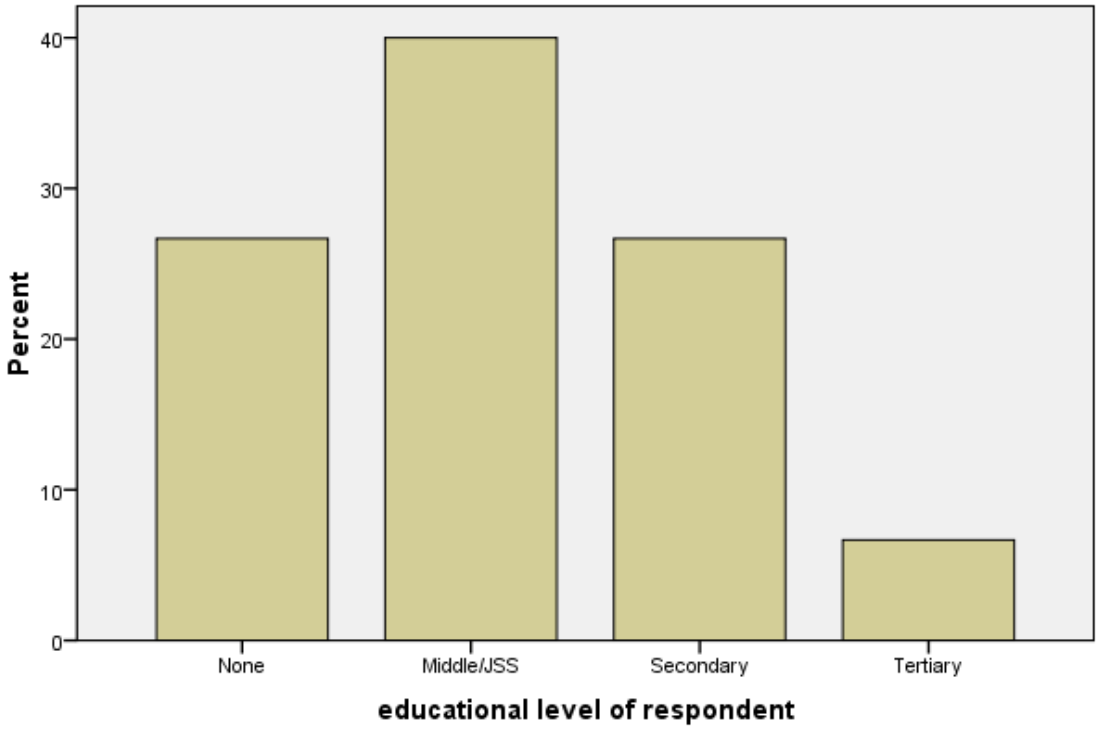

Figure 25 Educational level of respondents in Gomoa West District

Gear used to catch target fish

Seven main different fishing gears are employed in the fishery. Twenty percent of the fishers employ the hook and line with between 7% – 13 % using the other fishing methods of 'watsa', set nets etc. (Figure 26. 80% of the fishers use the same gears throughout the year.

Period of bumper fish harvest

The bumper harvest in Central region is variously stated as being from April to July; August to September; August to December and August but over 55% of the respondents held that the bumper harvest is in August (Figure 26).

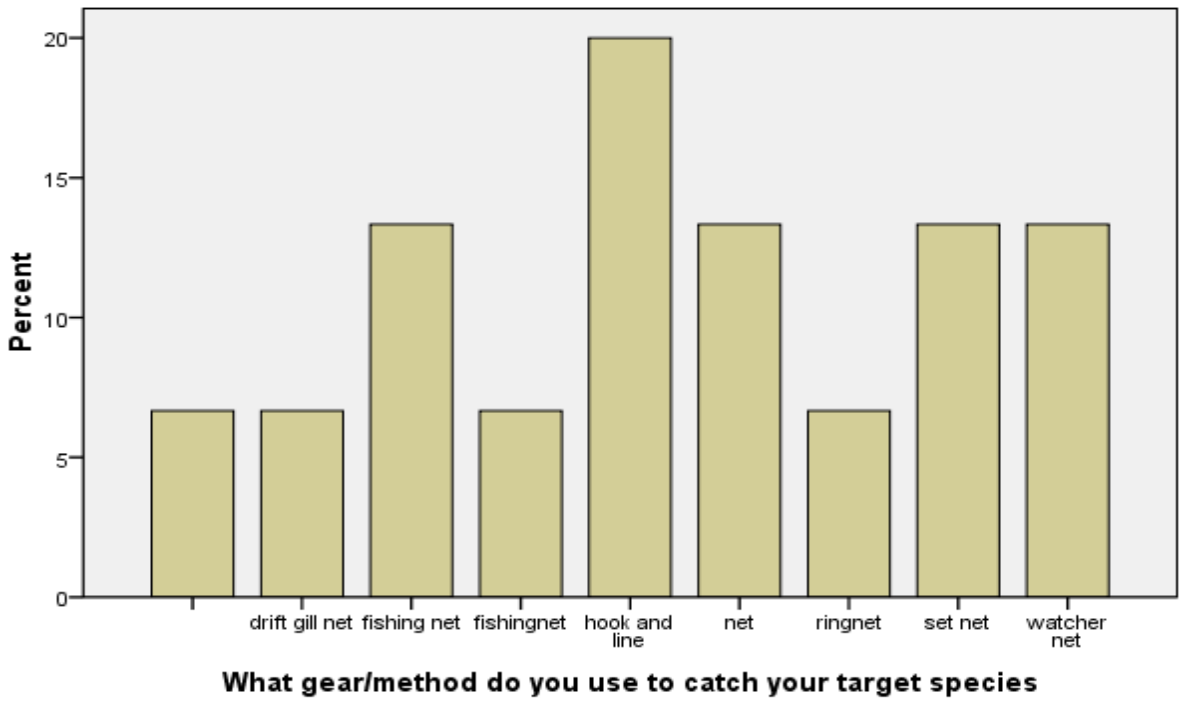

Figure 26 Fishing gear type used at Gomoa West District

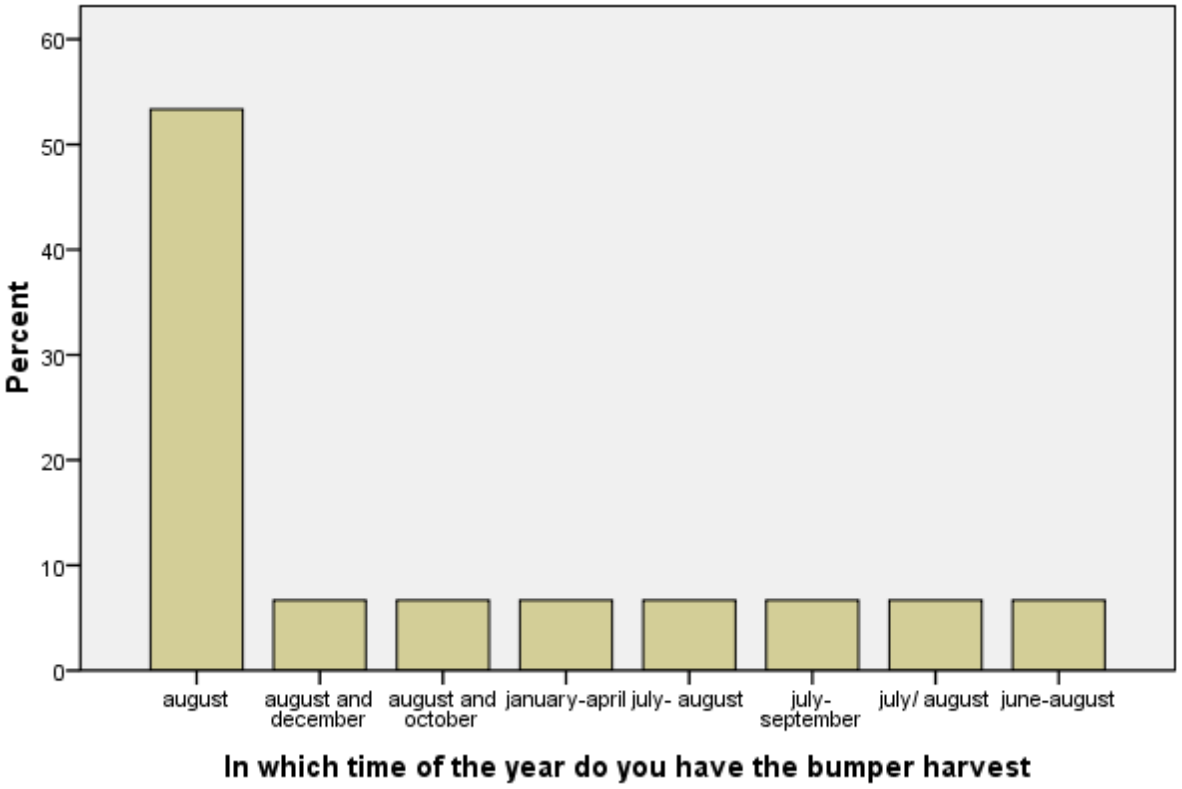

Figure 27 Period of bumper harvest in Gomoa West District

Duration at sea and fish preservation time

Majority of fishermen (60%) stayed at sea for one day. This category of fishers had no need for ice usage. 13% of respondents stayed for 5 days. Only 7% of them used iced throughout

the period. 60% of respondents had no use of ice for fish preservation at sea. Maximum ice usage was by those who stayed at sea for four days. Those doing a day's fishing trip had no need for ice (Table 11).

In addition to the normal fishing practices in the Gomoa district, some canoes do daily trips to offshore locations to procure juvenile fish by-catch, known locally as 'Syco fishing' and land them at the various landing beaches, especially at the Apam main landing beach. This fish comes frozen from the blast freezers of the industrial trawlers.

Table 11 Fishermen duration at sea ad fish preservation whilst at sea

	Duration on sea		Maximum fish preservation time on sea	
Time	**No. of Responses**	***Percentages (%)***	**No. of Responses**	***Percentages (%)***
1 day	9	*60*	-	-
2 days	2	*13*	1	*7*
3 days	1	*7*	1	*6*
4 days	1	*7*	3	*20*
5 days	2	*13*	1	*7*
N/A	-	-	9	*60*
Totals	**15**	***100***	**15**	***100***

Duration of fish at landing beaches

Landed fish is sold fairly rapidly and happens within 30 minutes. The actual time it takes to dispose of all the fish is however a function of the quantum of fish landed (Figure 28).

Ways of losing the catch

The major ways by which fish is lost at sea is through theft, according to the majority of the respondents. Other ways of fish loss are through loss of net at sea and broken nets. To others, there are no losses incurred and therefore this does not appear to be a problem (Figure 29).

