“FIELD TESTING OF METHODOLOGIES FOR EVALUATING POST HARVEST LOSSES OF ARTISANAL FISHERIES IN WEST AFRICA:” (A Case Study of Kormantse Fishing Community, Central Region, Ghana.)

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TABLE OF CONTENTS ii

ACRONYMS USED IN THIS REPORT

PRA	-	Participatory Rural Appraisal
FRI	-	Food Research Institute
WADAF	-	West African Development of Artisanal Fisheries
NRI	-	Natural Resources Institute
H.P	-	Horse Power
CEDECOM	-	Central Regional Development Co-operation
SSI	-	Semi Structured Interview
QTY	-	Quality

SUMMARY

1. This report is an output of field activities carried out at Kormantse a fishing community in the Central region of Ghana. The main task involved the planning and implementation of PRA based (informal method), Questionnaire and Load Tracking Surveys. Kormantse is located about 140 kilometres off the Accra-Abidjan trunk road.

2. The three methods were explained during a training workshop conducted by NRI at the FRI from 24 August 1998 - 4 September 1998. The objective of the Accra workshop was to provide training in the three survey methods which can be used to assess post harvest fish losses and draw up an action programme of field work to test the methods in Ghana.

3. The execution of the work was delayed for several months when the first research co-ordinator engaged could not carry out the field surveys due to pressure on other assignments. The very low catch of fish in and around the community during the survey period also contributed to the late submission of this report.

4. Specific field activities carried out were:

i planning and implementation of PRA (informal) post harvest fish loss assessment at Kormantse

ii planning, design, implementation and analysis of questionnaire survey at Kormantse, and

iii planning and implementation of load tracking exercise from Kormantse (the fishing centre) to Techiman (the marketing centre).

5. Starting with the informal survey gave a clear understanding of the background information about the fishing industry in the community and also an insight into the most appropriate period to conduct the other two surveys and the type of questions to ask.

6. Results from the three surveys which were complimentary to each other showed some consistency in the information provided. It was observed in all the three surveys that limited physical losses occur from the point of catch to landing site. Short distances between landing sites and smoking units (between one and two kilometres) and short interval period between landing and smoking (about two hours delay) have little influence on both the quality at landing and quality of the final smoked product.

7. From the field surveys it was concluded that the PRA is a good tool for eliciting general information about the fishery sub-sector as well as broad information on where, when and how losses occur. It also seeks to obtain information about local peoples perceptions and knowledge about causes and possible solutions on identified issues. However, it generates more qualitative and little quantitative data making it difficult to determine actual numerative loss assessment.

8. The questionnaire method, although can generate data for actual physical and economic loss assessment, it is, however, very expensive and time consuming regarding to its design, training of enumerators, pretesting, administration and analysis. The high level of illiteracy of commercial operators in the fishing business limits the usefulness of this survey method in fish loss assessment. Translation and interpretation of information between the literate enumerator and the illiterate respondent add to its limitation in this exercise.

9. The load tracking as a survey method allows for objective and systematic examination of a number of variables in the distribution chain which can affect quality. Like the PRA it is a relatively moderate and quick way of obtaining information on all aspects of the artisanal fishery sub-sector. It gives a good balance between qualitative and quantitative assessment.

10. From the foregoing, it is recommended that for a better understanding and objective balance between the local people and technocrat knowledge and perceptions, rhetoric and reality, quantitative and qualitative assessment of post harvest fish losses, PRA should be used to obtain generalized information which should be verified and validated with the Load tracking method

11. Results obtained from the surveys cannot be said to be a good representation of post harvest fish losses in the community or that of the national average due to the very low catches during the survey period and special treatment given to the test fish. In order to obtain a more accurate and reliable result, the survey should be repeated at different seasons at the same community. There is also the need to replicate it in other communities in the artisanal fishery zone.

INTRODUCTION

In Ghana the artisanal fisheries sub-sector which is the mainstay of fisheries economy plays a significant role in fish supply and employment generation. The flesh of fish is a very important source of top quality protein and represents a significant proportion of the animal protein in the Ghanaian diet, either as fresh fish or cured in a variety of ways, such as smoking, salting and drying. Fish can be regarded as a renewable natural resource provided that the seas and lakes are not overfished.

In Ghana and most other tropical countries, fish is regarded as one of the most perishable commodities. It will become unfit for human consumption within hours after capture, unless it is subjected to some form of processing. With the traditional methods of processing, the fish is still subjected to many forms of losses and spoilage.

Despite the increasing number of frozen and canned fish coming into the local markets all over the country, fresh and cured fish are the most important in the domestic market. Regrettably however, a significant per cent of the total weight landed may be lost due to poor post harvest handling, preservation, processing, storage and distribution inadequacies. The most obvious means of increasing supply of fish, even without increased landings, would, therefore, be by reducing post harvest losses of what is presently caught.

Post-harvest losses are of various types. The most obvious are the losses in material or physical losses when fish is not sold. These physical losses, caused by, for example, poor handling and processing, or the discarding of by-catch may also represent economic loss. There is also the economic losses which occur when spoilage of wet fish brings about a reduction in its value or when there is a need to reprocess cured fish, thereby increasing the cost to the processor. Traditional processing methods can cause a reduction in nutrient availability, leading to nutritional loss.

To curtail the physical, economic and nutritional losses of smoke-dried fish in the artisanal fisheries, an assessment of these losses using various and varied assessment methodologies is imperative to enable us identify why, where, how and when losses occur so as to be able to advice economic operators in this sub-sector and policy makers in Government.

Post harvest losses in small scale fisheries can be measured and quantified through three methods. These are an informal method based on Participatory Rural Appraisal, a formal Recall Questionnaire method and Load Tracking.
This study was initiated by the Natural Resource Institute (NRI) as a follow-up of a Training Workshop on Fish Loss Assessment methods, held in Accra, Ghana from 24 August 1998 - 4 September 1998 with a view to test the feasibility and practicality of adapting the three methods in loss assessment at the local level. The objective of this study was to field test the three methods

to assess fish losses in the distribution chain and determine the strengths and weaknesses of the methods according to the work carried out during the field surveys at Kormantse, a fishing community located about 140 km West of Accra, the capital city of Ghana.

