Post Harvest Fisheries Research Programme
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A Manual for Assessing Post Harvest Fisheries Losses

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Overseas Development Administration

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Natural Resources Institute

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Natural Resources Institute

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Abbreviations

FAO	Food and Agriculture Organization of the United Nations
NGO	Non-Governmental Organisation
NRI	Natural Resources Institute
PALM	Participatory Analysis and Learning Methods
PRA	Participatory Rural Analysis
ODA	Overseas Development Administration
PHFRP	Post Harvest Fisheries Research Programme
RRA	Rapid Rural Appraisal
SSI	Semi-Structured Interview

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Chapter 1 *Introduction*

Background

The scope to harvest more fish from the world's oceans, lakes and rivers is now much more limited. At the same time it is widely recognised that from the point of capture to the consumer a certain amount of the harvested fish is lost physically or the value of the fish is reduced because of quality changes or market forces.

One of the ways of reducing the gap between fish supply or production and demand is to reduce post-harvest fish losses. The cost-effective reduction of post-harvest fish losses is likely to increase the level of income to fishing communities and at the same time increase food security.

In order to plan loss reduction strategies, information is needed on the size of losses, the reasons why losses occur and the socio-economic context within which they are found.

This manual is a guide to methodologies that can be used to generate the infomation necessary to plan loss reduction strategies. The methodologies will assist the fisheries planner and policy maker to understand more fully post-harvest fish losses from both a quantitative and a qualitative angle.

One of the main reasons why this research and development of loss assessment methodologies was carried out was because much of the historical data available on post-harvest fish losses, especially loss levels, is derived from limited and unsystematic observations and studies. In many cases the way that data have been collected and interpreted is not clear, neither is the type of loss being measured. Poulter *et al.* (1988) describe the problem in these words

> "very few quantitative studies of actual losses have been undertaken and much of the available data is therefore actually based on qualitative estimates sometimes involving rather massive extrapolation from single landing sites to whole countries, even regions .....the inherent error in the data needs to be emphasised at all stages".

Until now little effort has been made to develop systematic and practical assessment methodologies that can generate accurate information on post-harvest fish losses. Methodologies have been developed by FAO (FAO, 1981) and NRI (Wood, 1986) and

this work has been a starting point for the methodologies presented in this manual. Morrissey (1988) sums up some of the key reasons which had so far prevented the development of a loss quantification methodology

> "...the number of species of fish that are involved in fisheries in tropical waters, the lack of uniformity in weight and shape that occurs in small-scale fisheries and their variability of spoilage rates under differing conditions. In addition to this is the fractured distribution system of fresh fish that is found in less developed countries with the involvement of many fishing groups and several levels of middlemen throughout the distribution chain."

The impetus for the development of methodologies presented in this manual was the meeting for the Strategy for International Fisheries Research in 1991 which recommended that post-harvest fish losses should be a priority issue for future research. It was concluded that there were no tried and tested techniques by which losses could be assessed. Clearly there was a need to develop sound and widely applicable methodologies, not only quantify fish losses, but also to assist fisheries policy makers and planners to understand the context of losses more fully.

The Manual

This is a manual of post-harvest fish loss assessment methodologies. The manual describes two methodologies that can be used to generate information on post-harvest fish losses. Chapter 2 describes the informal methodology which will generate qualitative and indicative quantitative data on post-harvest fish losses. Chapter 3 describes a recall questionnaire methodology designed to generate quantitative data.

The data these methodologies produce will assist those responsible for fisheries planning and policy making to understand fish losses and to go on, if need be, to make informed decisions about how best to reduce losses.

The manual draws heavily on research by the ODA-funded NRI Post-harvest Fish Losses Project which over a period of three years set out to develop and field test methodologies to assess post-harvest fish losses. It is designed to be a practical guide for those who wish to investigate post-harvest fish losses and is aimed at those who will be involved in implementing loss assessments, i.e. fisheries researchers, extension workers, post-harvest specialists and socio-economists. The manual will be of interest to those working for bilateral and multilateral organisations who are concerned with fisheries development and management issues and the reduction of post-harvest fish losses.

Although the methodologies presented were developed in the context of artisanal fisheries there may be scope for the manual to be used by people in private sector business to characterise losses in their particular environment for the purpose of increasing efficiency and profit.

Post-harvest Fish Losses

The term **post-harvest** refers to the period of time from when a fish is separated from its growth medium (Morrissey, 1988). This includes the time a fish enters a net, is caught on a hook or in a trap.

Fish is one of the most perishable of all protein foods. Once caught or harvested it is paramount that measures are taken to slow down spoilage and preserve it, otherwise losses may occur.

The methodologies described in this manual are designed to generate data on **physical** losses, **quality** losses and **market force** losses. These can occur at any point in a distribution chain, from the capture of fish to final consumption. The assessment of biochemical nutritional losses in fish and fish products are not the focus of this manual.

One of the major problems in using some loss data is that rarely is it clear what type of loss the data refer to, neither is it clear how the data were collected. It is recommended therefore that whenever data on losses are presented the type of loss is clearly defined and the method used for assessment also made clear. The following are definitions of types of post-harvest fish loss of which researchers should be aware. It is up to the user of the manual to decide which of these losses are a priority for assessment. It could be argued that physical loss and quality loss are likely to rank as higher priority than market force losses. They are also easier to assess than the latter.

Physical loss refers to fish that is either thrown away or is consumed by insects or animals. This type of loss can be measured in terms of weight and in terms of monetary value. In other words a physical loss can also be a financial loss.
The following are examples of causes of physical loss:

- *spoilage*
- *attack by insects*
- *eaten by animals*
- *oversupply*
- *theft*
- *discarded by-catch (trash fish).*

A **loss** in **quality** will often lead to fish being sold for less money than it could otherwise have realised because the market recognises differences in quality.

Examples of quality loss are:

- *fish has spoiled, but it is still saleable, and is sold for a price less than the price it would have been sold for had it been in good condition*
- *dried fish is damaged during processing or during transport and as a result is sold for a reduced price.*

BOX 1

On arrival at Kariakoo Market the smoked fish is sorted and the broken pieces, known as kachala, put to one side. On average there are 15 broken pieces per kilo. Breakage is caused during processing and packing. In a load of 400 kg, 2.5% can be broken, but this can increase to 25% if the processing and packing is careless. This broken fish is sold for human consumption by the bundle (50 kg) for 15 000 Tsh. Breakage is also caused by rough journeys, and repeated handling at the marketing stage. Excessive breakage of smoked fish is one of the reasons why salting has become popular.

Fish that have spoiled and consequently sold for a reduced price are often said to have been **downgraded**. Fish that have spoiled so that they are sold to a different market or are sold for processing are sometimes referred to as **rejected** fish.

Similarly, because of changes in demand and supply but not quality, the price of fish can also change. This type of loss is termed a **market force** loss. If price drops because of an oversupply of fish to the market then the seller can incur a loss.

Market force losses are the most difficult to measure accurately since they could be defined as either a loss due to a drop in price below an optimum price, or a loss because marketing and production costs outweigh revenue earned.