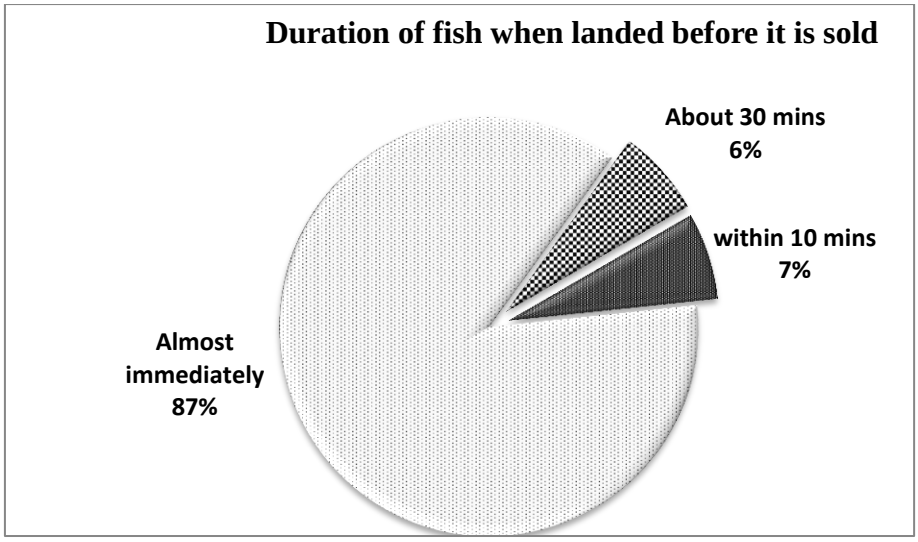

Figure 28 Time lapse between landing fish ad selling out at landing beaches

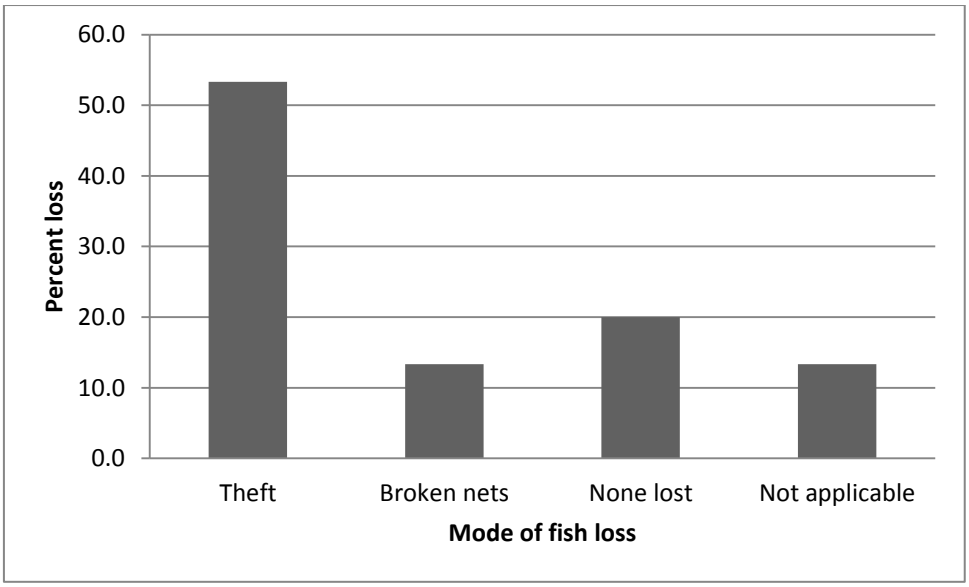

Figure 29 Ways of fish loss at sea

Processing, packaging, haulage, and marketing

Processing

In principles, no fish gets discarded because it is going bad. The processors are able to gauge the extent of deterioration and apply the appropriate processing method to it to make it utilizable. There are three major processing methods currently in vogue in Central region. These are respectively, smoking, salting/drying and frying. Other minor methods include simmering and roasting. The latter two are, however, reserved for domestic usage as the life span is relatively very short.

In the order of preference, fish smoking as processing and preservation method takes the center-stage with about 60% of all fishes are able to be processed. Salting and frying follows in the order of importance at 33% and 7% respectively (Figure 30). The main reason adduced

for choice of fish smoking is on the account of salability. Profitability is a good consideration but majority of the practitioners prefer to keep a steady flow of business, hence the choice of smoking as a fish processing techniques over the other methods. This is followed closely by consideration of longevity in storage which the smoked fish provides. While salting/sun-drying is a specialty for some fish processors, for others, the technique becomes important when fish begins to show signs of deterioration.

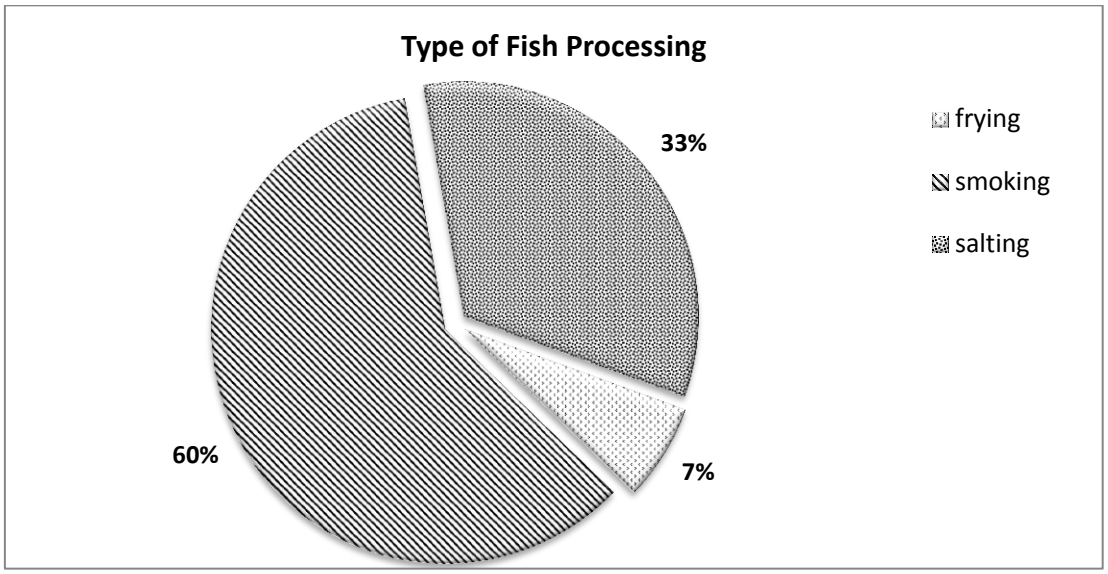

Figure 30 Fish processing types and their relative importance

Packaging

Packaging forms a very important component of the profitability of the processed fish sales. Thus the practitioners take extra care to package the fish which could be readility hauled to the marketing centers or stored for a while; all in an effort to preserve the intergrity of the fish and make it attractive to buyers. In the Gomoa West district, packaging of processed fish is done in baskets and in enemel bowls. These are usually lined with brown paper and the smoked fish painskakingly lined in a manner that allows no room for movement of the fish in the packaging vessel thereby minimizing breakages (Plate 3).

Plate 3 Packaged fish for haulage to commercial centers

Fish processing and loss analysis

By far smoked fish gives the highest profit margin in the fish processing and marketing chain. It must be noted, though, that the profitability as noted elsewhere is as a result of how fast it sells rather than cost per unit volume. In the same way, the processing method that results in maximum losses is the smoking but the economics still favors smoking as the choice processing method. Salting and drying is also profitable but its salability is not as much as that of the smoked fish. Losses incurred in the course of processing salting / drying fish are second to smoking (Figure 14).

The fish processors list ten causes that can lead to processed fish loss. Fish breaking up into pieces is believed to be the largest contributing factor to processed fish loss and accounts for 30%. Poor salting results in fish loss for the momoni processors while fish getting burnt and theft by domestic animals are other contributing factors (Table 12).

Table 12 Causes of processed fish loss in STMA / Shama District

Reason for general loss in processed fish	Counts	Percent
fish gets burnt	3	10
fish breaks in pieces	9	30
fish stored for long	2	7
poor salting	5	16
bad loading in vehicles	2	7

delay in delivery / vehicle accident	1	3
fish keeps long before processing	3	10
not stored well	1	3
theft by humans	2	7
theft by domestic animals	2	7
Total	**30**	**100**

Haulage and Marketing

Marketing of fish follows both market trends and traditions of established market links in commercial centers. Markets trends are used especially during periods of bumper harvests when marketing of processed fish is generally slowed down. The strategy at this point is to hold onto processed fish in storage but when the economics do not favor the locking up of capital for a long time, the processors look for where they can best sell their fish products. In this case, the processors move to the markets and attempt whole sale of products or retail, as the case may be. Losses may be incurred at this stage so the strategy will be to sell to break even.

In normal times, marketing of processed fish follows the traditions established by fore practitioners where the markets are established between families and known buyers, known as customers. Such customers are always on course to receive supplies from the fish mongers directly or through their designated agents like drivers, porters (kaya) or co-processors. The whole exercise is based on trust and fish loss at his stage is estimated to range from low to negligible; exceptions being through incidences of motor accidents and loss through improper loading unto the vehicles. Losses incurred through this window are either borne wholly by the driver at a negotiated cost and payment schedule or at a shared cost with the driver taking between 60-70% of the agreed cost.

Cost of lifting packaged processed fish from the production centers to the marketing centers is a function of distance and may range from GHc 3.0 to GHc 7.0 per package of at least two baskets tied together or an enamel bowl packed to at least two times the normal height.

3.3 Greater Accra Region

The SNV post-harvest loss study in the Greater Accra region covered 10 landing beaches in five out of the eight coastal districts. The intention was to cover the entire fishing areas in Accra and the Tema areas. The location of landing beaches in the Districts is presented in Table 13.

Table 13 Location of landing beaches

Region	District	Landing Beach
Greater Accra Region	Ningo/Pampram	Pampram
		Ningo

		Ahwiam
		Nmetsokope
		Kponkpo
	Kpone Katamanso	Kpone
	Tema Metro	Tema Fishing harbor
	Accra metro	Chorkor
	Ga South	Bortianor

3.3.1 Team Metro, Accra Metro, and Ga South District

Demographic Characteristics

Age

The ages of fishermen, fish mongers and processed fish haulage drivers in three districts of Greater Accra region; Tema metropolitan area, Ga Central and Ga South districts spans 5 decades in the age groups of 20 to 59 years. Among the fishermen, the age group of 40 to 49 years dominates at 63%. This is followed jointly by the age groups of 50-59 years and 30-39 years at 16.5%. Among the fish processors, the younger age group of 30 – 39 years dominates at 54% and it is followed by the age group of 50 – 59 years of the respondents sampled. All the drivers fall within the age group of 20-49 years and with those in the age group of 30 -39 years forming as much as 60%.

Table 14 Age profile of fishermen, fish mongers and drivers

	Fishermen		Fishmongers / Buyers		Drivers of Vehicles	
Age	No. of Respons es	Percent (%)	No. of Respons es	Percent (%)	No. of Respons es	Percent (%)
20 – 29 years	1	4	1	4	1	20
30 - 39 years	4	17	13	54	3	60
40 - 49 years	15	63	4	17	1	20
50 -59 years	4	16	5	21		

Above 60 years			1	4		
Totals	24	100	24	100	5	100

Gender

Fishing activities are wholly executed by males while fish mongering is undertaken wholly by females. The drivers are also all males.