METHODOLOGIES

PRA (INFORMAL) SURVEY

Nine persons who were described as opinion leaders and who form the decision making team in matters concerning fishing, fish processing and marketing were initially met (Appendix 1). Reasons for conducting the three surveys were explained to them. They welcomed the team of outsiders made up of Ivor Clucas from NRI, Grace Quaye a commercial operator from Accra, the research co-ordinator and a driver. They expressed their appreciation to the team for choosing Kormantse for the exercise and expressed their commitment and support to the work. The next two days were used to develop checklists for semi structured interview to use as a guide for the PRA (Appendices 2 & 3).

Two separate checklists were developed with the key informants listed in appendix 1. The checklist for the fisherfolks was designed to obtain information on fishing methods, types, quantity and quality of fish landed at the shore, fish losses and other activities engaged in by the fisherfolks. The one for the processors and the traders touched on general information about artisanal fisheries in the community, fish types and processing, losses and storage. All the traders who participated in the exercise were also smokers. The implication is that at Kormantse most of the smokers market their own products outside the community.

THE QUESTIONNAIRE SURVEY

Two separate questionnaires were developed to assess losses at different stages of the fish catching, processing and distribution mix (Appendices 4 and 5). Three persons from the community, the Assemblyman, the Secretary of the Kormantse No. 1 Fish Smokers Association and the Secretary of the Kormantse No. 2 Fish Smokers Association were trained to be able to administer the questionnaires. The questionnaires were pretested after which some slight modifications were made to suit the understanding and the perceptions of the local respondents. ‘Poor quality’ in the questionnaire was changed to ‘low quality’ since the local people consider poor as something of no value

Fifty (50) fisherfolks responded to 10 questions each aimed at assessing losses from the point of catch to landing off shore, whilst fifty (50) processors answered 15 questions each to determine losses of fresh fish bought at the shore through processing to marketing. It was observed from the PRA that almost all the fish smokers also engage in trading of the smoked product in markets outside Kormantse. The administration of the questionnaire lasted for 3 days.

LOAD TRACKING SURVEY

West African Sardines (Sardinella maderensis) were used in the study. The gears used in the catching operation included a beach seine and encircling nets. Freshly caught Sardinella were assessed using the demerit score sheet based on the quality as at the time the fish were landed. The demerit scores were developed with 24 commercial operators during a PRA at Kormantse in March 1999. The criteria which were those used traditionally in the community to assess fresh fish quality were smell, slime, texture, colour and appearance. Temperature at landing and at the processing unit were recorded. Ambient and fish temperatures were measured using a digital clinical thermometer.

Processing of Sardinella
The fresh fish were laid on 3 wood-supported wire mesh in a traditional rectangular mud oven (popularly known in Ghana as 'Chorkor Smoker') without washing. The fish was not washed because they were purchased straight from the canoe and transferred into a big aluminum tray without spreading them on the sea sand. The fish were smoked for 5 hours and left in the oven for 24 hours for drying using hardwood. This smoked fish was not fully dried and was therefore less susceptible to breakage. Smoking of full dried fish normally takes 2 - 3 days. There were 3 turnings during the period of smoking to ensure uniformity in drying of the final product. The criteria for the demerit scoring of the fresh fish which were developed with the fisherfolks during the PRA can be found in Appendix 8.

Demerit scoring for smoked Sardinella
Criteria and scores for the smoked Sardinella were developed with the commercial operators during the PRA (Appendix 9). These were based on some features such as brittleness, colour, dryness, breakage and insect infestation of the product.

Packaging of Smoked Sardinella
The smoked fish were packed in two small baskets by the women processors who volunteered to take part in the exercise. The packaging was done in the same traditional way being practiced in the community. The baskets were lined with brown cement paper. After the fish were carefully packed, the paper was folded to cover the fish. The 2 baskets were then overlapped and a nylon net was wrapped over them to fasten them together.

Seven hundred and fifty (750) pieces of smoked fish were packed into 2 baskets. Basket one contained 400 pieces while basket two contained 350. They weighed 15 kg and 13 kg respectively.

Transportation of Smoked Sardinella

Transportation of the smoked fish was by arrangement with commercial commuter truck used by the economic operators. The president of the fish smokers association, another economic operator who participated in the study and the co-ordinator traveled in a car to meet the fish at Techiman market. The 400 km journey from Kormantse to Techiman market was made in approximately six hours. The road is good. There are a few spotted potholes.