Both quality and market force losses are sometimes referred to in the manual as **reduced price losses** and like physical losses can be measured in monetary or percentage terms. To measure them in monetary terms will require the use of price discounts as proxy indicators.

Fish of poor quality that are sold for a reduced price may mean an economic loss to the seller, but such fish may also be a source of cheap protein for people who may not otherwise be able to afford higher prices for better quality products. The elimination of an economic loss may therefore remove a supply of cheap protein for people.

Physical loss is combined with reduced price loss to give **total loss,** which is used to quantify and summarise overall losses in a particular fishery or sector. For example, a fisherman may experience more than one type of loss at the same time. He may sell some fish for a reduced price and also throw away some fish from the same catch.

A simple way to define the total loss is to calculate the maximum value of the whole catch had it all been sold for the **best** price. Then calculate the value of fish thrown away and the loss in revenue as a result of selling fish for a reduced price. These two values are added together and the total is expressed as a percentage of the maximum value of the catch, or simply as a monetary value.

In many fisheries the best available means are used to retard spoilage and preserve fish, but for economic, technical or social reasons these are not always adequate enough to prevent post-harvest fish losses.

There are a number of general factors that can increase the likelihood of post-harvest losses. These include:

- *unreliable transportation*
- *inadequate preservation techniques*
- *adverse weather conditions*
- *fish supply greater than demand*
- *market for fish not developed.*

Table 1 shows why and where losses can occur within a fish distribution system.

Table 1- Distribution Stages and Reasons For Losses

Distribution Stage	Cause of Loss
Fishing	fish spend too long in nets and spoil
	fish exposed to high ambient temperatures in boat
Processing	adverse weather conditions
	insect infestation
Transport	mechanical damage to fish
	delays
Storage	poor storage facilities leading to spoilage
	insect infestation
Marketing	insect infestation
	supply and demand

Pricing

Since prices are used as an indicator of losses and for measuring losses in both the informal and formal methodologies covered in the manual it is worth highlighting some of the key factors to remember or be aware of when recording prices during fieldwork and data collection.

Fish is a highly perishable commodity and like many other such foods the price at which it is sold can vary on a weekly, daily and even hourly basis. Traders often accept that they will not be able to sell all their fish at the same price irrespective of quality changes.

For example, at a major urban fresh fish wholesale and retail market in India one merchant commented that he will try to sell all the fish he buys in the morning by the end of the day even if this means dropping the price of the fish. This was so he would avoid the cost of icing the fish overnight and would not have to worry about fish being stolen when held overnight.

Furthermore, price reductions may not necessarily be a loss in the sense that they may be part of a promotional marketing strategy to attract customers.

The manual includes references to the **best price**, which is used as a bench mark to measure loss due to price reductions. It is recomended that the best price is an average price based on several observations taken over the course of a sampling period.
There are two ways in which average prices can be measured, i.e. **weighted average selling price** and **clean average pricing**.

Weighted Average Price

Assume a 100 kg consignment of fresh mackerel is sold as follows:
50 kg sold at 100 sh = 5000
20 kg sold at 75 sh = 1500
20 kg sold at 50 sh = 1000
5 kg sold at 20 sh = 100
(5 kg which cannot be sold)

Total revenue = 7600

The average selling price is 7600/100 = 76 sh

(For more information see Shepherd, 1993.)

Clean Average Price

If five prices are available for a particular fish or from different respondents:

1	15
2	22.5
3	22.5
4	20
5	20

Step 1 Cross out the highest price (22.5) and the lowest price (15).

Step 2 Calculate the average of the remaining three prices
(20 + 20 + 22.5)/3 = 62.5/3 = 20.83

Step 3 Round off the average to the nearest 0.5
20.83 becomes 21

A similar process is applied to other numbers of prices.

(For more information see Shubert, B., 1983.)

Bear in mind that collecting detailed data on prices may adversely affect the rapport between researcher and respondent. Likewise, a great deal of data on prices can make data anlysis complicated and lengthy.

The Methodologies

Chapter 2 of the manual describes the informal methodology, which is based on the tools and techniques of Rapid and Participatory Appraisal. It is designed to generate qualitative and indicative quantitative data on fish losses, especially :

- *indicative physical and economic loss levels*
- *estimates of monetary losses*
- *reasons for losses*
- *seasonal variations in loss levels*
- *the perceptions of fish losses by those who are affected by them*
- *importance of fish losses compared to other issues*
- *historical levels of fish losses.*

Chapter 3 describes a methodology based on a formal questionnaire survey which is used to generate quantitative data on losses. The raw data are collected at selected sites by enumerators over a set period of time. It is then entered into a computer database and analysed. The data this methodology will produce will be primarily quantitative and can be used to generate information on the following:

- *financial value of fish losses per fisherman or processor*
- *percentage levels of physical loss; economic loss and total loss*
- *the reasons why losses occur*
- *what happens to fish that is classified as a loss.*

Which Method to Use

The decision on which methodology to use will depend on the resources available and the type of data required.

Before deciding which methodology to use decide which fishery or fisheries are to be assessed for losses. Then identify the availablity of the key resources needed for applying the methodologies, i.e. human resources, finance and time.

The informal methodology is less costly than the formal questionnaire methodology and requires less time to implement. A typical formal questionnaire survey would cost 20% more than an informal survey of the same fishery and would require three times the number of man days for implementation.

The user should now decide the type of data required and when it is required by.

If a comprehensive quantitiative assessment of losses is required then a questionnaire survey would be appropriate. If data to understand losses and an indication of loss levels are required then the informal methodology would be appropriate. If the data on losses are required quickly then again the informal methodology would be appropriate. If a thorough understanding of losses is required then the questionnaire survey should be done in conjunction with informal methodology studies.

If the questionnaire methodology is to be used then a **pre-survey appraisal** or **exploratory study** should be carried out for the fishery or sector that has been identified for assessment using the informal methodology described in Chapter 2.

Chapter 2 *Informal Fish Loss Assessments*

This part of the manual describes the informal fish loss assessment methodology, which is a planned yet flexible way to collect qualitative and indicative quantitative data on post-harvest fish losses.

The recently emerged qualitative methodologies for data collection such as **Rapid Rural Appraisal** (RRA), have formed the basis of the informal fish loss assessment methodology presented in this chapter. RRA emerged in the late 1970s, as a reaction to the general dissatisfaction with the biases inherent in the 'rural development tourist' approach (Pretty *et al.,* 1995). Conway (1986) defined RRA as

> " a systematic activity carried out in the field by a multi-disciplinary team designed to acquire quickly new information on and new hypotheses about rural life".

For the the informal loss assessment methodology substitute fisheries and losses for rural life.

The informal methodology can be used to produce data on the following issues:

- *indicative physical and quality loss levels*
- *estimates of monetary losses*
- *reasons for losses*
- *seasonal variations in loss levels*
- *the perceptions of fish losses by those who are affected*
- *importance of fish losses compared to other issues*
- *historical levels of fish losses.*

This is important information to know if loss reduction strategies are to be well planned.