Education

The fisheries practitioners are fairly well educated in the Greater Accra region as 33% of fishermen possess tertiary degree qualifications. 25% of the respondents possess secondary education while 33% of them have middle school/JSS standard of education. Among the fish mongers, as much as 71% have attained the Middle school/JSS level of education. 60% of the drivers also have Middle school/JSS standard of education. Those with no formal class room educational qualifications among the fishermen, fish mongers and the drivers are respectively 5%, 21% and 20%.

Table 15 Educational level of respondents

	Fishermen		Fishmongers / Buyers		Drivers of Vehicles	
Educ.	No. of Response	*Percent (%)*	No. of Response	*Percent (%)*	No. of Response	*Percent (%)*
None	1	*5*	5	*21*	1	*20*
Middle/JSS	8	*33*	17	*71*	3	*60*
Secondary	6	*25*	2	*8*	1	*20*
Tertiary	8	*33*				
N/A	1	*4*				
Totals	24	*100*	24	*100*	5	*100*

Months of bumper harvest and high fish transport

Fishing takes place at all times of the year. However, July-August is perceived by most fishermen to be the bumper harvest. Others list August - December and July - September as the most productive periods in the fisheries. The period that marks greatest haulage of processed fish to other parts of the country is given as July – December. Correspondingly, fishermen record most fish sales in August and September (Figure 31).

Method of fish preservation at sea

In the Greater Accra region, as much as 42% of the fishers employ the use of freezers and other coolers mounted in their vessels to preserve their catches prior to marketing. 37% of them use ice blocks while only 21% of them do not use any form of preservation of fish at sea.

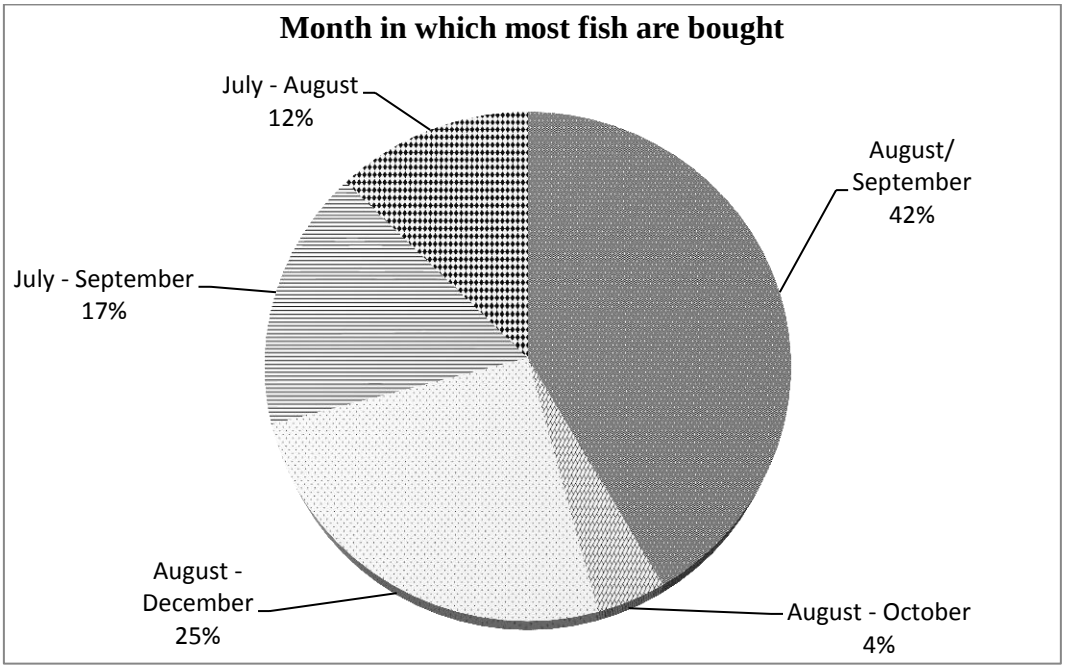

Figure 31 Months in which most fish is marketed

Table 16 Preservation of fish at sea

Preservatives	Number of Respondents	Percentage (%)
Ice Blocks	9	37
No Preservation	5	21
Freezer or coolers in Vessels	10	42
Total	**24**	**100**

Fishermen duration at sea and fish preservation time lag whilst at sea

Fishermen operating in the Accra and Tema metropolis spend comparatively longer periods of time at sea. On the average, between 12 hours and two months are spent on sea fishing, according to the survey (Table 17).

The time spent at sea also has cost implications on the preservation of fish. While monetary terms cannot be applied to the cost incurred in fish preservation at sea, the view of most of the respondents is that maintaining freezers at sea present highest cost in fish preservation. This is followed by transport and use of ice blocks at sea. 24% of the respondents did not need to preserve their catches and therefore incur no cost on fish preservation (Table 6).

Table 17 Duration of stay at sea and fish preservation time

	Duration on sea		Maximum fish preservation time on sea	
Time	**No. of Responses**	***Percentages (%)***	**No. of Responses**	***Percentages (%)***
12 hours	5	*21*	1	*4*
1 day	5	*21*	4	*17*
2 days	1	*4*	2	*8*
3 days	3	*12*	3	*12*
1 Months	1	*4*		
2 Months	9	*38*	8	*33*
N/A			3	*12*
As long I stay at sea			3	*12*
Totals	**24**	***100***	**24**	***100***

Table 18 Relative cost of preserving fish at sea

Preservatives	Number of Respondents	Percentage (%)
Ice Blocks	7	29

Freezer	11	46
N/A	6	25
Total	**24**	**100**

Duration of fish at landing beach before it is sold

The time spent at landing beach or the fishing harbor before fish is sold out ranges from 30 minutes for the small canoes to two hours for the large industrial vessels. 71% of respondents spend about 1 hour 30 minutes (Table 19).

Table 19 Time lapse between landing fish and selling out

Time	Number of Respondents	Percentage (%)
30 mins	3	13
1 hour	2	8
1 hour 30mins	17	71
2 hours	2	8
Total	**24**	**100**

Fish species landed and sold at bumper harvest

Many species of fish are landed during the bumper harvest in the Accra/Tema metropolis. The major species landed include the sardines: *Sardinella eba* (flat sardines) locally called Antebo; Sardinella *aurita* (round sardines) locally called Kankama; the mackerels: Scomber japonicas (chub mackerel) called locally as Saman; the tunas: *Thunnus albacore* (yellow fin tuna) also called Odaa in Ga and the African moon fish: *Selene dorsalis*; called Antele wawaa in Ga. All the seven major fish species are found in landings from July to September. The anchovies are perceived as the most profitable of the fish catches. This is followed by the mackerels, and tunas in that order (Figure 32).

Fish losses occur in the fishing operations through a variety of ways. These include attack on net by sharks and dolphins, broken nets, thefts, malfunctioning freezers and strong currents at sea. Local knowledge to addressing the issues related to the fish loss include adoption of more stringent security measures, use of stronger nets and making effort at keeping the freezers in good state of repair at all times.

Ways of losing catch at sea

While loss of fish was not perceived as a major problem at sea, dolphin and shark attacks were recorded as the main cause of fish loss. Broken nets and theft followed at the same level. Current was also thought to be a factor leading to loss of fish at sea (Figure 33).

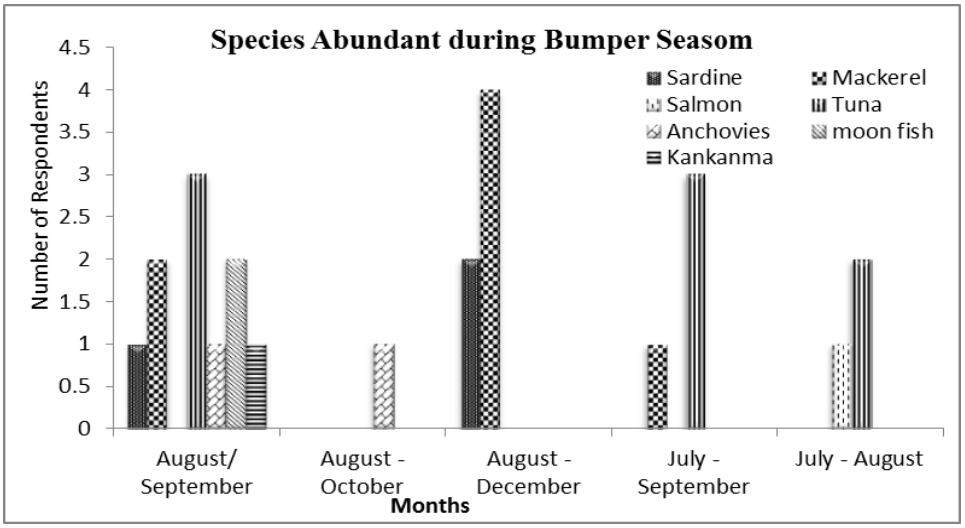

Figure 32 Major fish landings during the bumper harvest

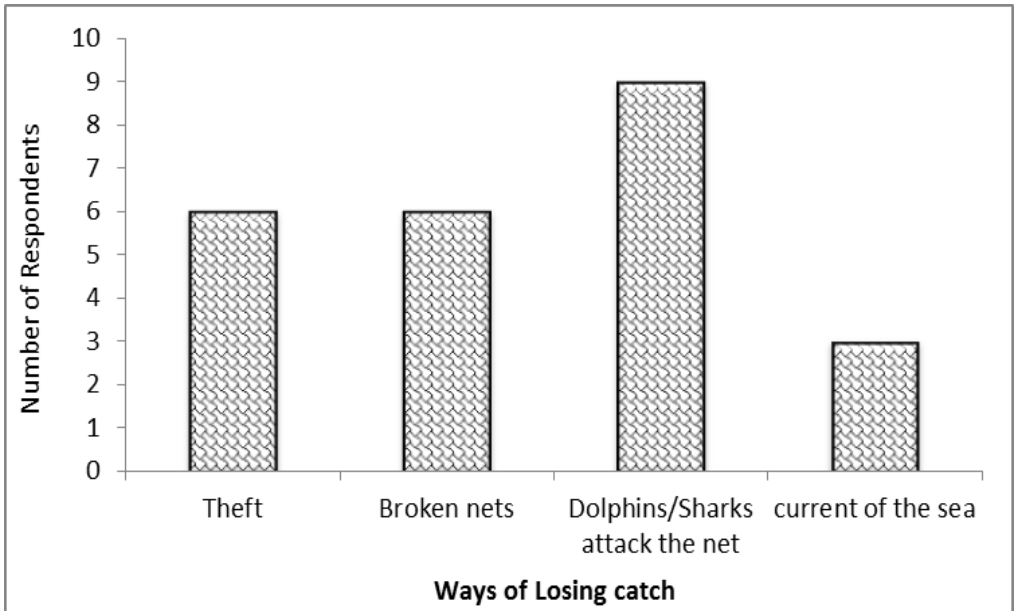

Figure 33 Causes of fish loss at sea

Reduction of fish loss and incidence of spoilage by fishermen

Majority of the fishermen (29%) were of the opinion that losses at sea could be eliminated or reduced substantially if they could keep their freezers in a state of repair at all times. Equal numbers of fishers thought that the use of stronger nets could thwart the attacking efforts of the sharks and dolphins and keep their fishes safe. Use of more ice at sea was also cited among others (Table 20).