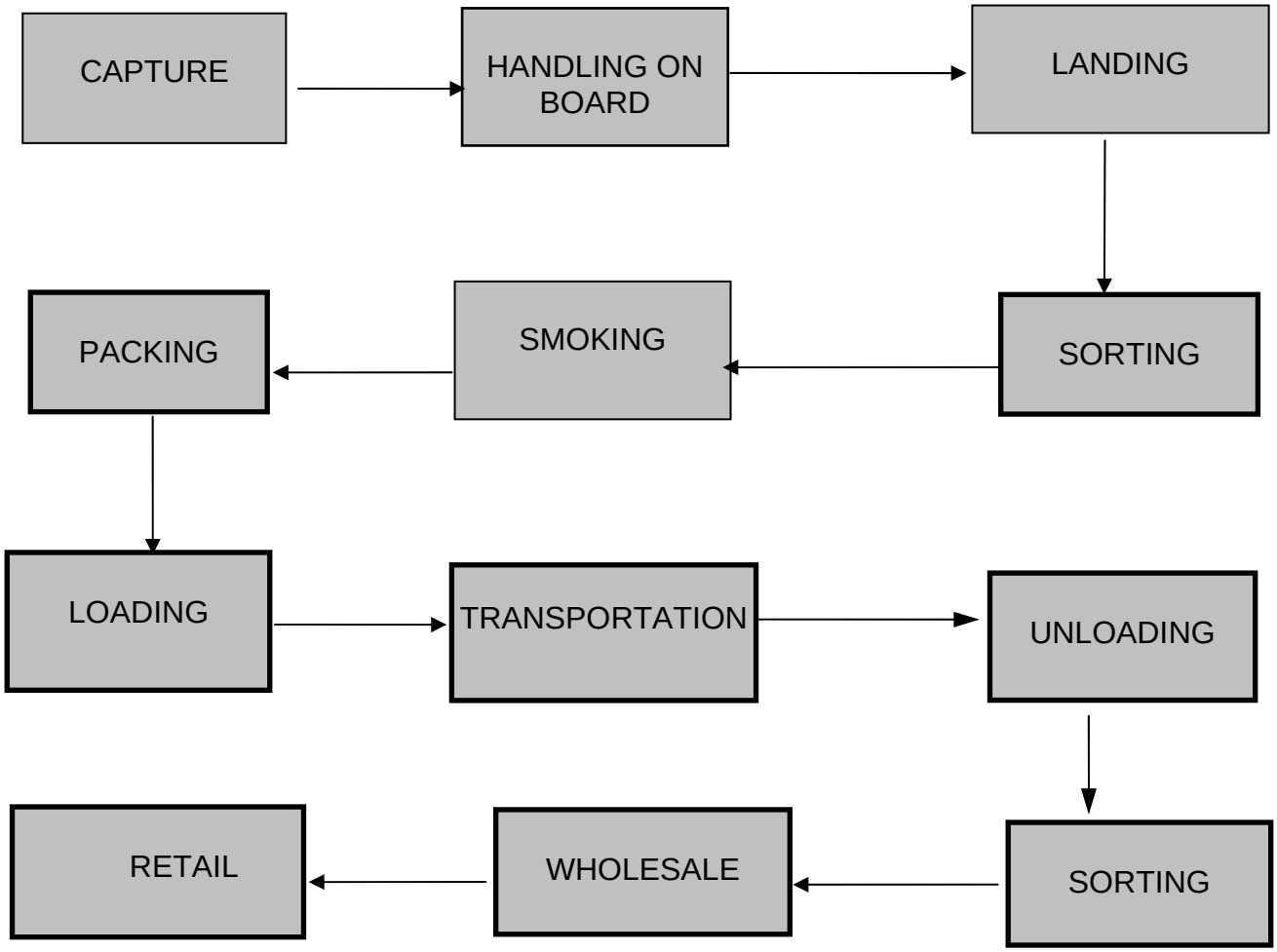
Load Tracking Exercise

Forty smoked fish from basket one containing 400 fish and 35 from basket two of 350 smoked fish representing an aggregate of 10% of total smoked fish were sampled at random and put under demerit scoring. For easy understanding of the calculation by the commercial operators who participated in the exercise, higher figures were awarded to good quality while lower scores were given to lower quality. The exercise was, therefore merit scoring rather than demerit scoring.

After transporting to the market, the content of the baskets were discharged following the normal procedure by the economic operators. The fish were again scored based on the demerit score sheet used for smoked fish before transportation.

Economic loss of the fish was not calculated since the traders considered damages occurred as minor and insignificant to warrant any reduction in price.

Figure 1. Flow Chart of Sardines (Sardinella maderensis) from Landing site (Kormantse) in the Central Region to Wholesale Market (Techiman) in the Brong Ahafo Region, Ghana.



RESULTS

PRA WITH FISHERFOLKS

It was learnt that there are about 50 big dug-out canoes powered by 40 H.P outboard engines and 20 smaller ones in the community. Between 20-40 people form a crew with a machine engineer, a captain, 2 assistants and a steersman as the officials. Individuals who do not go on fishing themselves own the canoes. The main fishing nets found in the community are the Purse Seine Net, the Gill Net and the Bottom Set Gill Net (use to catch lobsters)

Time Spent at Sea
Using a seasonal calendar, the time spent at sea and the type of fish caught during the various months of the year are tabulated below.

Table 1: Time Spent at Sea and the Type of Fish Caught During the Various Months of the year.

Months	Time At Sea	No. of Hours	Type Of Fish
January	04.00 - 09.00	5	Herrings, 'Boe' and Anchovies
February	04.00 - 09.00	5	Herrings, 'Boe' and Anchovies
March	03.00 - 15.00	12	'Tantamire' and 'Saforo', Tuna
April	03.00 - 15.00	12	'Tantamire' and 'Saforo', Tuna
May	03.00 - 15.00	12	'Tantamire' and 'Saforo', Tuna
June	18.00 - 08.00	14	Sardines, Herrings
July	18.00 - 08.00	14	Herrings, Anchovies
August	18.00 - 08.00	14	Herrings, Anchovies
September	18.00 - 24.00	6	Herrings, Anchovies
October	18.00 - 24.00	6	Herrings, Anchovies
November	06.00 - 15.00	9	Herrings
December	06.00 - 15.00	9	Herrings

The fisherfolks stated that during the peak of the herrings season, from August to October, season a crew can land with as many as 200 baskets of fish. The average catch during the lean season was given as 2 baskets. They said their major problem at sea is strong rain storms.

Quality of Fish:
According to the fisherfolks, the quality can be affected by:

- water leaking through the bottom of the boat - the fish become soft which affects the physical quality.
- number of hours spent at sea - very long delay (more than 24 hours) at sea can affect the physical quality of the fish
- seasonality . August - October. During this period, the fish become fatty hence more easily damage physically

Marketing of Fresh Fish

It was stated that there is always uniform price for both good quality and damaged fish. The reason being that sorting of fish is not based on quality. It is only based on species.

Other Jobs
All informants said they do not engage in other jobs. All their incomes are from fishing.

PRA WITH PROCESSORS

Types of Processing Units
- Round ovens - only use to store smoked fish.
- Chorkor smoker - rectangular mud oven introduced into the community by Fishery Research Institute. Has now replaced the round ovens.
- Gas oven - provided by CEDECOM on hire purchase. Use only during the peak period when the Chorkor smokers will not be enough to smoke all the fish bought. Due to operational difficulties, the gas ovens have not been fully accepted by the smokers.

Ownership of Processing Units
Female household leaders of Kormantse own the processing units. There are about 35 units with an average of 5 Chorkor smokers per unit. No one person has more than one processing unit. The owners of the units employ other women to work with them as help hands. Mode of remuneration is by sharing profit at the end of the season (one calendar year). Shared profit is based according to age. The youth receive 50% of what the older women get. Profit is shared after all expenses have been deducted. The owner takes 50% of the total profit whilst the remaining 50% is shared among the others.