This method relies on a team of specialists using **Semi-Structured Interviews** (SSI) (see page 26) to interview people in a fishery about the fishery and particularly losses. The interviews are supported by other data collection methods, such as observation and diagram tools, which facilitate dialogue during an interview as well as generate data. The key components of the methodology are shown in Table 2.

Table 2 - Key Components of the Informal Fish Loss Assessment Methodology

Planning	Research framework	hypotheses, indicators, measurements, information, sources, tools and techniques, time schedule
	Check-list	who, what, where, why, when, how
Fieldwork	Tools	semi-structured interviews, maps, observation calendars, ranking, demerits, flow diagrams
	Techniques	timing, triangulation, flexibility, bias, patience, discussion of data
Reporting	Report writing	hypotheses, team

The methodology is now described in the following stages:

- *types of study*
- *resources required to undertake a study*
- *planning*
- *fieldwork methods and principles*
- *reporting*
- *examples from loss assessments*
- *problems.*

Methodology Uses

The methodology can be used to assess fish losses in most fishery sectors and marketing stages in small-scale and industrialised fisheries. It can be applied in a short space of time to produce data (results) quickly.

There are a number of different ways the informal methodology can be used. It can be used for exploratory studies of fishery sectors and losses or for more focused, topical studies.

It can be used to generate qualitative and indicative quantitative data either as a stand alone loss assessment method or it can be used in conjunction with the questionnaire methodology. It can also be used to carry out pre-survey appraisals for the questionnaire methodology. More on this is can be found in Chapter 3.

Exploratory Studies

Exploratory studies produce general qualitative and indicative quantitative information on a fishery and fish losses. They can also be used to:

- *help explain or understand quantitative data produced by a formal questionnaire type survey*
- *be used to form hypotheses for further, more detailed (topical) studies*
- *generate information which can be used to formulate questions for a questionnaire survey*

- *identify data recording sites for questionnaire survey*
- *identify times for data recording for questionnaire survey*
- *identify fish species to target for questionnaire survey.*

Topical Studies

A typical topical study explores a specific topic, problem or issue in more depth. Such a study can follow on from the understanding built up by exploratory studies and focus on the qualitative nature of specific pre-defined losses or on key stages in the fish marketing chain. Topical studies should specifically address the 'why, when, how, where and who' of fish losses, at the same time clarifying the perceptions of losses by those affected or influenced by them. If the studies are very specific they may be termed **case studies**.

Examples of how the methodology can be used in a topical manner:

- *used by factory management to generate information on the losses that occur in a fish supply or processing system*
- *used by a research team to assess the losses in a particular distribution system in use in a country or fishery. The data from such a study can be used as bench-mark data to which data on losses in other fisheries can be compared.*

More information on exploratory and topical studies can be found in the Planning Section, page 13.

Resources Needed

The Team

The most important resource for an informal fish loss assessment is the research team which should:

- be motivated, multi-disciplinary and consist of technical specialists
- have enquiring minds and be well educated
- consist of an optimal 2 or 3 persons
- have an understanding of and experience in using informal data collection techniques such as RRA and Participatory Rural Appraisal (PRA), or similar informal data collection methods such as Participatory Action Research (PAR) and Participatory Analysis and Learning Methods (PALM).

A small team can usually work discreetly and be less intimidating to respondents. It may also be practical to use more than one team for a study.

TIP 1

A typical team for a study of losses in a distribution chain would include a socio-economist, a post-harvest fishery technologist and a marketing specialist.

"PRA is not mainly a matter of techniques. The most important quality an individual needs in order to conduct a successful PRA is an appropriate attitude towards participatory methods and the members of rural communities. This is often quite different to the attitude of many development professionals in which the educated expert knows what is best for the less educated farmer. Central to participatory approaches is the need to learn directly from the rural community members (Nabasa *et al.*, 1995)."

Sufficient time should be set aside prior to fieldwork to train the team or help them revive their use of the methodology methods and principles. Training should include adequate hands-on supervised practical fieldwork. Training guidelines can be found in Townsley (1993) and Pretty *et al.* (1995)

Skilled specialists are often in high demand. So it may be practical to establish a pool of specialists from which the team will be chosen. This is particularly important if the fieldwork is carried out over a prolonged period or conducted several times in a year or certain period. The team can be chosen according to availability. The pool would be involved in initial planning and perhaps monitoring of the fieldwork.

Finance

Funds will be required for:

- staff time
- travel
- stationery
- equipment (i.e. computer, weighing scales, thermometer and waterproofs).

Table 3 is a guide to the requirements for a typical loss assessment programme covering four fishery sectors in four different regions of a country. It assumes that 10 people are formally trained in the methodology at the start. You should substitute your own costs.

Table 3 - Estimated Requirements for Informal Study of Four Fishery Sectors in Four Regions of a Country

Category	Item	Days
Training	10 staff	5
Fieldwork	4 people x 4 regions x 4 sectors x 4 days per sector	256
	travel	
	report writing for 4 regions x 8 days	32
Equipment and	stationery	
consumables	lap top computer + printer + consumables contingencies	
	TOTAL DAYS	**293**

Planning

Planning is necessary in order to decide:

- *the type of data required*
- *where data collection will be done*
- *who will be involved in fieldwork*
- *how will fieldwork be conducted*
- *a check-list of topics and questions to guide fieldwork*
- *the equipment needed for the collection process.*

By going through the planning framework in Table 4 the team will think through in detail what the study is trying to achieve and how to achieve it. The team which is to carry out the study should go through this framework together, as a group, and if possible with other people who are thought able to contribute at the planning stage. It may be possible to arrange a preliminary workshop to discuss the fieldwork with government departments, NGOs, field-based fisheries staff and fisherfolk (Townsley, 1993). Similarly it is worthwhile locating and looking at secondary sources of information on the fishery to be studied and summarising key points which can be discussed during the planning process. An extension of this is a formal desk study also known as a literature study.

A poorly planned study will fail to address its objectives and will not provide adequate information to decision makers.

A study plan should be flexible. No matter how well thought out a plan is beforehand, there are likely to be uncertainties which will become evident as fieldwork progresses.

For example, during fieldwork an important data collection site may be discovered that was not included in the original plan, if possible the site should be incorporated in to the fieldwork. Flexibility is one of the most important inherent features of this methodology.

The following is a summary of the components of the planning framework and Table 5 sets out the differences between exploratory and topical studies in relation to the planning stages.

Table 4 - Planning Framework Summary

Number	Task
1.	Set objectives
2.	Set hypotheses—a statement that the study should prove or disprove
3.	What can indicate whether the hypothesis is right or wrong?
4.	What information is required to achieve the objectives and to determine the indicators and therefore prove or disprove the hypothesis?
5.	Where will the data come from? - secondary sources - fieldwork
6.	Site Selection—where should fieldwork be conducted?
7.	What are the key tools and techniques to use during the fieldwork?
8.	The team members—who will do what?
9.	When should fieldwork be conducted and for how long?
10.	What equipment is needed for fieldwork?
11.	Create a check-list to assist data collection

Objectives

Setting the objectives is one of the most crucial steps in a survey. The objectives of the assessment will be formed as a result of the team or 'pool' discussing the planning process outlined here.