Table 20 Reduction of fish loss and incidence of spoilage by fishermen

Strategy	Number of Respondents	Percent (%)
good security against theft	1	4
use more ice	6	25
Good observation and stronger nets	3	13
freezer working all times	7	29
use of stronger net	7	29
Total	**14**	**100**

Fish Processing

All the fish processors interviewed in the Accra / Tema metropolis were fish smokers. Some of them have salting / drying capabilities but they do not consider themselves as 'momoni' processors. Reasons given for choosing fish smoking over the other processing techniques include considerations of profitability and customer preference (Table 9).

Fish species difficult to process

While almost any type of fish landed may be smoked, the view held by the processors is that the tuna are very difficult to process due to such reasons as it being too oily or too fleshy. In the order of ranking, the tunas, anchovies and the African moon fish are respectively most difficult fishes to process while the sardines and the mackerels are the easiest to smoke (Table 21).

Table 21 Reason for preferred fish processing technique

Reasons	Number of Respondents	Percentages (%)
Sells faster	3	13
Easier to process	1	4
Customer's Preference	5	21
Profitable	14	58
Used to this method	1	4
Total	24	100

Table 22 Fish species difficult to process

Local Name of Fish Species	Number of Respondents	Percentages (%)
Tuna	11	46
Sardine	2	8
Mackerel	3	13
Anchovies	4	17
Moon fish	4	17
Total	24	100

Fish processing techniques with highest profit margins and losses

Ostensibly because fish smoking has been the processing techniques being practiced in these areas, the mastery of best practices seems to have been acquired and consequently high profitability assured. Compare to the other fish processing techniques, the respondents believe that fish smoking gives the best returns on their investments. Notwithstanding, 84% of them also believed that fish smoking elicits the highest losses during processing (Table 23).

Table 23 Fish processing techniques which result in losses

Processing Technique	Number of Respondents	Percentages (%)
Smoking	20	84
Freezing	1	4
Frying	1	4
Drying	2	8
Total	24	100

Dominant stage of fish loss

Fish losses do occur through such ways as theft at landing beaches, burning during smoking, in packaging, in storage or during transportation. The general view expressed is that the mode of loss encountered is largely a function of the expertise level of the fish monger. However, because the methodology used to catch the fish has some inference on the post-harvest life of the fish, the quality of the fish manifests during the smoking period and consequently during packaging and at the point of sale in that order (Table 24). Generally, the losses incurred at the processing stage results from burning and breaking during smoking. The consequence of this is that it cannot keep for too long before it begins to show signs of spoilage, discoloration and general deterioration in form and quality (Table 25).

Table 24 Stages of fish loss

Stage of fish loss	Number of Respondents	Percentages (%)
At the landing site	3	13
Before processing	2	8
During processing	8	33
In storage	2	8
In packaging	4	17
In transport	2	8
At the point of sale / market	3	13
Total	24	100

Table 25 Dominant form of fish loss

Form of fish loss	Number of Respondents	Percentages (%)
Broken into pieces	4	17
Discoloration	8	33
Spoilage	11	46
N/A	1	4
Total	24	100

Packaging, haulage and marketing

Packaging

The overwhelming majority of fish smoking processors (88%) employ the use of brown paper-lined baskets in packaging. Very few of the fish mongers will package the fish directly in the basket; usually in smaller baskets (Table 26).

Haulage

Road trucking of processed fish employs two sets of vehicles; the medium size 3-tonner KIA trucks and the huge 5-tonner trucks, depending on the distance, quantum of the load and whether the packages are in smaller baskets or in large baskets.

Marketing

Marketing centers are many but the bulk of the products are marketed locally with the Accra/Tema metropolis, including Ashiama, capturing as much as 38% of the market. 25% of the fishmongers market their produce in Techiman. Other marketing centers include Sunyani, Kumasi, Takoradi, Kasse, Mamprobi and Denu (Figure 34). Significantly, the haulage trucks that convey the processed fish to the marketing centers come back with new baskets.

Table 26 Types of packaging techniques

Fish Packaging	Number of Respondents	Percentages (%)
In basket	1	4
Basket covered with paper	21	88
In basket and sacks	1	4
In basket with net wrapped around	1	4
Total	14	100

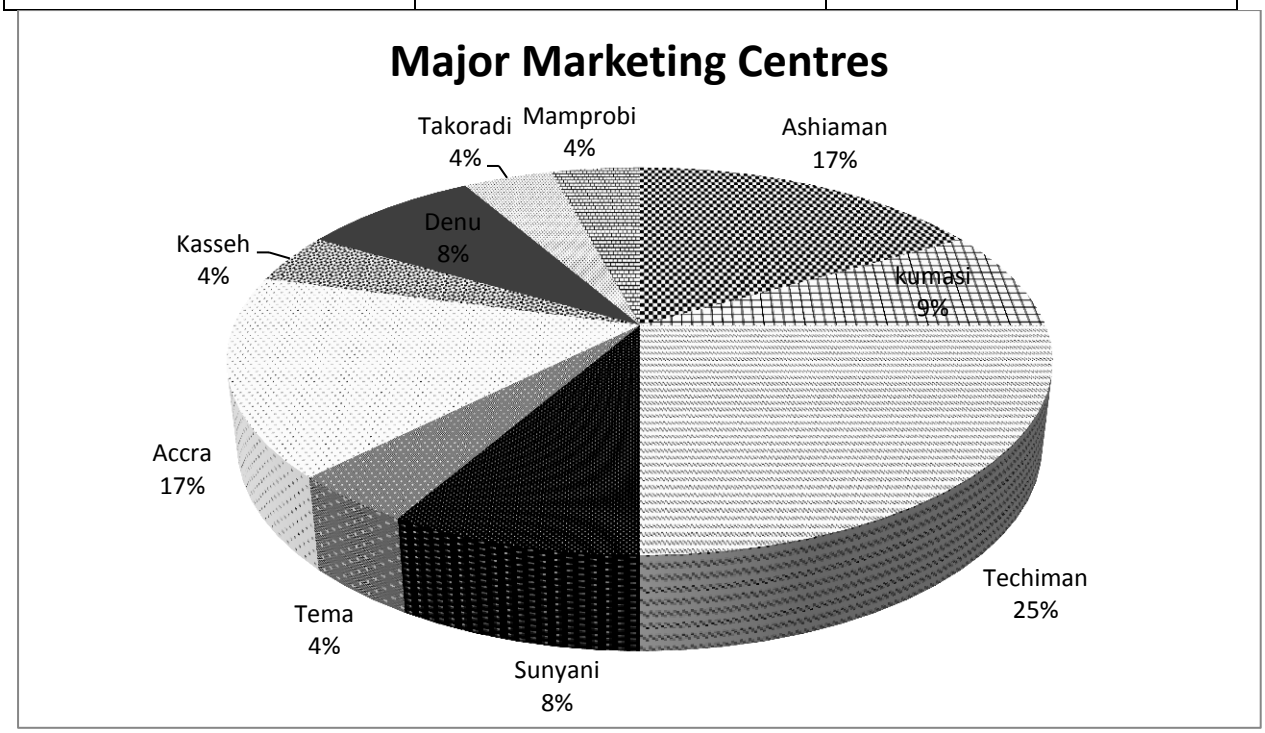

Figure 34 Major market destinations

3.3.2 Kpone / Katamanso District

One landing beach was studied in the Kpone / Katamanso District. The rationale was to cover as many districts to be able to learn of disparities, if any, of the mode of operations and to access how the fishing practices are faring there. Two fishermen and two fish mongers were interviewed from the Kpone-on- sea landing beach.

Demographic Characteristics

Gender

All the fishermen boat/canoe owners in this district were males while the fish processors and the mongers were women.

Age

The ages of the all the respondents ranged from 32 years to 45 years.

Education

Educational level was low for all the fishermen with highest classroom educational qualification not exceeding the Middle school level.

Time spend at sea depends on the type of vessel used. The local canoes spend between six hours and one day. In extreme cases, they may spend up to two days. Ice is carried along to preserve fish whenever they intend to stay overnight.

The period of highest fish landings was given as July to September and July to December. The major type of fish landed during this period is kankama, antebo, saman, tuna, mackerel and African moonfish. It takes not more than two hours to evacuate the catches and sell off the fish in normal times. During the bumper harvest the time may be prolonged but no fish is discarded as having gone bad.

Processing Haulage and Marketing

Fish smoking is the main fish processing practice in this community. All kinds of fishes are smoked but the commonest among them are the mackerels, anchovies, sardines, African moonfish, doctor fish and sole.

Fish salting / drying is the second most important fish processing practice. As a matter of principles in the business, no fish is considered wasted. Any ones showing signs of early deterioration is quickly salted and processed into ‘momoi’.

Designated marketing centers for the fish processors in this community are Techiman, Takoradi, Kumasi and Denu. Fish haulage is by small and large trucks. The packaging is done in big baskets and sometimes aluminum bowls. They are securely covered with brown paper and tied up.

The women may or may not accompany the processed fish to the marketing centers. When fish has to be transported without the processors, the latter follow up later or drivers are instructed to deliver them to their ‘buyers, usually called ‘customers’. There are usually no losses in the transportation and handling at the delivery centers.

3.3.3 Ningo/Pampram District

The survey in the Ningo/Pampram covered the landing beaches in Lower Prampram, Ningo, Ahwiam, Kponkpo and Nmetsokope. 20 people comprising of ten fishermen, five processors and fiver fish haulage drivers were interviewed in this community.

Demographic Characteristics

Age

The ages of respondents ranged from 25 years to 68 years. The female processors were comparatively older than the male fishing group. The drivers were all in the age group of 30-40 years.

Education

Educational level of respondents was mixed with about 30% of them having no formal classroom education. Majority of them were Middle school leavers.

Fishing practices

The three methods of fishing using ring nets, lift nets, and hook and line are the commonest practices in the district. About 80% of fishermen in the community use motorized canoes to ply their trade. Time spend at sea varies from six hours to four days but the vast majority of them spend between six to 14 hours.. For those staying at sea for prolonged period, ice blocks are carried along for the purpose of preserving their catches.

Period of maximum fish catch

The period of maximum fish catch spans the period of August to December. Major fish species caught during this period are the sardinella anchovies, mackerel, tuna, barracuda and the dentex (red fish). Fishing is carried out on daily basis and for the smaller landing beaches no ice is carried along. Tuesdays are however considered as taboo days where no fishing is done.