Species of Fish:
The major species of fish usually smoked by the women were scored and ranked according to their availability and seasonality.

TABLE 2: Species of Fish, Amount Smoked Per Day and Seasonality

FISH SPECIES	SCORE	RANKING	AMOUNT SMOKE/ DAY/UNIT	SEASONALITY
Anchovies	100	1st	50 basins	August - October
Herrings	20	2nd	50 baskets	June - August
Mackerel	15	3rd	Not Applicable	June - August
'Mmoeba'	6	7th	Not applicable	November-December
Tuna	10	4th	Not applicable	August-October
'Ndeema'	10	4th	Not applicable	January - August
'Sropaa'	6	7th	Not applicable	January-December

The informants could not estimate the amount of Mackerel, 'Mmoema', Tuna, 'Ndeema' and 'Sropaa' since they come occasionally.
Sorting:
Sorting is done according to species.

No sorting according to quality since they consider loss in quality as insignificant.

Unit of Measure: (Fresh Fish)
Anchovy - Large aluminium basins
Herrings - Baskets
Bigger species - by counting

Cost Per Unit:

	Peak Season	**Lean season**
Anchovy	¢20,000.00	¢40,000.00
Herrings	¢20,000	¢36,000.00

Weather:
No effect on smoking because all the sheds are roofed.

Fuel Wood:
The types of fuel wood, their relative cost, availability and quality regarding to the quality of final smoked product were scored by the women based on their own set criteria.

Table 3: Scoring of Fuel Wood, Their Cost, Availability and Quality

Fuel Wood Type	Cost	Availability	Quality
'Esa'	4	2	1
'Emire'	3	2	1
'Kakadukurua'	3	3	3
'Pepe'	2	2	3
'Offam'	2	2	2
'Ogwon'	1	1	4
'Asraben'	1	3	4
'Katakyenkyen'	1	1	2
'Sanfomma'	1	1	4
'Akodaayeden'	1	3	2
'Okora'	1	1	4

Criteria

Cost	Most Expensive	4	Least Expensive	1
Availability	Most Available	4	Least Available	1
Quality	Smokes Best	4	Smokes Worst	1

Losses :

- All the informants said they do not normally incur physical losses but said it is possible to incur losses in quality due to burning. The low quality fish is sold to poultry farmers.
- They also mentioned reduction in value due to damage to smoked products during packaging and transportation.
- Reduction in value and physical losses due to beetles infestation in storage.

Storage:
- During the peak season because of low market price.
- They cover the fish with polythene sheets and store in round ovens and warehouse.
- Good quality smoked fish can be stored for 8 months.
- The major problem with storage is beetle infestation.

Losses during Storage:
There was an example of a loss of 10 baskets out of 60 baskets stored over 8 months period due to beetle infestation and shrinkage.
They suggested research into ways of dealing with beetles infestation

PRA WITH TRADERS

Who Does the Marketing
They mentioned that they sell about 80% of their smoked fish at Techiman market. They sell the remaining 20 % at Kumasi and Obuasi markets in the Ashanti region, Oda market in the Eastern region and Mankesim Market in the Central region.

They however, mentioned that some traders come from Accra, Kumasi, Mankesim, Techiman and Oda to buy smoked fish and sell them in the markets listed above. They sell herrings and anchovies at Techiman the farthest market and the bigger fishes at other markets. The reason being that, consumers of fish in the Northern part of Ghana prefer the smaller fish and also breakage incurred when transporting bigger fish over long distance is high.

There is no agreement between the outsider traders and the local traders and processors from Kormantse as regard to the signing of any contract for the advancement of loan to buy fresh fish and selling of smoked fish.

Unit of Measure
There are two types of baskets for purchase and sale of smoked fish; big and small. They are both made of raffia palm.

Packaging:
Packed into baskets lined with brown paper, covered with brown paper and tied with nylon netting. They use sticks to separated 2 baskets in the commuter trucks.

Transportation
Readily available trucks from Mankesim and other places.

Number of Times One Trader Goes to Techiman Market
Peak period - once a week.
Lean season - irregular.

When the supply is greater than demand, restriction are made by wholesalers in Techiman and the other markets as to the number of baskets and how many times a trader can send fish to the market.

Problems with Marketing and Losses
- Rains during transportation .
- Accidents during transportation.
- Do not consider fish consumed by the family or given out to friends, relatives and others as losses.
- Stealing of money and fish at the market places.
- Packaging into trucks - broken heads, removal of scales.

THE QUESTIONNAIRE SURVEY

Twenty four representing 48% of the fisherfolk respondents stated that they had gone on fishing within 14 days prior to the interview day while twenty six, (52%) said they had not gone on fishing within the period (see Appendix 6). Fifteen (63%) of the 24 respondents said they had catches ranging between 7 and 25 baskets, (the unit of measure of fish in the community) while 9 representing (37%) mentioned that they had no catch. The amount of fish caught, proportions of good and lower quality and their correspondent unit and prices are represented in table 4.

Similarly, 27 (54%) of the processors/traders who responded to the questionnaires mentioned that they had bought fresh fish and sold smoked fish within 14 days to the interview. Twenty-three (46%) said they had not engaged in any activity regarding to purchase, smoking or sale of fish within the same period (see Appendix 7).

Table 4: Quality Loss Assessment - Fisherfolks

NUMBER	FISH CAUGHT	FISH LANDED	GOOD QUALITY	LOW QUALITY	TAKEN HOME, ETC.
1.	10	10	9	-	1
2.	18	18	17	-	1
3.	15	15	14	-	1
4.	22	22	20	-	2
5.	15	15	14	-	1
6.	25	25	24	-	1
7.	14	14	13	-	1
8.	25	25	24	-	1
9.	10	10	7	1	2
10.	15	15	14	-	1
11.	20	20	18	-	2
12.	18	18	16	-	2
13.	20	20	19	-	1
14.	10	10	9	-	1
15.	7	7	6	-	1
Total	**244**	**244**	**224**	**1**	**19**

It can be derived from the table that out of the total number of 244 baskets of fish caught by the 50 respondents nothing was thrown away before landing. Only one basket of fish was regarded as having a lower quality which could be assessed as physical loss. Nineteen baskets of fish were either taken for home consumption or given to help hands**.** Since catches were low, about 10% of what is normally caught during the bumper season, fish was handled with extra care and therefore no physical loss was experienced.