> ".....setting objectives. This is so often ignored, or taken as being obvious, that it is necessary to affirm its importance at every possible opportunity" (Gilling and Cropley 1993).

If the objectives are not discussed and determined beforehand, the assessment will be prey to unfocused and arbitrary questions during fieldwork which will result in a failure to find out about key issues and lead to the formation of weak conclusions.

Objectives are influenced by:

- *what data is required*
- *what information is already available*
- *whether the study is exploratory or topical*
- *how much time is available for the assessment.*

Whether the study is topical or exploratory the methodology will be the same, but the objectives will be different. For an exploratory study the objective will be broad, whereas a topical study will have more focused objectives.

Hypothesis

Once the objectives are clear, it is then useful (but not compulsory) to develop, form or determine a hyphothesis or hypotheses. This will help focus the study at the planning stage. A hypothesis is what the study will aim to prove or disprove.

Indicators

The indicators are what the study should eventually quantify or measure. They are used to decide whether the hyphothesis is true or false.

Similarly, an indicator of whether losses are important would be the perceptions of fisherfolk and traders who are experiencing losses i.e. do they see losses as a major problem or are losses taken for granted?

> "The perception of some traders in Madras and Vizag was that quality losses were not a significant problem. If possible traders would compensate for selling fish at a loss by selling the better quality fish for a high price" (Ward *et al.*, 1996).

Indicators could also be the monetary significance of losses. Therefore, finding out about fish prices and seasonal levels of loss, the number of operators and frequency of operation would assist in quantifying the indicators.

Information

Information refers to the information which the study team should collect during the fieldwork to assist in measuring the indicators and in meeting the objectives of the study. The information should be defined as a list of topics related to the study. The list can be produced by 'brain storming' by the team during the planning stage. The topics must relate to the indicators or the objectives of the study. The list of topics will also be used as the basis for a check-list by the study team during fieldwork (see section on check-list, page 22).

Other topics such as fishing methods and the reasons why losses occur are also included in the topic list because knowing about these will give a better understanding of the sector and thus improve the quality of any subsequent decisions based on the study findings.

Table 5 - Differences between Exploratory and Topical Studies

	Exploratory	Topical
Objectives	Assess the importance of post-harvest fish losses in the LakeVictoria fishing sector in both qualitative and quantitative terms.	Define the perceptions of smoked fish losses by women fish processors in Kayenze fishing village.
Hypotheses	(a) In quantitative terms fish losses are high and are affecting the less well-off fisherfolk who are concerned about losses.	(a) Women fish smokers are more concerned about smoked fish losses than losses in other income-generating activities.
	(b) Losses are seasonal and not a problem as fisherfolk rely on other sources of income which are more important than fishing.	(b) Women processors are not concerned about smoked fish losses.
Indicators	(a) The monetary value of fish losses to fisherfolk according to different wealth groupings.	(a) and (b) Levels of smoked fish losses in monetary terms; other losses; perceptions of women fish processors.
	(b) Loss levels according to seasons; importance of other sources of income.	
Information	Numbers of operators (fisherfolk, traders); frequency of operation (fishing); fish species and products; fishing methods; prices of fish.	Numbers of women processors; frequency of smoking; fish species and products; processing method; prices; traditional units of fish measurement; grades of fish; monetary value of fish losses; fish handling and processing procedures; the reasons why losses occur.
	Traditional units of fish measurement; grades of fish; monetary value of fish losses; fish handling and processing procedures; the reasons why losses occur; seasonal levels and variations of losses; the perceptions of losses by fisherfolk; importance of fishing to other income-generating activities; socio-economic background of the community.	Seasonal levels and variations of losses; the perceptions of losses by processors; importance of processing to other income-generating activities; socio-economic background of the community.
Sources of information	Primary: fisherfolk, boat and gear owners, fish traders, community officials.	Primary: women processors, processors, fish traders, community leaders.

	Exploratory	Topical
Site selection	Secondary: reports, newspapers, articles, market and fish landing data, statistics, people who have worked in the sector. Fishing communities, fish markets, fishing harbours, beaches or landing areas. Libraries, government departments, NGOs.	Secondary: reports, newspapers, articles, market and fish landing data, statistics, people who have worked in the sector. Fishing communities, fish markets, processing sites. Libraries, government departments, NGOs.
Tools	SSIs, observation, wealth ranking, calendars.	SSIs, observation, wealth ranking, calendars.
Study team	3 people—fisheries technologist, socio-economist, anthropologist. Note-taking shared, team meeting at the end of each fieldwork session. Report to be written by team and a draft ready one week after fieldwork finishes.	3 or 4 people—fisheries technologist, socio-economist, anthropologist, women in development specialist. Shared note-taking, two teams of two, discussions at the end of each fieldwork session. Report to be written by team and a draft ready one week after fieldwork finishes.
Time	2 days travel time, 4 days fieldwork, 3 days report writing. Visit in warm season when losses possibly highest.	4 days fieldwork, 3 days report writing. Visit before and during marketing of smoked fish.
Equipment	Thermometer, weighing scales, camera.	Weighing scales, camping equipment.

Sources of Information

There are two main sources of data: **primary sources** and **secondary sources.**
Primary data is that which is collected during fieldwork from interviews and observation.

In general terms sources of primary data are:

- *fisherfolk, processors, transporters, traders, wholesalers, retailers*
- *the owners of capital equipment, i.e. boats, shops, etc.*
- *community elders*
- *other members of the community*
- *national and local government staff*
- *staff of transport organisations*
- *consumers of fish*
- *processing factory staff.*

Secondary sources of data are defined as information already produced such as reports, journals and newspapers. Surveys of sites or areas can be useful sources of data on population, livelihood and key issues and problems. Fisheries Department Offices and Agricultural Departments will be good places to approach for reports and surveys. Multilateral organisations may have libraries to which researchers could have access. University libraries are also another source of secondary data.

During an assessment of losses in the Nile perch fishery of Lake Victoria the study team came across a report of a socio-economic survey of fishing communities written 3 years earlier. The survey prioritised the problems faced by fisherfolk. Interestingly post-harvest fish losses were not perceived by the fisherfolk as a problem. This information was obviously useful to compare with data collected during the assessment fieldwork.

Secondary sources should be used before (during planning), during and after fieldwork. Prior to planning and fieldwork secondary source data should be used to provide background information to help the study team understand some of the issues likely to arise during fieldwork. The extract below from a marketing bulletin (November 1996) clearly highlights some of the key issues which should be explored during fieldwork. It also gives the team an idea of when will be the best time to observe losses.

> "The rainy season is virtually over, sea conditions have become relatively calm and fishing activities are intensifying. Consequently, landings have increased appreciably and major post-harvest problems are beginning to re-appear ...increased *bonga* landings caused the price of the product to plummet by 50% in the first two weeks of October. In the last two weeks of the month landings were so abundant that fresh *bonga* was being discarded in the dump due to lack of storage facilities ." (Infopeche 1996).

Secondary sources can be a good source of historical data which can be compared to recent data to identify any changes over time.

It is also worth talking to people who have been to the fieldwork sites or who work there or who are familiar with the issues of the study.