Fish evacuation from canoes and follow-up sales usually last for 30 minutes to one hour but may be extended to two hours in periods of high catches.

According to the respondents, to a large extent, no fish losses occur at the landing beaches during the period of discharge and sales. Notwithstanding some pilfering may take place on very small scale but as if by some convention, most fishermen turn blind eye on the behavior.

They have not received any training so they have no method of preserving the species when they are at sea. The fish mongers also buy the fish and smoke immediately because it is profitable compared to any other processing type. After smoking, the fishes are covered with brown paper and kept in a basket for storage.

The fish mongers buy all the fish that is landed at the beach. Some element of losses does occur through pilfering perpetuated by the large number of people usually found around the beach working as porters or looking for some chores to perform for a fee in cash or in kind.

<u>Processing, Haulage and Marketing</u>

Processing

Fish species such as anchovies, tuna, mackerel, flat sardines, round sardines are mostly smoked in these communities. The deep bodied fish like the croakers and shads as well as all fish showing signs of deterioration are procured and processed into ‘momoi’.

Some losses do occur during the processing. For the fish smokers, losses are largely due to unregulated heating which is traced to the type of fuel wood used. The processors are also of the view that the catching method has some influence of the quality of the final smoked fish product. For the processors who undertake salting/drying processing, losses occur through activities of such domestic animals like pigs, dogs and cats.

The main avenue for combatting these losses, according to the focus groups like the leadership of the various associations, is for their members to be more vigilant.

Haulage

The mode of transport of the processed fish is mainly by large trucks where a group of fish mongers come together to hire to convey their wares to their desired destinations. Medium-size trucks may be used for non-long- distance hauls (Figure 6). The major marketing centers are Techiman, Ada, Denu and Accra. The fish mongers do not often accompany the trucks carrying the fish; instead they make arrangements to go to the markets by other means to collect their wares. The salting/drying processors never accompany the ‘momoi’ haulage trucks.

Indirect sources of fish loss

Two major issues that introduce some indirect losses in the fishing business are: use of light in fishing; activities of industrial trawlers. Whole nets can be swept away in the trawl nets

whenever thy come inshore to fish the pelagics which is forbidden for them to do. In the case of the light fishing, it is believed that the lighting cause the fish to aggregate around those areas where lights are being used thereby denying them access to fish. This is in addition to biologically destroying the fishery by attracting the non-target juvenile fishes and killing them.

3.4 Volta Region

The main fishing practice in the Volta region is the beach seine. While this fishing technique is officially outlawed in the country because its tendency to sweep out juvenile fishes from large areas of the near shore, its application is very widespread and has become synonymous with the presence of one particular ethnic community.

As traditional regulatory and conservation measure, Volta region has instituted taboo days for all the landing beaches. Three days, Sunday, Tuesday and Wednesdays are variously observed by the landing beaches in the Keta district while South Tongu district observe mixed days of the week.

The study covered fourteen out of twenty five landing beaches in the two coastal districts of the Volta region. Eight beaches were studied in the Keta district while five were selected from the Ketu South district. Details of the landing beaches in the respective districts of Keta and Ketu South districts are presented in Table 27.

Table 27 Fish landing beaches in Keta Metro and Ketu South District

Region	District	Major fishing towns	Landing beaches	Taboo days
Volta	Keta	Abutia		
			Abutiakope	Wednesday

		Adzido	Adzido	Wednesday
		Dzekukofe	Dzekukofe	Wednesday
			Kedzi	Sunday
			Kedzikofe	Wednesday
		Tegbi	Tegbi	Sunday
		Tetekope	Tetekope	Sunday
		Vodzah	Vodzah	Sunday
	Ketu South	Denu	Adafianu	Wednesday
			Denu	Nil
			Hedzranawo	Sunday
			Viefe	Sunday
		Aflao	Atorkukope	Friday

3.4.1 Keta District

Demographic Characteristics

Age

The ages of the fishermen interviewed fell within 30 and 59 years with the modal class in the 40 – 49 year group. Similarly, the ages of the divers were in the range of 30 – 59 years. 36% of them were in the age group of 40 – 49 years. While the ages of the fishmongers also in the range of 30 – 59 years, majority of them (36%) were in the age group of 50- 59 years (Table 28).

Gender

All the fishermen and the drives were males. On the other hand, it was observed that some males were also into fish processing.

Education

The educational level of the fisheries practitioners are general low. 64% of the fish mongers had no formal classroom education. While 22% have only middle school level education. With the fishermen, only one person (7%) had secondary education. The remaining had only middle school qualification (Table 28).

Table 28 Age distribution of respondents

	Fishermen		Fishmongers / Buyers		Drivers of Vehicles	
Age	No. of Responses	*Percent (%)*	No. of Responses	*Percent (%)*	No. of Responses	*Percent (%)*
30 - 39 years	4	*29*	3	*21*	2	*14*
40 - 49 years	7	*50*	4	*29*	5	*36*
50 -59 years	3	*21*	5	*36*	3	*21*
N/A	-	-	2	*14*	4	*29*
Totals	14	*100*	14	*100*	14	*100*

Table 29 Educational level of respondents

	Fishermen		Fishmongers / Buyers		Drivers of Vehicles	
Educ.	**No. of Response**	***Percent (%)***	**No. of Response**	***Percent (%)***	**No. of Response**	***Percent (%)***
None	-	-	9	*64*	-	-
Middle/JSS	13	*93*	3	*22*	8	*57*
Secondary	1	*7*	-	-	2	*14*
N/A			2	*14*	4	*29*
Totals	**14**	***100***	**14**	***100***	**14**	***100***

Months of bumper harvest and high fish transport

In normal years, the periods of highest fish catch occurred in June and July and from September and October. The corresponding period of highest fish transport is in August to October. The month of highest fish marketing was recorded as June and July (Figure 35).

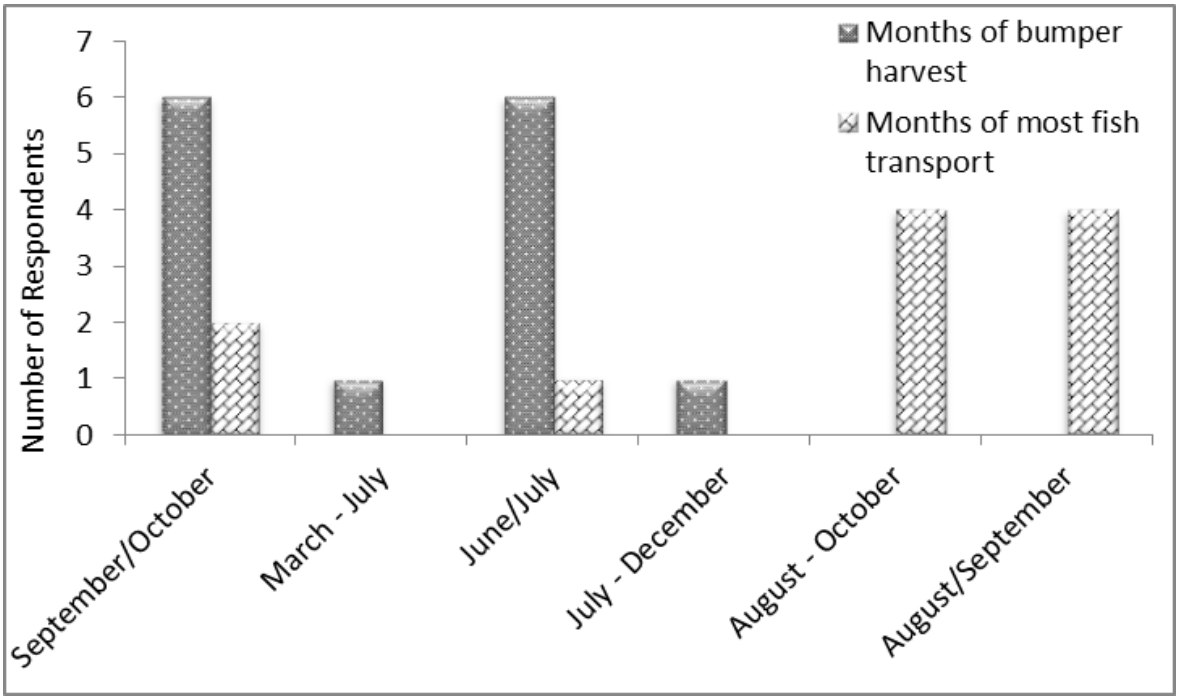

Figure 35 Period of bumper harvest and most fish transport

Method of fish preservation when at sea

Essentially because of the type of fishing practices prevailing in the Volta region requirement for ice as a fish preservative is very low. 93% of respondents did not require ice at ice. Only 7% claimed to have need for use ice at sea. Even at that the total duration of stay at sea did not exceed three hours in all instances. 50% stayed at sea on any fishing day for not more than 6 hours (Table 30).

When the fish had landed at the beach, 86% of respondents said they disposed of all their catches within one hour. The remaining 14% disposed of all catches within two hours (Table 31).

Table 30 Fishermen duration at sea and fish preservation at sea

	Duration on sea		Maximum fish preservation time on sea	
Time	**No. of Responses**	***Percentages (%)***	**No. of Responses**	***Percentages (%)***
12 hours	1	*7.1*		
6 hours	7	*50*		
9 hours	2	*14.3*		

4 hours	2	*14.3*		
3 hours	2	*14.3*	1	*7*
N/A			13	*93*
Totals	**14**	***100***	**14**	***100***

Table 31 Duration of fish when landed before it is sold

Time	Number of Respondents	Percentage (%)
1 hour	12	86
2 hours	2	14
Total	**14**	**100**

Bumper harvest

The period of maximum harvest is in June-July and September-October. During this period, the commonest fishes in fish landings are the anchovies, Engraulis encrasicolus (abobi) and the chuck mackerels, *Scomba japonicas* (Ablotsikpokpokuvi). Other minor catches include the pink shrimp, *Penaeus notialis* (bolu) and the big eye scad *Selar Crumephchthalmus* (Tsiyi). These fish species form the major fishery in this area during the period (Figure 36).