Table 5: Economic Loss Assessment - Fisherfolks

FISH CAUGHT a	GOOD QTY. b	UNIT PRICE (¢) c	LOW QTY. d	UNIT PRICE (¢) e	H. C. ETC. f	axc (¢)	bxc (¢)	fxc (¢)
10	9	25000	-		1	250000	225000	25000
18	17	25000	-		1	450000	425000	25000
15	14	30000	-		1	450000	420000	30000
22	20	30000	-		2	660000	600000	60000
15	14	30000	-		1	450000	420000	30000
25	24	30000	-		1	750000	720000	30000
14	13	30000	-		1	420000	390000	30000
25	24	25000	-		1	625000	600000	25000
10	7	30000	1	20000	2	300000	210000	60000
15	14	30000	-		1	450000	420000	30000
20	18	30000	-		2	600000	540000	60000
18	16	30000	-		2	540000	480000	60000
20	19	30000	-		1	600000	570000	30000
10	9	30000	-		1	300000	270000	30000
7	6	30000	-		1	210000	180000	30000
244	**224**	**435000**	**1**		**19**	**7055000**	**6470000**	**555000**

From the table, economic loss of fish due to down grading is ¢10000.00 that is the one basket of lower quality fish which was sold at ¢20000.00 instead of a good quality price of ¢30000.00. Taken the 19 baskets of fish for home consumption as economic loss to the respondents, the total economic loss then becomes ¢565000.00 thus the ¢10000.00 loss due to lower quality and the value of the 19 baskets of fish which should have been sold for ¢555000.00.

1$ = ¢2400 May 1999

Reasons accounting for the lower quality were given as;

- rains kept the fisherfolks longer than the usual fishing time
- the buyers did not come early because of the rain

Table 6: Assessment of Losses Between Landing and Smoking

No.	FRESH FISH BOUGHT	GOOD QUALITY	UNIT PRICE (¢)	LOW QUALITY	UNIT PRICE(¢)
1.	12	12	25000	-	-
2.	12	12	20000	-	-
3.	4	4	30000	-	-
4.	25	24	25000	1	20000
5.	20	20	20000	-	-
6.	7	7	30000	-	-
7.	6	6	25000	1	20000
8.	30	30	25000	-	-
9.	12	12	20000	-	-
10.	20	20	25000	-	-
11.	16	14	25000	1	20000
12.	15	15	32000	-	-
13.	8	8	25000	-	-
14.	18	18	30000	-	-
15.	10	10	30000	-	-
16.	18	18	30000	-	-
17.	18	18	40000	-	-
18.	12	12	20000	-	-
19.	15	15	20000	-	-
20.	70	70	20000	-	-
21.	10	10	20000	-	-
22.	30	30	20000	-	-
23.	30	30	25000	-	-
24.	30	30	30000	-	-
25.	20	20	25000	-	-
26.	20	20	25000		-
27.	40	40	30000	-	-
28.	50	50	30000	-	-
	578	**575**	**722000**	**3**	**60000**

Five hundred and fifty-five (575) out of the total number of 578 baskets of fresh fish bought were recorded to be of good quality while 3 baskets of the fish were said to be of lower quality. The low quality figure represents the physical losses between the point of landing and start of smoking. Considering the fact that each basket of fish should have been sold for ¢25000.00 instead of ¢20000.00 if they were of good quality, the economic loss to the processors is ¢15000.00 that is (3x¢25000.00) - (3x¢20000.00)

Reasons given for the lower quality were;

- fisherfolks kept too long at sea before bringing the fresh fish
- some of the fish were too small
- difficulty in getting fuel wood to start smoking.

Table 7: Assessment of Losses Between Smoking and Marketing

No.	FISH SOLD	GOOD QTY	UNIT PRICE(¢)	LOW QTY	UNIT PRICE(¢)	GOOD AFTER SMOKING	LOW AFTER SMOKING
1.	12	12	40000	-	-	12	-
2.	12	12	40000	-	-	12	-
3.	4	4	40000	-	-	4	-
4.	25	24	45000	1	40000	24	1
5.	20	18	40000	2	35000	20	-
6.	7	7	50000	-	-	7	-
7.	6	6	40000	-	-	6	-
8.	30	28	45000	2	40000	28	2
9.	12	12	45000	-	-	12	-
10.	19	19	40000	-	-	19	-
11.	15	13	45000	2	40000	14	1
12.	15	15	40000	-	-	15	-
13.	8	8	40000	-	-	8	-
14.	17	15	40000	2	35000	15	2
15.	10	10	50000	-	-	10	-
16.	18	18	40000	-	-	18	-
17.	18	16	45000	2	40000	17	1
18.	12	12	40000	-	-	12	-
19.	15	15	40000	-	-	15	-
20.	70	70	40000	-	-	70	-
21.	10	10	40000	-	-	10	-
22.	30	30	40000	-	-	30	-
23.	30	30	40000	-	-	30	-
24.	30	30	40000	-	-	30	-
25.	20	20	40000	-	-	20	-
26.	20	20	40000		-	20	
27.	40	40	50000	-	-	40	-
28.	50	50	50000	-	-	50	-
	575	**564**	**1185000**	**11**	**230000**	**568**	**7**

After smoking the 575 baskets of good quality fresh fish, 568 baskets turned out to be of good quality and 7 baskets were regarded as having lower quality.

Five hundred and sixty-four (564) baskets of fish out of the 575 sold were said to be of good quality while 11 were of lower quality. The 11 baskets of fish include the 7 that were considered to be of lower quality after smoking. The difference of 4 baskets could be attributed to losses that occurred during packaging, loading, transportation and unloading at market.

The economic loss associated with the 11 baskets of fish can be determined as; [(7 x ¢45000.00) + (4 x ¢40000.00)] - [(7 x ¢40000.00) + (4 x ¢35000.00)] = ¢55000.00

Reasons given for the low quality were;

- low quality fuel wood
- fish were burnt
- broken heads.