Try to be objective about the information in secondary sources, some information may be old and some data may have missed relevant issues or be inaccurate or biased. Finally, it can be a waste of resources to spend too much time collecting data from secondary sources.

Site Selection

An important part of the planning process is to decide on fieldwork. For most studies it will not be practical to talk to every fisherman or processor or trader in a fishery or sector, unless the fishery is very small. So sites should be selected which are representative of the fishery or fishery sector. (More information on site selection can be found in Chapter 3 on page 81).

Often the resources available for fieldwork will determine how many sites can be visited and for how long. As a rule of thumb it is best not to be over optimistic about the number of sites that should be visited for data collection. It is better to concentrate on a few representative sites rather than visit many sites quickly. Too many sites in a limited time can mean the study will be rushed and results and conclusions possibly weak.

Researchers should be aware of the bias that is related to site selection. Spatial bias refers to the actual geographic position of the site which often dictates how easy the site is reached. For example, it may be decided by the team that there are several potential sites for fieldwork. Some sites may be relatively easy to get to and others not so easy. It may be tempting to only visit the sites that are easy to reach. But how representative will the study results then be?

At sites (fishing villages) where vehicle access is relatively easy then the fish landed there may be easily transported to markets. However, the fish landed at villages that are relatively inaccessible may have to be processed, which may result in a financial loss to the fisherfolk, or fish may even be thrown away because there are no buyers coming to the village.

TIP 2

The assessment survey will be much more conclusive and representative if data are collected at both easily accessible and inaccessible sites.

An element of bias will occur if the sites that have been chosen have been the focus of other projects. Sites that are highly recommended because they are good examples of successful projects in the past may also provide bias information. If these types of site are chosen then other sites should be included in the study which have not been the focus of other projects.

The people at sites which are favoured by researchers may become fatigued from receiving a large number of researchers. This may affect the quality of data and the willingness of people to co-operate in a study and be interviewed. (More information on bias can be found on page 55.)

One final point on site selection, is to incorporate a degree of flexibility into the study. If during fieldwork new sites are discovered that would be worthwhile visiting then there is the option for including them.

As an example, during a study of transport losses traders were freezing fish before transportation. Before the study it was not known how many freezing plants were being used and how much fish was being frozen. During the study it was found there were five potential freezing plants and so each one was visited or contacted to verify if it was used for freezing fish and if so how much fish was being frozen.

Which Methods?

It is a useful practice during planning to think about the way in which the information will be collected during fieldwork. The most important data collection method is the semi-structured interview. However, there are a number of other methods such as observation, ranking, mapping and load tracking which can be used. These are all described between pages 24 and 52. It will be possible during planning to decide how these methods could be used during fieldwork and with and by whom.

Study Team Roles and Tasks

The roles of the team members during fieldwork should be discussed during planning particularly:

- *who will take notes during fieldwork*
- *who will lead SSIs*
- *who will write up the notes*
- *during fieldwork when will the data be discussed*
- *who will use particular methods for data collection*
- *who will write the different sections of the report.*

It may be decided that the roles of the team members are flexible and that each will take turns in leading interviews and writing notes.

Time

The duration of the study will be determined by the resources available and any other commitments the team members may have. Theis and Grady (1991) suggest " use at least four days but not more than three weeks" for fieldwork. The total time the assessment will take will be related to:

- *travel times to fieldwork sites*
- *the time for fieldwork*
- *the time for data analysis and report writing.*

Allow plenty of time for fieldwork and try not to make the travel schedule too tight, especially if there will be little chance of follow-up once the fieldwork has been completed.

Secondary source data can be used to identify when the best time for conducting fieldwork will be, i.e. when fish catches are high, during particular seasons of the year.

TIP 3

For example, if the losses in a fish processing sector are to be studied and resources permit then it may be useful to conduct fieldwork at times when processing conditions are poor and losses are possibly high and then when conditions are good and losses perhaps low.

TIP 4

If fishing is seasonal or is done according to cycles and fisherfolk are to be involved in fieldwork then the team should choose a time for fieldwork when fisherfolk are likely to be available for interviewing.

Introductions

It will be useful for the team if they have a contact who knows people within the fishery sector to be studied and can introduce them to the team at the beginning of fieldwork. Fisheries departments or NGOs often have field staff at sites or in the area they could be asked to be with the team at the beginning of fieldwork and introduce them to key fisherfolk, traders, etc. Once introduced it will be easier for the team to operate.

Equipment

During planning the team should decide what items of equipment will be required during fieldwork and then obtain them prior to fieldwork. Common items used during fieldwork are:

- stationery
- dictaphone
- thermometer
- small spring balance weighing scale
- camera
- waterproof clothing
- camping equipment.

Stationery will be required for recording data and writing reports, i.e. notebooks, plain paper, graph paper, pens, pencils, waterproof plastic wallets for field notes.
A small tape recorder (dictaphone) can be useful for taking notes after an interview is over, especially when it has not been possible to take written notes during the interview. Tape recorders are not usually used to record interviews.

For the post-harvest technologist a thermometer can be useful for checking the temperature of fish to determine the effectiveness of any chilling practices.

> "Temperature readings of prawns awaiting sorting at a factory were between 1 and 8 °C. Prawns at 8 °C would be spoiling at a high rate."

In many fisheries traditional units are used to measure quantities of fish as opposed to kilograms or pounds. Quantification of amounts of fish will require samples of traditional units to be measured. This can be done for smaller units in the field with weighing scales. Ideally pocket-sized spring balances should be used for ease of carrying.

> "Dried fish are stored in sacks, normally there are 6 *debes* per sack. A *debe* is an empty cooking oil container used as local unit of measurement. Each *debe* is about 5 kg of dried fish."

It may be difficult to judge by eye the weight of an individual fish or an amount of fish. For example, a fisherman's catch may be divided into different qualities or grades and to estimate rapidly the proportion of a grade of fish in a batch it may be helpful to weigh a sample and then, if practical, to count or estimate the total number of fish to estimate the weight.

A camera, preferably small and auto focus so as to attract the minimum of attention, can be useful for recording observations. Photographs can jog the memory and help in explaining issues later on after fieldwork is over. Likewise, photographs can be used to good effect in reports.

The team should be equipped with appropriate clothing for fieldwork. If it is likely to be wet then make sure the team has the right clothing, i.e . waterproofs.

In some field locations it may not be feasible to find accommodation so camping equipment, tent, stove cooking utensils, etc., may be necessary.

Check-list

One of the most important activities during planning is to develop a check-list of key topics, and if necessary key questions, which is used by the team as a guide to interviews. By using a check-list during fieldwork one can avoid the "I wish I had asked about that" scenario, which can occur after fieldwork has been thought to have been completed.

The check-list should be clearly written or ideally typed on as small a sheet of paper as possible. Each member of the team should have a copy. The check-list should be updated accordingly as fieldwork progresses. During fieldwork it may be possible to remove topics from the original list because the team is satisfied that enough data have been collected or the topic is not relevant any more. Likewise new topics may arise that were not thought relevant at the planning stage.