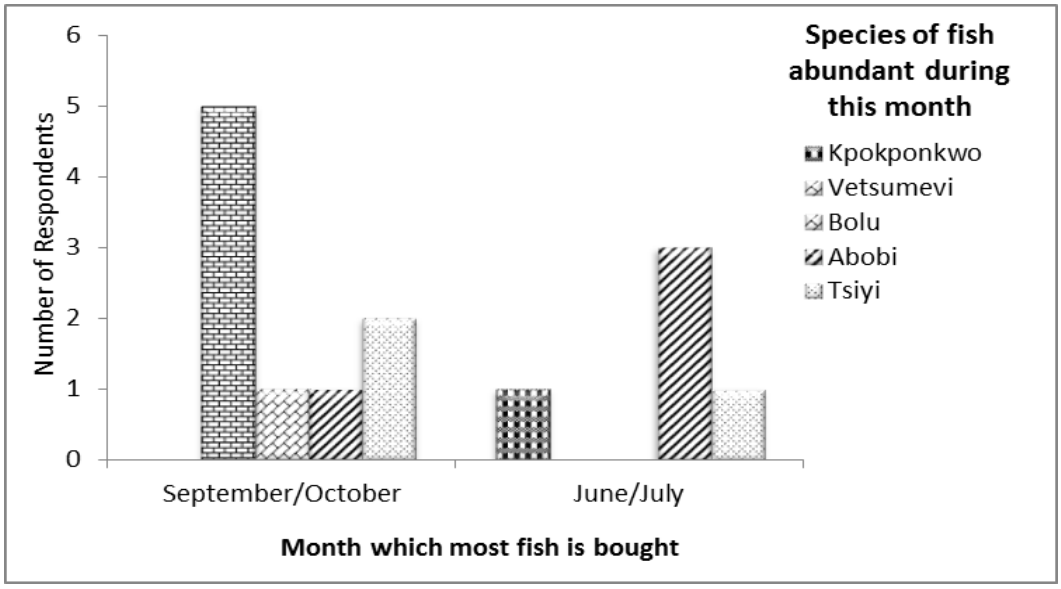

Figure 36 Fishery at the time of bumper harvest

Ways of losing some of the catch

Fish losses in their operations are not considered a major issue. When it does happen, it is either part of the net is torn or the fish simply manages to jump out of the encircling net (Figure 37).

Ways of reducing fish loss at sea

The way the problem of fish loss at sea, if they do occur, is to inspect the nets when they are back at the shore and mend them. Furthermore, they could be more vigilant at keeping the fishes in the water at sea. (Table 37).

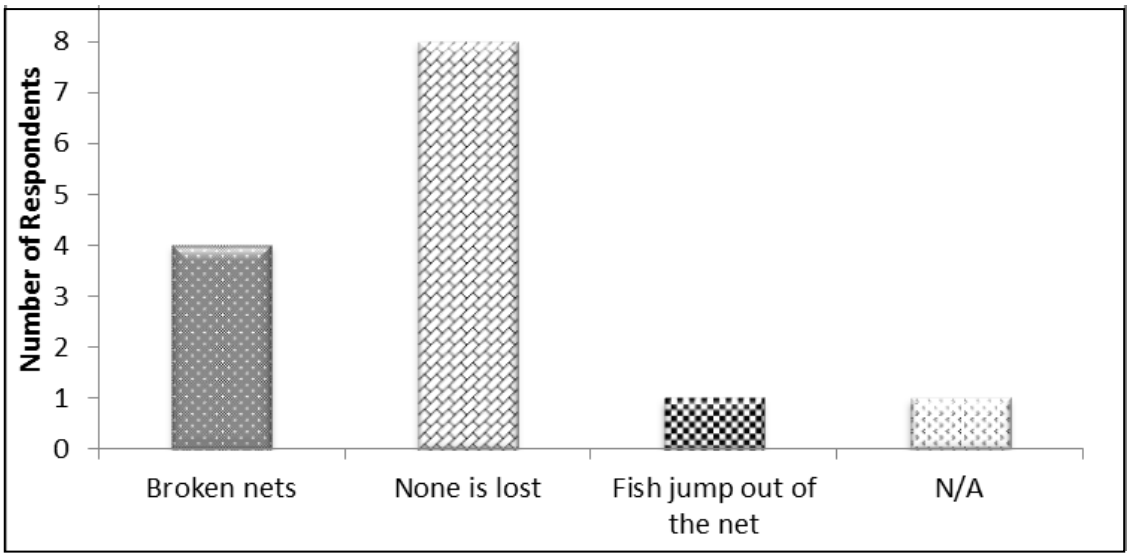

Figure 37 Sources of fish loss at sea

Table 32 Reduction of fish loss by fishermen

Strategy	Number of Respondents	Percentage (%)
Repair of nets	5	36
Keep fish in the net whiles at sea	1	7
No loss of fish	8	57
Total	**14**	**100**

Fish Processing, Packaging, Haulage and Marketing

Fish processing

The main fish processing activity in the fishing communities in the Keta districts are smoking and salting / drying. In event of bumper harvests, fish may be preserved by freezing prior to processing. The respective proportions of processing types of smoking, salting/drying and ice

preservation are 72%, 14% and 7%. 7% of the respondents do not specialize in any of the techniques (Figure 38).

Choice of preferred processing technique

The choice of methods of fish processes is informed by the ease of processing and longevity in storage. Others do the smoking processing because they have inherited it from the earlier generations (Table 33).

Fish species difficult to process

Tsivi or the big eye scad is the most difficult to process. This is followed by hawui (crabs) and the chuck mackerels, Kpokpokuvi. All the other species require the same effort to process (Table 34).

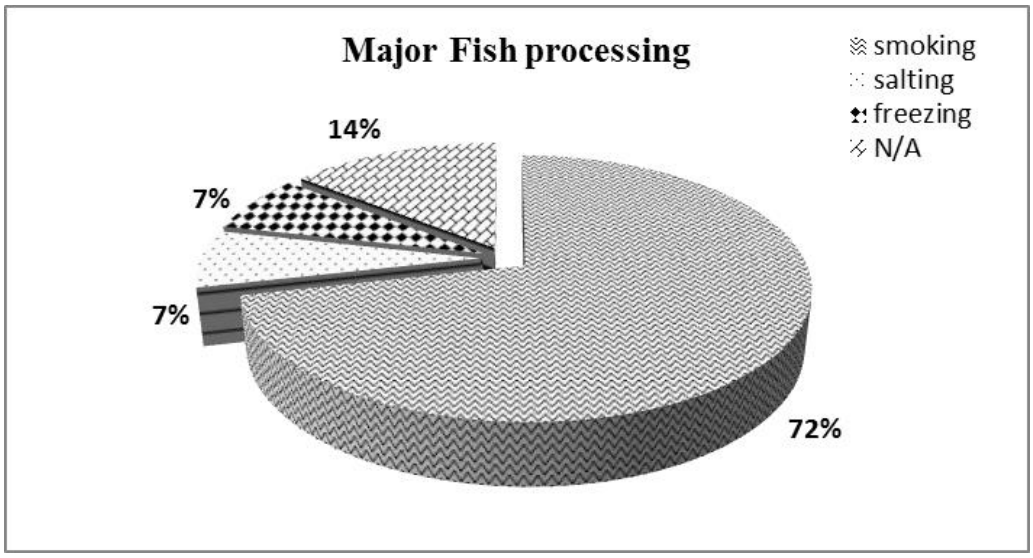

Figure 38 Fish processing and preservation techniques

Table 33 Reason for preferred fish processing technique

Reasons	Number of Respondents	Percentages (%)
used to this method	2	14
easier to process	5	36
can be stored for long	5	36
N/A	2	14
Total	**14**	**100**

Table 34 Effort level of fish species' processing

Local Name of Fish Species	Number of Respondents	Percentages (%)
Kpokponkuvi	2	14
Tsiyi	5	36
Bolu	1	7
Mpayi	1	7
Hawui	3	21
Abobi	1	7
N/A	1	7
Total	**14**	**100**

Fish loss during processing

Nine out the 14 respondents (64%) do not lose any fish from processing to marketing. Among those who lose some fish, the loss occurs during processing or in haulage. Whenever there is any fish loss during processing, it is assumed to have been perpetuated through petty thieving, cats and in extreme cases, rainfall (Figure 39).

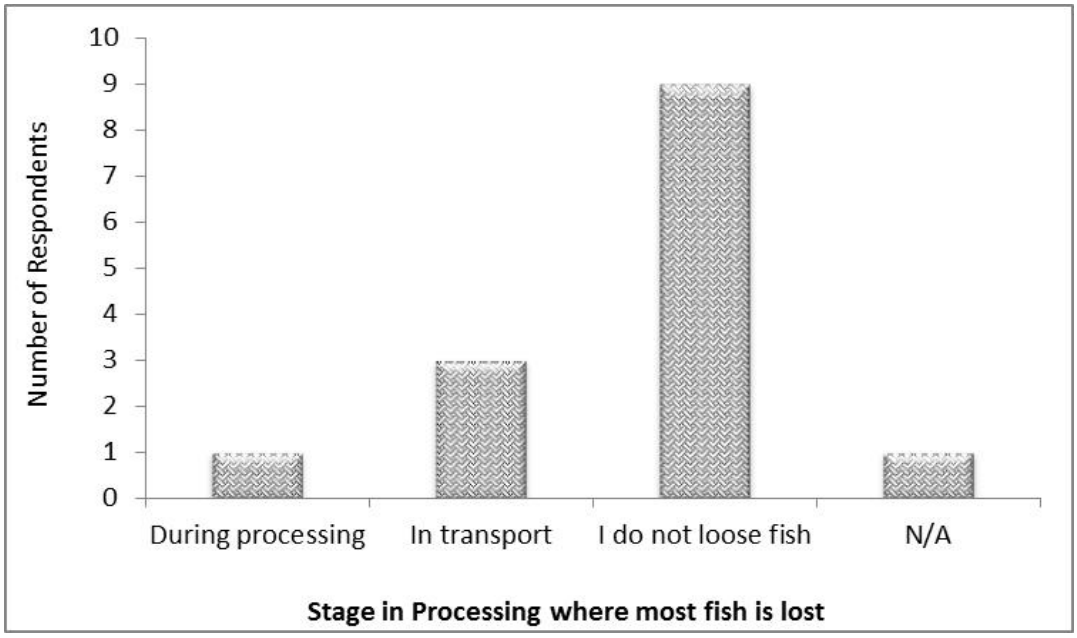

Figure 39 Dominant forms of fish loss

Packaging and Haulage

The majority of fish processors (85%) package their processed fish in baskets. While majority of them pack fish directly into the baskets, a few of the line the baskets with paper before packaging. Yet another small group (7%) may package the fish in baskets and in sacks (Table 9). The choice of packaging type is informed by the distance travelled to the marketing centers. Thus, the longer the distance to traverse, the more sophisticated the packaging.

Usually small vehicles are used to cart fish to the fish marketing centers, essentially because of the relatively shorter distances covered. Such vehicles include mini busses, pick-ups and taxis among others.

Fish marketing

Fish products are marketed largely within the Volta region. For example, among the respondents from the Keta municipality, the furthest fish is hauled is said to be Aflao, a distance of just 15 kilometers. Other marketing centers are Denu and Anloga. 36% of the processors market their products in Keta (Figure 40).