THE LOAD TRACKING SURVEY

Quality Assessment of Fresh Sardinella

The results of the "demerit" scores immediately after landing and just before the commencement of the smoking of the fish are presented in Table 8. All the parameters examined for quality assessment produced identical scores of 2 each. This implies good quality fish after landing and just before smoking. This is consistent with the results from the PRA which showed that losses only occur between capture and landing, and landing and smoking during bumper catch. Ambient temperature recorded was 29^{o}C while that of the fish was 27^{o}C. The time from landing to smoking was found to be less than one hour.

Table 8: "Demerit" scores for *fresh Sardinella between landing and smoking of the fish.

PARAMETER	QUALITY	
	At Landing Site	At Smoking site
Overall smell	2	2
Eyes	2	2
Gill colour	2	2
Texture	2	2
Slime	2	2
Appearance	2	2
Total Score	12	12

Score ranges

Good quality 2
Average quality 1
Low quality 0

*Mean score of 100 pieces of fish subjected to demerit score sheet**.**

No physical losses occurred because catches were very low.

Load Tracking of Smoked Sardinella

Tables 9 and 10 show the "demerit" scores for smoked Sardinella immediately after smoking and after transportation to market for basket 1 and basket 2 respectively. Total score after smoking for basket 1 was 12 while the score recorded after transportation was 11. For basket No. 2 (Table 10) the scores were 12 and 11.5 after smoking and transportation to the market respectively.

Table 9: Average "demerit" score for *smoked Sardinella immediately after smoking and after transportation to the market (Basket 1)

PARAMETER	"DEMERIT SCORING"	
	After smoking	after Transporting
Brittleness	2	2
Scales	2	2
Colour	2	2
Belly	2	2
Breakage	2	1
Beetle/Insect damage	2	2
Total Score	12	11

Score ranges

Good quality 2
Average quality 1
Low quality 0

*Average score of 40 pieces of fish subjected to "demerit" scoring.

Table 10: Average "demerit" for smoked Sardinella immediately after smoking and after transportation to the market (Basket 2)

PARAMETER	"DEMERIT SCORING"	
	After smoking	After Transporting
Brittleness	2	2
Scales	2	2
Colour	2	2
Belly	2	2
Breakage	2	1.5
Beetle/Insect damage	2	2
Total Score	12	11.5

Score ranges

Good quality 2
Average quality 1
Low quality 0

* Average score of 35 pieces of smoked fish subjected to demerit scoring.

Quality Assessment Of Fresh Sardinella

The study found that not much deterioration occurred in terms of quality loss. None of the fresh fish purchased for the purpose of this experiment was thrown away as being due to physical or economic losses. All the fish were smoked and came out with no sign of low quality as a result of the starting raw material. The implication of this finding is that, delay for less than one hour before smoking as recorded in this study had no effect on quality of the end product. However, further investigation is needed to fully understand the effect of delay for different periods before smoking on the overall quality of the final product.

Load Tracking – Smoked Sardinella

Results from the load tracking exercise on smoked Sardinella from Kormantse to Techiman market are presented in tables 9 and 10. Quality scores for smoked fish in basket 1 were 12 and 11 before and after load tracking respectively, thus a difference of 1.0. A similar trend was observed for Basket 2. Score of 12 after smoking and 11.5 after transportation, showing a difference of 0.5.

COMPARING THE RESULTS OF THE 3 METHODS

METHOD	PHYSICAL LOSS			QUALITY LOSS		
	Fisherfolks	Smokers	Traders	Fisherfolks	Smokers	Traders
PRA	N/A	N/A	N/A	N/A	N/A	N/A
Questionnaire	0	0	0	0.4	1.7	0.7
Load Tracking	0	0	0	0	0	6.2

- Data obtained from the PRA was mostly qualitative hence physical and quality losses could not be quantified.

- All the fisherfolks, smokers and the traders did not experienced any physical loss during the questionnaire and load tracking due to very low catches during the survey period.

- The load tracking is based on two baskets of 40 and 35 pieces of "fresh dried" herrings respectively.

- Demarcations between segments of the chain was very clear - no different interpretations.

- In order to make a reasonable comparison between the questionnaire and the load tracking method they should be applied to the same batch.

DISCUSSION

Starting with the informal survey gave a clear understanding of the background information about the fishing industry in the community and also an insight into the most appropriate period to conduct the other two surveys and the type of questions to ask. All the three surveys were done with selected people who are physically involved in the fishing business. Information obtained was, therefore precise and accurate based on experiences and actual field surveys.

Results from the three surveys which were complimentary to each other showed some consistency in the information provided. It was observed in all the three surveys that limited losses occur from the point of catch to landing site. Short distances between landing sites and smoking units (between one and two kilometres) and short interval period between landing and smoking (about two hours delay) have little influence on the quality of the final smoked product.

The PRA was done face to face with all the three groups involved in the fish catch, processing and marketing mix. This created an interactive atmosphere for exchange of ideas between the survey team and the informants which excited interest and commitment. The informants interests were further aroused when they were asked to use symbols and real objects found around the meeting place. The whole exercise needed a little bit of outsiders input after which the local people dominated the discussions. They were empowered and felt proud to own the results that came out of the discussions. The majority of the informants, however seemed to have lost concentration and interest after keeping them for more than five hours.

The questionnaire method, although could generate data for actual physical and economic loss assessment, it is very expensive and time consuming regarding to its design, training of enumerators, pretesting, administration and analysis. The high level of illiteracy of commercial operators in the fishing business limits the usefulness of this survey method in fish loss assessment. Translation and interpretation of information between the literate enumerator and the illiterate respondent add to its limitation in this exercise.

The load tracking as a survey method allowed for objective and systematic examination of a number of variables in the distribution chain which could affect quality. It is relatively, a moderate and quick way of obtaining information on all aspects of the artisanal fishery sub-sector. It gives a good balance between qualitative and quantitative assessment. It allows for a better understanding and objective balance between the local people and technocrat knowledge and perceptions, rhetoric and reality, quantitative and qualitative assessment of post harvest fish losses

Advantages of the method as found out in this study were the ability to assess the quality of both fresh and smoked fish objectively and systematically as

the fish moved through the distribution chain. Another advantage is the ability of the method in quickly assessing fish quality in the field.