The check-lists can be protected from the wet conditions encountered during fieldwork by using plastic wallets

TIP 5

A check-list should only be used as a guide to interviews, it should not be used as a questionnaire. By doing the latter the survey would stray away from the flexible, probing approach of this methodology.

Table 6 is an example of a comprehensive check-list that could be used for an exploratory study of losses in a fish distribution chain. Such a study would aim allow the team to learn about the distribution chain in general terms as well as focus on losses.

Table 6 - Check-list for Exploratory Study

General Heading	Factors to Consider
General/fishing	method(s) fishing cycle monthly calendar seasons—fishing cycle catch levels and seasonality losses during fishing and landing ownership (gear and vessels) organisation of fishing activity—decison making other occupations of fisherfolk number of fishing units and catch per unit species caught
Losses	types of loss perceptions—are losses a problem or not? seasonality of losses reason for losses quantities of fish sold for a good price quantities of fish sold for a reduced price/downgrading quantity of fish thrown away and what happens to it/ discards? loss avoidance strategies
Processing	products markets method(s) grades how often, how much fish and by who? other occupations effect of weather and seasonal variations storage number of processing units ownership of fish and processing facilities
Storage	where and facilities how long and how much? seasonality of storage problems during storage

Table 6 continued overleaf

General Heading	Factors to Consider
Marketing	who does marketing? where are the markets? journey time to market journey frequencies seasonal variations of quantities of fish marketed transport costs preservation of fish before marketing other occupations customers (who, what, where and how?) transport types prices and fluctuations grades of fish sold, reasons and prices—who buys? seasonality when is business best, bad and why?
Traditional units of fish measurement	quantify in kg values
Others	other activities, occupations and sources of income gender and who does what? labour (who, what, where and when) mobility and migration of sector population who makes decisions?
Other problems	i.e. access to credit
Changes	how has the sector changed over the last 1,2,3, etc. years?
Questions from respondents	make sure that you encourage/allow questions from the respondents

Methods for Data Production

Fieldwork is the main data collection exercise. There are two aspects of data collection, i.e. the methods for collecting data and the principles to guide data collection. This section deals with the methods.

Methods for Data Collection

A number of methods are commonly used in rapid appraisal work (see Table 7) for generating data.

> "Methods are used during the fieldwork to facilitate communication between the external team members and local people, and amongst local people themselves. These methods enhance the understanding and analysis of local situations, problems and possible opportunities" (Pretty *et al.*, 1995).

The most important method is the semi-structured interview (SSI). Other methods are based on diagrams and observation, these are usually used in conjunction with SSIs.

Some methods can be used to generate specific data on fish losses. Some are used to generate more general qualitative data or specific qualitative data on the fishery in general. For example, observation, demerit scoring and calendars can be used to generate specific data on fish losses, mapping produces more general data, i.e. on fishing grounds, and ranking can be used to produce specific data on qualitative issues such as the importance of other livelihood activities.

The choice of which method or methods to use should not be pre-determined but should be influenced by the circumstances in which the team finds itself. A method should not be used just for the sake of using it.

Table 7 gives an overview of the most commonly used methods and indicates the type of data that can be generated by each. There is a section devoted to the generation of indicative quantitative data on page 59.

Table 7- Fish Loss Assessment Tools

Tool	Type of Loss Data
Semi-structured interviews	qualitative indicative, quantitative
Secondary sources (see also planning)	qualitative, quantitative, historical
Observation	qualitative
Mapping	qualitative
Calendars	qualitative
Ranking	qualitative
Ranking fish species	qualitative
Scoring	qualitative
Percentage loss	indicative, quantitative
Daily activity chart	qualitative
Flow diagrams	qualitative
Demerit score systems	indicative, quantitative
Load tracking	qualitative, indicative, quantitative

Semi-Structured Interviews

The most important data collection tool is the SSI. A conversational interview/discussion conducted by the team or team members with people who are likely to be knowledgeable about the study issues.

> "At the heart of all good participatory research and development lies sensitive interviewing. Without it, no matter what other methods you use, the discussion will yield poor information and limited understanding" (Pretty *et al.*, 1995).

An SSI does not involve the use of a questionnaire, but a check-list of key topics is normally used to guide the team so that they cover all the relevant topics on which data are required.

One person in the team should lead the interview by asking informal questions, another member of the team should take notes and a third can also ask questions and probe answers. These roles can be swapped around between team members during the course of fieldwork.

> "The team must be able to put the informant(s) at ease and give them the confidence to share their knowledge and perceptions by showing a sincere interest in learning from the community" (Nabasa *et al.*, 1995).

The people/respondents/interviewees who are to be interviewed are usually interviewed as either key informants or as a group:

Key informants

A key informant is someone who has specialist knowledge of a topic or topics relevant to the assessment. Key informants are important people to interview in a study. For example, a fisherman will have first hand knowledge of fish losses that occur during fishing, likewise a fish transporter will have knowledge about fish losses in that sector. Other key informants are fish factory managers, public sector fisheries workers, fisherfolk's leaders, fish retailers, local government officials and fish traders.

Below is a summary of an SSI with a Tanzanian fisherman working on Lake Victoria. The interview was conducted during an exploratory study of losses in the fishing sector and is presented here as a case study. It shows the sort of qualitative information that can be gleaned from patient and probing interviewing. It shows the issues that would form the basis of further investigation such as the seasonality of losses.

BOX 2

Case Study: Fisherman at Buzaga Village

John started fishing in 1978 and moved to Buzaga in January 1994 because of net theft and poor catches in Magu district.

The canoe in which he fishes is sail powered, has a total crew of 3 and carries 41 gillnets: 20 x 6 inch, 14 x 6.5 inch and 7 x 5.5 inch. Three fishermen are employed on board. One of the crew is in charge and liaises with the owner of the gears.

Unless there are any problems with gear or boat then fishing continues every day. Canoes generally leave around 4 pm (16.00 hours) when they catch a wind (*buhanga*) that takes them to the fishing grounds. Another wind (*nkomaji*) brings them back the next morning. The choice of fishing ground depends on the weather and the moon.

It takes about 1.5 hours to set the nets. Which are hauled at 5 am (05.00 hours). It can take 2–4 hours to return to the village depending on the wind speed.

The catch is less during the dry season of May to October, 19–30 (57–90 kg) pieces or fish per day. During the rainy season of November to April the catch can be up to 80–100 pieces per day (240–300 kg).

From February to April more stale fish is landed. This fish is sold to processors (salters). The high proportion of stale fish he says is attributed to warm water.

Small fish rejected by the factory buyers are sold to processors as well or bartered by fishermen for other goods within the village.

During the warmer months more fish is thrown away before landing.

Fish kills occur in April and such fish is normally sold by fishermen. Probably to processors. All sizes of fish die in these kills.

In another study fish auctioneers were ideal key informants.

BOX 3

Mr Ibrahim and Mr Mzee Kapera have been auctioning fish at Banda Beach market for many years. They say that often fish that spoils is that which has been at the bottom of an ice box. Sometimes out of 250 baskets of fish (2500 kg) one can have 50 baskets (500 kg) of spoilt fish. This normally occurs in the warm season whereby out of the 50 baskets of fish, 30 are sold at a reduced price Tsh 500/=–600/= per basket and 20 baskets at a very low price (almost free), i.e Tsh 200/= per basket. During the cold season fish spoilage at Banda Beach is minimal.