Table 35 Packaging types for processed fish

Fish Packaging	Number of Respondents	Percentages (%)
In basket	9	64
Basket lined with paper	3	21
In basket and sacks	1	7
N/A	1	7
Total	**14**	**100**

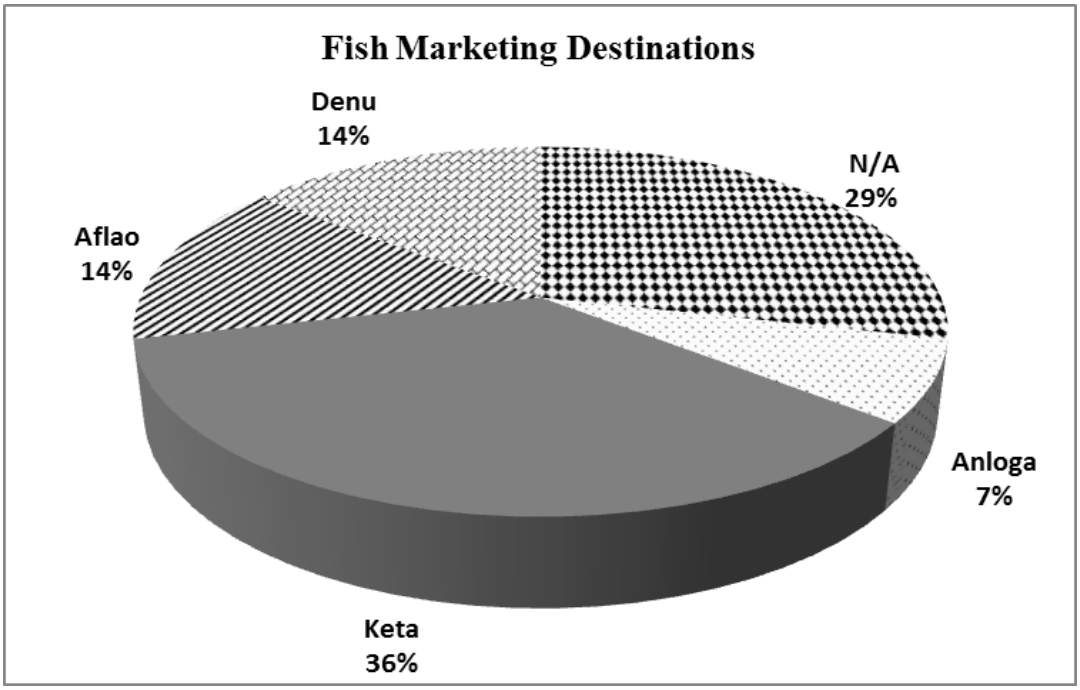

Figure 40 Major market destinations for processed fish

3.4.2 Ketu South District

<u>Demographic Characteristics</u>

Age

Analysis of the ages of the fishermen, the fish mongers and fish haulage divers show the ages structure to span five decades; from the thirties to the seventies, with a minimum of 32 years and a maximum of 76 years. The mean age was recorded at 52.07 years. The modal age was 56 years.

There was skewness in the age structure of the male and female fisheries practitioners at 0.339 and showed the female processors to be slightly older than the male counterparts (Table 36).

Table 36 Age structure of fisheries practitioners in Ketu South

N	20
Mean	52.07
Median	52.00
Mode	56
Skewness	0.339
Minimum	32
Maximum	76

Gender

All the fishing groups were males. The drivers were also all males. The processors were a mixed gender represented approximately at 1male to 9 females. The profile of the local processors association executives is presented in Plate 4.

Plate 4 Mixed gender fish processors in the Ketu South district

Education

The educational background spanned the maximum range of no formal classroom education to tertiary level training. Nonetheless the majority of them were middle school leavers (56%) with 1in 24 (6%) having a tertiary level education. 25% of them had not been to school before (Figure 41).

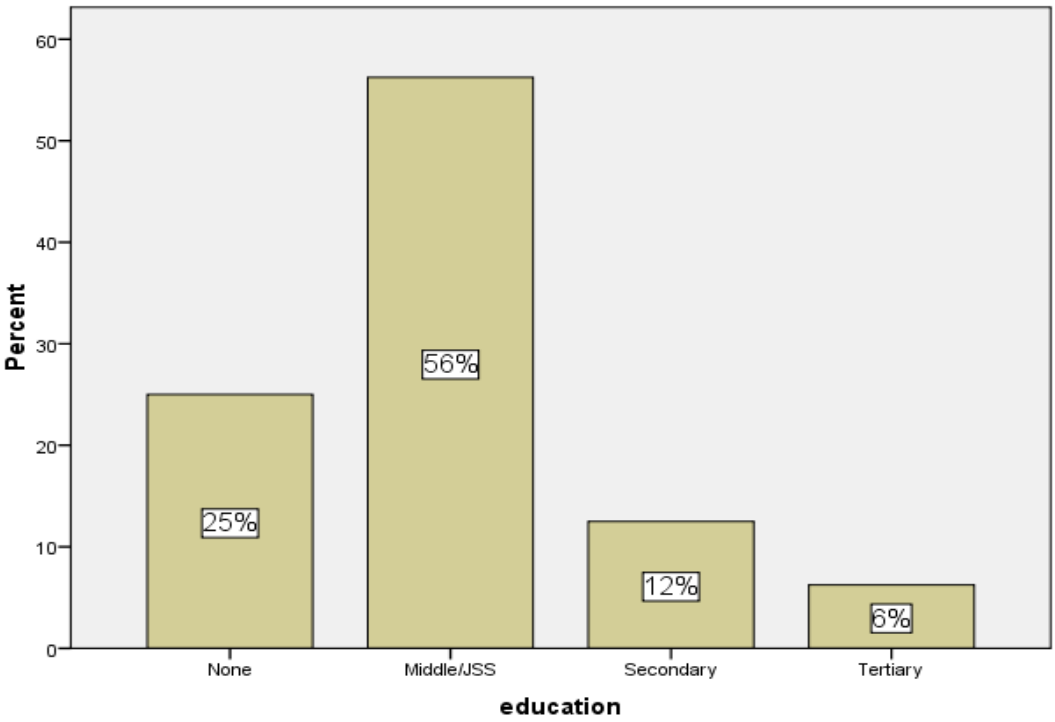

Figure 41 Education level of fisheries practitioners

Fishing practices

The main fishing practice in use in this district is the beach seine or the drag net, known locally as Yevudor (Plate 5). Other practices are the ring net (Watsa) and rift net (Toga). Irrespective of the fishing practice, the main fishing economic unit is the locally made wooden boats operated by outboard motors.

Drag net operatives ply their trade in the nearby shallow coastal area by encircling very large and dragging the net ashore with the catch entrapped in it. Fish is not emptied into the boat at shore. Catches may be sold directly from the net at the beach or from the sandy ground.

The ring net boats and rift net boats operate in deep waters and therefore spend a lot more time at sea. Fish catches comprise of the slightly mature pelagics as against the usually smaller juvenile pelagics landed by the beach seine.

Plate 5 Drag net (Yevodor) operation at landing beach

Periods of maximum catch and fish landings

The major fishing seasons in this location occurs in May/June and August - October. It is believed that the bumper harvest hovers around these months and that there is the likelihood of an early or late start. The main fish species landed during the bumper harvest are the anchovies, *Engraulis encrasicolus*, chuck mackerels, *Scomba japonicas* and the sardines, *Sardinella aurita* (round sardines) and *Sardinella eba* (flat sardines). Each species is harvested for a period within the season. The tuna, *Thunnus albacore* (Yellow fin tuna) is landed throughout the year.

In terms of profitability, the sardines and anchovies are the most important catches. However, about 50% of respondents were of the opinion that there were no marked differences in the price of the different fish species (Figure 42).

Fish landings take approximate 30 minutes to one hour to evacuate landing crafts and another one to two hours to sell off the fish catch. Fish loss at the landing beaches is thus insignificant.

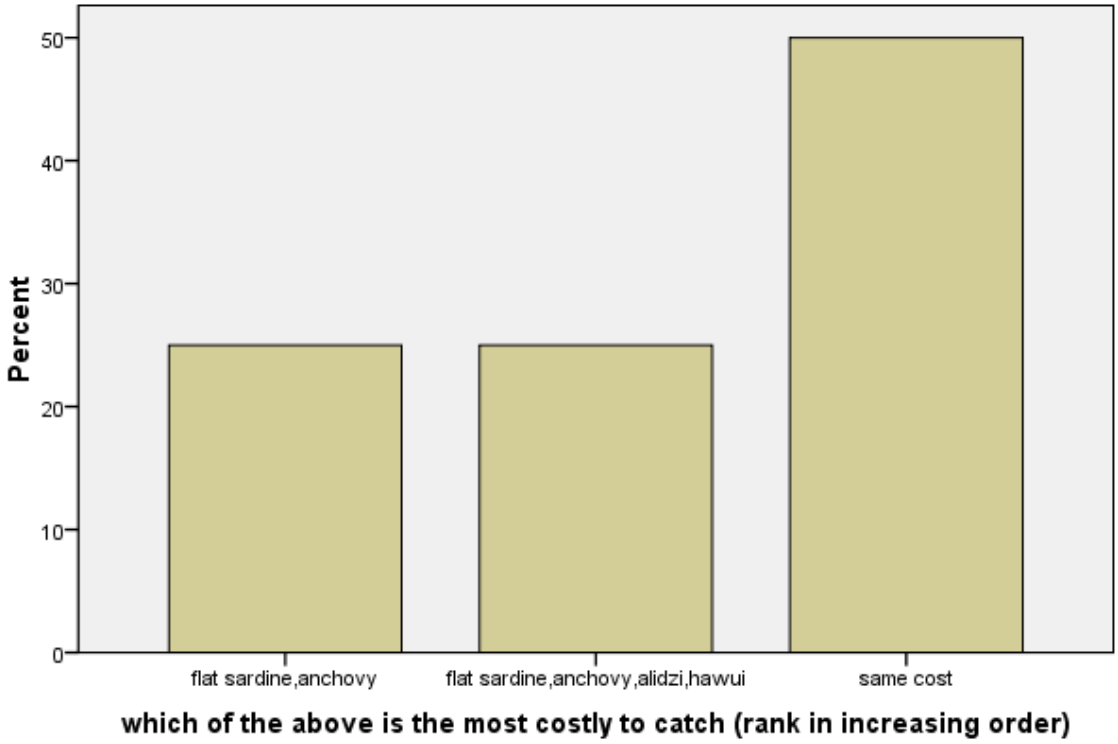

Figure 42 Catch analysis of fish species (in terms of cost)

Fish loss

Three major ways by which fishermen lose fish are: breakage of collecting bag on the net; delay in sales; pilfering. The fourth way is seen to be a combination of the three main factors. The respondents assign equal weighting to all the four different ways of fish loss (Figure 43).

The ingenious ways devised to arrest the problems include frequent replacement of the collecting sack, being more vigilant of the pilfering and getting more buyers.

Local knowledge from the drivers intended to help to reduce fish loss during transportation include suggestions to tie-up packaged fishes very well, and the use of smaller baskets in packaging.