The only problem associated with the method is that, it should be used when there is an appreciable amount of fish landing in and around the survey area. The exercise was carried out during the lean season. The fish was given special care. This might be a contributing factor to the very low losses experienced.

Commercial operators with basic numeracy level should be able to use the method when given the right training.

RECOMMENDATION

The questionnaire method, although generated data for actual physical and economic loss assessment, it was very expensive and time consuming regarding to its design, training of enumerators, pretesting, administration and analysis.

For better understanding and objective balance between the local people and technocrat knowledge and perceptions, rhetoric and reality, quantitative and qualitative assessment of post harvest fish losses, PRA should be used to obtain generalized information which should be verified and validated with the Load tracking method.

Further surveys of this type should be timed to meet the period of good catch, when all commercial operators would be actively involved in their businesses to reduce biases in the load tracking by given special treatment to the sampled fish.

CONCLUSION

From the field surveys it was concluded that the PRA is a good tool for eliciting general information about the fishery sub-sector as well as broad information on where, when and how losses occur. It also seeks to obtain information about local peoples perceptions and knowledge about causes and possible solutions on identified issues. However, it generates more qualitative and little quantitative data making it difficult to determine actual numerative loss assessment.

The load tracking method is good for the generation of both quantitative and qualitative data for post harvest fish losses. In Ghana this method can also be used to assess losses of perishable farm produce like fruits and vegetables.

Results obtained from the surveys cannot be said to be a good representation of post harvest fish losses in the community or that of the national average due

to the very low catches during the survey period and special treatment given to
the test fish. In order to obtain a more accurate and reliable result, the survey should be repeated at different seasons at the same community. There is also the need to replicate it in other communities in the artisanal fishery zone.

Appendix 1

KEY PEOPLE CONTACTED At KORMANTSE

1. Hannah Abban - Secretary of No. 1 Fish Smokers Association
2. Nana Kwame Esuon II - Chief of Kormantse
3. Mr. Titi Arthur - Assemblyman
4. Abba Yankaa - Leader of No. 1 Fish Smokers Association
5. Felicia Ofori - Participated in the Accra Workshop
6. Juliet Acquah - Participated in the Accra Workshop
7. Kwabena Tawia - Chief Fisherman
8. Abena Nyarkoa - Leader of No. 2 Fish Smokers Association
9. Mary Ottoo - Secretary of No. 2 Fish Smokers Association

Appendix 2

PRA Checklist for SSI - Fisherfolks

FISHING METHODS

- Gear - types, numbers, ownership
- Boats - types, numbers, ownership
- Number of people involved and their responsibilities
- Where do they fish
- Time spent at sea
- Seasonality
- Weather effects

TYPES OF FISH

- Different Species
- Quantity of different species caught
- Quality of the catch
- Handling on board.
- Use of ice ?

LANDING

- Quality of fish at landing
- Quantity of fish landed
- Grading of fish - criteria used
- Pricing of different grades

LOSSES

- Types of losses
- Losses during fishing operation
- Losses between capture and landing
- Reasons for losses
- What quantity of fish is thrown away
- What happens to it
- Are losses perceived as a problem
- How do they reduce losses

OTHER ACTIVITIES

- What other forms of work do they do
- When do they do other jobs
- What portion of their income comes from fishing

Appendix 3

PRA Checklist for SSI - Processors

GENERAL INFORMATION

- Types of processing unit/smoker
- Capacities of different types of smoker
- Ownership of the smoking units
- Number of people involved in each unit
- Scale of operations. How many people have x numbers of unit, y numbers etc.
- How many people employ non family members as help hands
- Types of firewood used and costs, which are best - ranking

FISH TYPES AND PROCESSING

- Different species - scoring and ranking
- Seasonality
- Quantity of fish bought
- Units of measure
- Prices per unit - different species
- Transport to the processing site
- Sorting of the fish
- Smoking times
- Effect of weather on processing
- Amount of wood used

LOSSES

- Before smoking
- During smoking
- After smoking
- Reasons for losses
- Measures taken to reduce losses

STORAGE

- Reasons for storage
- Where
- Facilities
- How long
- Costs of storage
- Seasonality of storage
- Problems and solutions

Appendix 4

QUESTIONNAIRE FOR POST-HARVEST FISH LOSS ASSESSMENT AT KORMANTSE

FISHERFOLKS

(Make sure all answers relate to a single boat that the person fish in)

1. What is your name?**.....**

2. What is the name or number of your canoe**?.....**

3. When did you last go fishing? **Date.....**
(IF MORE THAN 7 DAYS AGO, END OF QUESTIONS)

4. How much fish did you catch?

(a)unit.....(b) number of units.....

5. How much of the fish did you throw before landing?

(a)unit.....(b) number of units.....

(c) Reason.....

6. How much of the fish did you keep (brought to shore)?

(a)unit.....(b) number of units.....

7. Did you throw any fish after landing?**.....**

(a)unit.....(b) number of units.....

(c)Reason.....

8. How much fish of good quality did you sell?

(a)unit.....(b) number of units..... (c) price per unit.....

9. How much fish did you sell at a lower price?

(a)unit.....(b) number of units..... (c) price per unit.....

(d) Reason.....

10. Did you take any fish for home consumption or give to others?

(a)unit.....(b) number of units.....

(c) Reason.....

Appendix 5

QUESTIONNAIRE FOR POST-HARVEST FISH LOSS ASSESSMENT AT KORMANTSE

FISH PROCESSORS

All questions relate to a single specie fish e.g. Anchovies or Herrings

1. What is your name or the name of your processing shed? **.....**
2. When was the last time you sold smoked fish?**.....**

(If More Than 14 Days, End Of Questions)

3. How much fish did you sell? **(a) Unit.....(b) number of units.....**
4. How much good quality smoked fish did you sell?

(a)unit.....(b) number of units.....(c) price per unit.....

5. How much fish did you sell at a lower price?

(a)unit.....(b) number of units..... (c) price per unit.....

Why was the quality of the fish lower?

6. When did you buy the fresh fish?**.....**
7. How much fresh fish did you buy? **(a) Unit.....(b) number of units.....**
8. How much good quality fresh fish did you buy?

(a)unit.....(b) number of units..... (c) price per unit.....