If the spoiled fish are to be auctioned then they alert customers to the fact the fish is of poor quality. Whoever buys the spoiled fish will not then be allowed to return the fish. Spoilt fish are normally bought by women for frying and by fish driers.

According to the auctioneers, the amount of spoiled fish nowadays is much greater than previously and this is due to the following reasons:

- transporters nowadays stay for longer periods in Mafia because fish are scarce, possibly due to the increased competition (number of collector boats)
- an inadequate supply of ice due to power shortages
- damage to ice boxes (although this is rare).

According to the auctioneers the number of traders and friers has increased recently. In earlier times the fish trade and frying was mainly done by middle aged and old people but nowadays youths have involved themselves in the fish business.

Market officials are also sources of data.

BOX 4

In terms of physical wastage, the amount of waste appears to be minimal both at the wholesale and retail market levels. Fish inspectors who have the power to condemn produce which is unfit for human consumption reported that the quantities which are condemned are insignificant (Digges and Clucas, 1995).

In another example below the data has been derived from interviews with exporters.

BOX 5

Downgraded fish originally intended for export manifest themselves through rejections by the exporter and the switching of these products to other markets usually through another type of trader or fish curers. Reasons for rejections include soft fish, belly bursting and bruising. The level of price discounting associated with poor quality is potentially significant with discounts of up to 85% given for poor quality fish sold to curers. The question is, how significant are these rejections by the exporter and the switching of products to other markets (Digges and Clucas, 1995)

Fish processors are obvious candidates for interview.

BOX 6

Fish curers, those who dry and salt fish for human consumption are potential end-users of downgraded fish and as such are a potentially useful indicator of post-harvest losses (Digges and Clucas, 1995).

People who are not directly associated with a fishery activity but who are resident in a study area may also be classed as key informants, for example, teachers, doctors and shopkeepers. They may be able to provide data on activities that are occurring around them.

Groups

An interview with a group of people is a good way to get a lot of information quickly, although it often provides general data usually in the form of opinions. Ideally groups should not be too large, 10–15 is recommended as the maximum number of people.

> " As soon as you arrive in the community, try to identify locations and times where people gather and talk. Such natural meeting places are often the best spots for picking up information on subjects of current local interest and can be very good places for discussing general issues which the team is interested in investigating" (Townsley 1993).

In large groups some people may dominate, voicing opinions and providing information. This is probably a reflection of the social and personal hierarchies and relationships within a community or particular group. To overcome this bias members of the group who did not contribute as part of the group should be interviewed later on their own.

There are three types of group:

- *formed for an interview*
- *encountered while doing fieldwork*
- *focus group.*

A group formed for an interview will often be dominated by community leaders and officials. A group encountered during fieldwork may be more free and interactive. A focus group consists of a small number of people who have specific experience of knowledge on a particular topic or topics.

Group dynamics are important if the team are to make the respondents feel at ease.

> "Of the two sessions the first with fishermen flowed much better then the second with processors. This was partly due to the sitting arrangement of team and group. In the session with the fishermen the group sat on the ground among the fishermen. However, during the interview with the processors the team sat in one group and the processors in another. There was very much an 'us and them' feel to the arrangement which may haveunsettled the processors" (Ward, personal communication).

Questions and How to Use Them

Questions should be formed as the interview progresses rather than be pre-determined. The check-list should be referred to making sure the questions cover the issues of interest. If need be, a list of questions can be compiled before an interview to make sure that all the important issues are covered. As a rule of thumb, the interview by the team should start with general questions which become more focused.

Try to avoid asking questions that lead to a yes or no response, unless you are trying to verify something. For example "Are fish losses highest in summer?" is a leading question. A better question would "When are fish losses highest?"

How to ask questions and the type of questions to ask is one of the most important components of an SSI. The best type of questions to ask are those that are open ended. For example, questions that begin with what, when, who, where and how are generally good to ask. The following are examples of open-ended questions:

- *Can you tell us about your work?*
- *How do fish losses affect your business?*
- *Is your business affected by fish losses?*
- *What are the weekly resources for the business?*
- *Can you tell us about some of the problems you face?*
- *Can you tell me more about that?*
- *Can you give us an example?*
- *Could you explain that to me?*

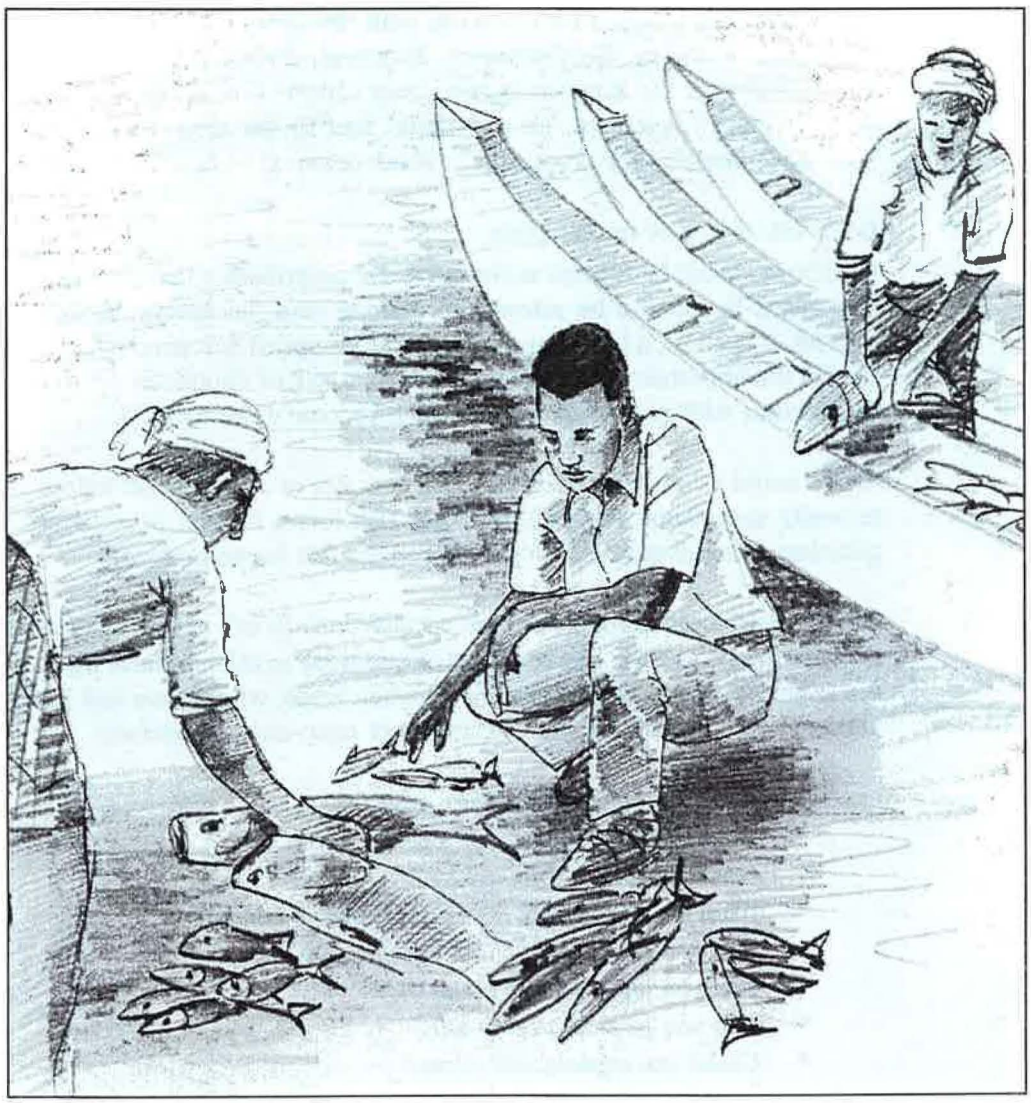
> "It is very difficult to ask open-ended and non-directive questions and to probe carefully the responses. Yet effective interviewing will only occur if this happens. "(Pretty *et al.*, 1995).