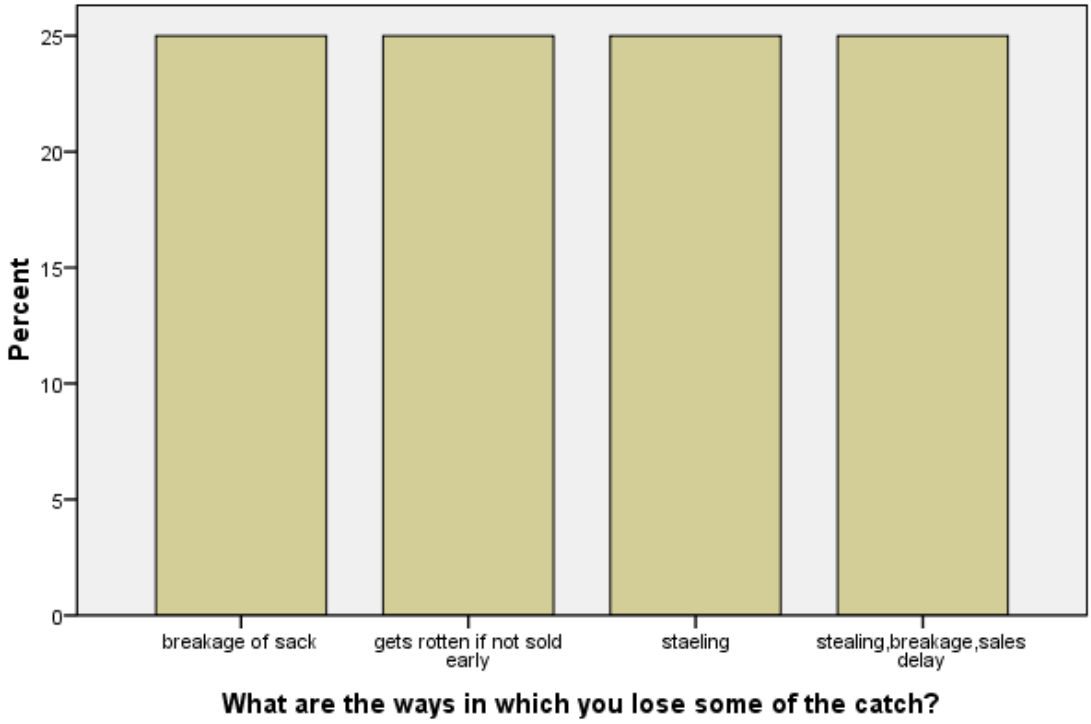

Figure 43 Modes of fish loss at sea

Processing

The major prevailing methods of fish processing in Ketu South are: smoking; drying / drying; salting. Smoking is preferred over the other processing methods because it is has the overall profitable over the other methods. Furthermore, it can be stored during periods of fish glut in the market and sold at a later time. The third reason for choosing smoking over the other methods is that it is unaffected by rain. Stored fish is marketed in February and March, the lean period in fishing business.

Fish drying is done during bumper harvest as a way of complementing the smoking process. Sun dried fish has a relatively short life span and therefor usually not considered a major processing option in this community. Salting/drying is also usually done during bumper harvest when offloading of fish from the many fish-laded boats may take longer time and fishes begin to show signs of deterioration. Commonest fishes that are processed into momoni (salted/sundried fish) include the jack mackerel, Spanish mackerel and false scad there is no loss due to spoilage because they are salted and cost more than when smoked on the market. Salted/dried jack mackerel is presented in Plate 6.

Plate 6 Salted / dried Jack Mackerel (Momoni)

Preservation and Storage

There are a variety of ways by which processed fish is stored in the Ketu South district. They include short term and long term measures. For the short term storage, fish may be smoked dry and packaged in brown paper-lined baskets and securely tied. It may also be left to simmer gradually on smoking ovens under very low intense heating. Others sprinkle ground dry pepper over the packaged fish and left in cool storage. For long term storage, preparation includes well-packaged fish covered with sacks (Plate 7). Packages are placed in windowless, non-ventilated room with single door which remains closed for the entire period of storage. Life span is said to be anything between four to six months.

Plate 7 Sack covered packaged fish for long tem storage

Packaging, haulage, and marketing

Packaging

Fish from this community is usually packaged in baskets after processing. The baskets may be lined with brown paper before packaging. One packaged load may comprise of two baskets joined gape to gape and fastened together with ropes (Plate 8).

Plate 8 Packaged processed fish for road trucking

Haulage

Transportation of processed fish makes use of taxis, vans and smaller haulage trucks. On the other hand Denu serves as a very important fish market and receives processed fish supply from a great number of destinations. These other destinations include locations in the Keta District, Ada, Tema, Accra, Cape Coast, Axim and Half Assini. Transportation from Keta District and other parts of the Ketu District other than Denu is done by mini buses and

taxicabs while fish from Denu fishing communities are transported by head porters and truck pushers. Taxi cabs also play a major role in the short distance haulage.

Marketing

Fish markets are relatively closer to the producing centers with Ho being the furthest destination. Denu market serves as a transit point to other locations outside the country including; Lome in the Republic of Togo and Benin City in Benin Republic. Processed fish is done in the open markets by the fish mongers or are sold wholesale to designated buyers.

4.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

4.1 Summary

Ghana's four coastal regions comprise of a total of 47 coastal district and 228 landing beaches. The SNV post-harvest loss reduction study was conducted in 47 landing beaches in 13 districts between August and September, 2015.

The patrons of the industry are largely middle-aged to old practitioners with ages ranging between 22 to 70 years and averaging around 50 year for the exclusively male fishing practitioners and several years more for the predominantly female processors.

Knowledge base of the practitioners is excellent in every respect in the practice of their trade but lends very little support for innovation in the industry essentially because it is, to a very large extent, oral tradition-based rather than being based on training and novelty.

Formal classroom educational level of practitioners is low and averages at middle school/JSS. Notwithstanding, there is a demonstrable evidence of ingenuity to the overall execution of the fishing and processing trade.

Fishing practices include the beach seine, set nets (rubber net) Ali (encircling net), Poli (encircling net with fine-mesh net at base), Watsa (ring net) and hook & line. Unconventional methods like light fishing, chemical fishing and use of dynamite are also in use at some landing beaches.

Industrial trawlers support an illegal but vibrant pelagic by-catch fishery known locally as 'syco'.

The variety of methods appears to have cultural antecedents with certain ethnic groups being associated with particular fishing methods.

For some of the fishing groups, the quest for good fish catch appears to take precedent over observance of the governing fisheries regulatory laws as manifests in the use of the illegal fishing methods.

Fishing expedition, on the average lasts for less than 24 hours for the outboard motor propelled canoes. The fishermen's use of ice at sea as a preservative ranges from minimal to nonexistence.

Periods of maximum fish catch (bumper harvest) vary from one region to the other but largely center around July to October.

Marketing of landed fish does not last for more than two hours in all the landing beaches. Ex-landing beach sales are conducted by the fishermen and prices vigorously negotiated for by the Konkohemaa (legally approved sales superintendent for the community).

Extent of losses incurred by fishermen at sea and during processing in terms of volume and cash, at this juncture, is not quantifiable because expression of losses along the value chain is more qualitative; and generally expressed as being minimal or negligible.

Fish mongering involves largely women who learnt the trade from their elder peers or departed parents. No effort seems to be made at attracting young educated individuals into the trade.

Production methods, especially the salting/drying, operate under conditions that are generally not environmentally acceptable. Nevertheless, it is good to note that in very few places, salted fish is dried on platforms.

Haulage of usually well packaged processed fish is by a variety of vehicles ranging from small saloon taxi cubs to huge cargo trucks driven by relatively younger drivers. Cargo is usually transported and delivered to designated markets un-accompanied.

Marketing of processed fish is based on trust reposed in hauling drivers, porters and known buyers instead of a search for excellence.

4.2 Conclusions

Fishing exploitation is all-year round in all the 47 coastal districts of the country using three major fishing vessels; the motorized wooden canoes, the semi-industrial and the industrial trawlers and a variety of methods including beach seining.

A variety of fish species are landed all year round but species dominance marks the period of bumper harvest. Three main small pelagic fish species, *Engraulis encrasicolus* (Abobi or Keta school boys) *Sardinella aurita* (round sardines) and *Sardinella eba* (flat sardines) form an important fishery during the bumper harvest period in all the fishing communities.

By and large, post-harvest fish losses at sea; the landing beaches, the processing facilities and the marketing outlays can be considered minimal to negligible based on the current available evidence.

Nonetheless, decimation in catches at sea stems largely from dolphin and shark attack on fishing nets and at the landing beaches; through petty pilfering. At the processing level, any fish loss may arise from the smoking process and theft of drying salted fish by cats, dogs and pigs.

Local knowledge in fish preservation and storage is very good and contributes largely to minimal post-harvest loss.

The major problems encountered by the fishermen and fish processors are inadequate catches and supply of fish respectively.

In addition, the fisheries practitioners can also do better with financial support and technical training to broaden their financial base and improve their management skills respectively.

The fisheries value incorporates school-going aged children and other minors at various points along a very long value chain.

Any efforts aimed to improve fisheries development will need to incorporate general environment issues to make the exercise a worthwhile venture.

4.3. Recommendations

It is recommended that the fishing practices currently in vogue must be thoroughly evaluated and the necessary regulatory measures put in place and enforced to ensure the prevalence of a sustainable fishery.

The artisanal fisheries operatives and the fish processors especially can do with some training and some credit facility to improve on their equipment base and knowledge in the planning and management of their business as a viable and sustainable commercial venture.

While the study emphasizes post-harvest losses, it is important that the fishermen are made to understand the dynamics of a dying fishery to enable them practice responsible fisheries.

An investment into alternative means of livelihood, for example, aquaculture, will help to engage the fishermen during the lean season and lessen the pressure on the fish stocks to allow them to rebuild the populations. In this way, the fish processors can also run their businesses all year round.

5.0 BIBLIOGRAPHY

Directorate of fisheries (2007). A summary of fisheries statistics in Ghana (Mimeo). P2. Ministry of Food and Agriculture, Accra

Directorate of fisheries (2008). National Fisheries and Aquaculture Policy, 2008). Ministry of Food and Agriculture, Accra

Directorate of fisheries (2010). Fisheries regulations (Arrangements of regulations). Ministry of food and Agriculture, Accra

FAO (1992) (Code of conduct for responsible fisheries (CCRF); http://www.fao.org/docrep/005/v9878e00.htm

FAO (2008). Fishery Country Profile - The Republic Of Ghana

Maaeten Bavinck, Ratana Chuenpagdee, Mamadou Diallo, Jan Kooiman, Robin Mahon, Stella Williams (2005). Interactive Fisheries Governance. Delft: Eburon Publishers. 72pp

Millennium Development Challenge Goals (MDCG) 2000. http://www.unmilleniumproject.org

Quaatey, S. (1997). Synthesis of recent evaluations undertaken on the major fish stocks in Ghanaian waters. A working document for the 11th session of the CECAF Working Party on Resource evaluation held in Accra. 35 pp.

Sustainable Livelihood Approaches (SLA) (2005). http://www.sla.org

www.Fao.Org/Fi/Oldsite/Fcp/En/Gha/Profile.Htm