9. How much fish did you buy at lower quality?

(a)unit.....(b) number of units..... (c) price per unit.....

Why was the quality of the fish lower?

10. How much fish did you take home for family consumption or give to others

(a)unit.....(b) number of units....*(c) Why was the quality of the fish lower?*

11. How much fish did you lose before smoking? **(a)unit....(b) number of units....**
12. How much good quality fish did you have after smoking?.**(a)unit..... (b)number of units.....**
13. How much fish of lower quality did you have after smoking? **(a)unit..... (b)number of units.....**
14. What are the reasons for the lower quality fish?
15. What did you do with the lower quality fish?

Appendix 6

RESPONDENTS - FISHERFOLKS

NAME	CANOE	FISHING TIME
1. Kwaku Ano	Dadaba	6
2. Kwesi Begyima	Use Force	4
3. Kwame Ahor	City Line	30
4. Kwame Atta	Show Boy	16
5. Kwesi Imprimu	Delmas	16
6. Kwesi Narkwa	Apese	28
7. Kwame Takyi	Alomo	21
8. Yaw Addo	Boo Say	40
9. Kofi Atta Payin	Jesus Reba	21
10. Amma Adoma (F)	Kotoka	31
11. Kwame Efirimu	Kotoko	21
12. Kweku Essel	City Boy	28
13. Kofi Amoah	Apaapa No. 3	16
14. John Qurashie	Hasmal	32
15. Kwame Wi	Egya Pa Ye	16
16. Kofi Minta	Tema Boys	28
17. Kwame Acheampong	Matthew 5	28
18. Kwaku Bosompem	Aye Dwe	28
19. Kwame Badu	Good Mother	28
20. Kofi Aidoo	Nyame Na Ose	28
21. Adjoa Aponkye	Ocran Boys	21
22. Kow Gyaaha	Emmanuel	21
23. Kobina Yanka	Smart Boys	20
24. Kofi Samaa	Twere Nyame	20
25. Grace Mends (F)	Ebenezer	20
26. Ekow Sofo	God's Time	20
27. Kobina Yinku	Bernasko	15
28. Kobina Asaase	More Time	21
29. Adjoa Tawia (F)	Nyimpa Ye Bad	10
30. Kofi Donkor	Sunkwa Boys	13
31. Kofi Akyere	Asodzi	10
32. Kofi Kakraba	Lucky Boy	4
33. Kwame Esson	Happy Boys	5
34. Kofi Akyen	Odzimafo Jesus	5
35. Kojo Awotwe	Onyame Beye	7
36. Kow Mensah	Osibisa	5
37. Ekua Baduwa (F)	Aben Woha	4
38. Kwesi Tawia	Nana Ampadu	12
39. Kwesi Arhin	Dr Paabobo	12
40. Kwabena Tawia	Obeyeyie	12
41. Kwaku Atta	Dwarfs	6
42. Atto Kwamina	Nkansa Boys	10
43. Kwesi Nyame	Onso Nyameye	3
44. Kwame Fynn	Appapa Boys	6
45. Kwabena Gaisie	Elimina Boys	5
46. Kwasi Poku	Japo Boys	6
47. Adjoa Amissah (F)	Amissah Boys	3
48. Kofi Abam	Ewuradzie Kasa	3
49. Kwesi Brow	Apese No. 2	4
50. Kwesi Ewul	Nyame Bekyere	6

Appendix 7

RESPONDENTS - PROCESSORS

NAME	LAST TIME SMOKED FISHED (DAY)	LAST TIME BOUGHT FRESH FISH (DAYS)
1. Thank You Jesus	3	4
2. Nana Awoh	2	4
3. Efua Manan	43	-
4. Aba Atia	20	-
5. Good God	5	8
6. God is King	5	6
7. Ama Adoma	1	3
8. Peace and Love	2	4
9. Love Sweet	6	8
10. Action	9	11
11. Nyane Na Ose	4	7
12. Dada Ba	5	7
13. Adwoa Tawia	2	4
14. Aggie	11	13
15. Abba Essoun	28	-
16. Good Name	15	-
17. Takyiwa	1	2
18. Twer Nyame	2	6
19. Adjoa Buduwa	4	6
20. Adom A.	3	7
21. Suro Nipa	12	13
22. Two Heads	5	7
23. Adjoa Ska	6	7
24. Adjoa Tami	7	5
25. Esi Fadzi	5	5
26. Araba Atta	5	6
27. Adjoa Darko	7	4
28. Nana Adjoa	4	3
29. Abba Yanka	7	8
30. Akua Awotwe	6	5
31. Ama Eduma	5	4
32. Maa Yaa	39	-
33. Harribelle Sam	37	-
34. Esi Kakra	32	-
35. Bantre Adjoa	35	-
36. Bo Me Nkomo	28	-
37. Kawatum	32	-
38. Attaa	31	-
39. Jah Bless	60	-
40. Sekune Sons	27	-
41. Ante Ekua	26	-
42. Maa Peyin	24	-
43. Kyerewaa Brew	40	-
44. Maame Lynn	17	-
45. Baaba	15	-
46. Araba Quayson	23	-
47. Yaaba Essandoh	30	-
48. Ekua Sam	26	-
49. Maame Ekua	19	-
50. Amma Fuah	18	

Appendix 8

Demerit Score Sheet For Fresh Fish

PARAMETER	**QUALITY**		
	Good (2)	**Average (1)**	**Low Quality (0)**
Overall smell	Fresh	Neutral	Bad
Eyes	Clear	Cloudy	White
Gill colour	Red	Brown	White/not red
Texture	Firm	Loose	Soft
Slime	Thin	Thick	Creamy
Appearance	Shiny	Slightly dull	Dull

Appendix 9

Demerit Score Sheet For Smoked Fish

PARAMETER	QUALITY		
	GOOD (2)	AVERAGE (1)	LOW QUALITY (0)
Brittleness	Hard	Slightly soft	Soft and crumbly
Scales	Smooth	Loose	Raised and/or missing
Colour	Shiny brown	brown	Black/red
Belly	Complete	Broken	Missing
Breakage	Not broken	Head or tail broken	Body broken
Beetle/Insect damage	None	Slight	Very noticeable