In some situations admitting to post-harvest fish losses and throwing fish away may not be easy for fisherfolk. Discussing poor quality can also prove difficult. Nobody wants to admit to selling poor quality fish. So to overcome this problem it is often best to talk in terms of 'grades' of fish, rather than quality.

"Can you explain about the different grades of fish you land or sell?" will usually lead to a more informative answer than "do you sell poor quality fish?"

Observation is a good way to form questions during an SSI. For example, while waiting to interview a fish trader some fish may have just been landed and it can be seen that fish are being sorted or graded. A question could then be put to a trader "Can you explain the grading of fish over there?" Indicating where the grading is taking place. See page 34 for more information.

Figure 1 - Researcher and trader discussing grading of fish



Whether interviewing an individual or a group the team should discuss not only recent events and the current situation, but also the past. To try and establish how loss levels have changed over time.

> "In the late 1980s losses were high. This was before freezing became more organised and efficient. Up to 50% of fish could be lost because of spoilage. Nowadays losses are rare and not perceived as a significant problem." Fish trader, Tanzania, 1994.

TIP 6

General Guide to Using Questions

- *explain the interview purpose to the interviewee*
- *if necessary prepare a short list of key questions have a checklist of questions/topics*
- *questions should be open ended and not produce yes/no answers*
- *make questions short and easy to understand*
- *ask only one question at a time*
- *probe answers*
- *wait for the interviewee to finish an answer and do not interrupt or finish sentences for the interviewee*
- *do not make comments about the quality of answers to questions even if you disagree with them.*
- *show a genuine interest in what the interviewees are saying*
- *finish the interview politely, thank the interviewee*

Probing

Probing is the process of thoroughly investigating or exploring issues raised during an interview. Often when probing has not been done then the study report will be weak with gaps in the data.

The focus of this methodology is post-harvest fish losses, it is important that when the subject of losses arises in an interview/discussion that probing is used to produce as much data as possible.

For example, during an interview a type of loss may be mentioned that was not expected by the team. By careful probing the team should be able to reveal as much information as possible on this new type of loss.

One of the topics on a check-list used to guide an interview with a major fish trader in Dar es Salaam, Tanzania was 'general' problems with the trade. When this subject was

raised in the interview it was revealed that one of the major constraints to business was a loss due to non-payment of credit. By probing, which involved asking questions about this loss, the team learnt that:

> "Some of the consignment of fish is sold wholesale in Dar es Salaam on a credit to the many small-scale retailers in the city. He tries to sell to retailers who have storage facilities as there is more chance they will sell fish successfully at a reasonable price. There are two problems with this: working capital is tied up and some retailers don't pay for fish taken on credit. This means that in a year he can lose 100 000 Tsh."

During another assessment it was revealed that one of the causes of fish loss was problems with rail transportation. Probing was used to find out what the problems with transport were in more detail:

> "Losses as a result of rail transport are more specifically caused by mechanical breakdowns, floods on the line, switching of carriages and delays clearing the fish once it has arrived in the city."

Guide To Conducting Semi-Structured Interviews

- Make sure that at the start of any interview you explain why you want to conduct the interview, who you are/represent and what is the purpose of the fieldwork. It may not be a good idea at first to be explicit about your intentions to study fish losses, mainly because fish loss and wastage may be something people are not happy about discussing. Also, being explicit may lead people to tell you what you want to hear. It may be appropriate to say that you are not involved in any taxation or licensing activities which would conflict with the data collection exercise.
- Try not to raise people's expectations. This can be done by stating clearly why you are collecting data and be honest about the likely outcome of the research. For if expectations are not met later then this may create some ill feeling or mistrust with in the communities or sites and make any further work in these places difficult for the team and other researchers.
- It is important to interview respondents at the most appropriate time for them and this may not be the best time for the team. Making appointments to meet key respondents and groups can give people a chance to choose a time and place which are comfortable for them. This can make the interview much easier to conduct.

TIP 7

A good time to interview fishermen is when they are in a relaxed mood repairing gear on the shore. It is difficult to talk freely with them when they active selling fish. For processors a good time may be when the fish are drying or freezing, rather than when they are being packed or transactions are being carried out. One of the most difficult groups to interview are fish retailers unless you can arrange to meet them outside working hours or are prepared to wait until there are no customers around.

- Try to make sure that an interview takes place somewhere comfortable for both the interviewee and the team. Make sure that the arrangement of the team and key informant does not create an 'us and them' situation and that the interviewee(s) do not feel intimidated or uneasy.

TIP 8

To offer or actually take part in an activity alongside the interviewee can often ease discussion. By assisting with the preparation or processing of fish and other activities, such as going fishing or net repairing, can make discussion easier.

- Show an interest in what the interviewee is saying and doing, even if what they are saying may not be relevant to the study.
- Although fish losses will be the focus of a study try not to show over surprise or excitement when losses have been identifed or become the subject of an interview. However, make sure that you carefully probe to reveal as much about fish losses as possible.
- Respect local customs and formalities and always be polite. Find out early on what is acceptable for a team in the data collection site. For example, will it be acceptable for women to interview men or *vice versa*.
- Note taking is the best way of recording data, but it should be done discreetly with the consent of the person/group being interviewed. It may be best to start taking notes a little way into the interview when the interviewee is more at ease rather then introduce the notebook at the beginning. In some situations it may not be practical to take written notes either because of the situation or because the person does not want notes taken. If this is the case then as soon as possible after the interview make sure as much information is written down as possible. A dictaphone or small tape recorder can be useful for recording observations and key points quickly in situations where writing is difficult.
- Bias is an important issue which is discussed in more detail in the techniques section on page 55. However, in a fishing community there will be different sub-groups characterised by such things as age, wealth, ethnic group or sex. Each sub-group may have particular circumstances and may be affected by fish losses in different ways. Therefore it is important to be aware of the different groups that may exist in a community and to try and include them in a study.
- Always finish an interview politely, thanking the respondent or group for their time and assistance. Allow time for the people interviewed to pose questions to the study team.

Loss Avoidance

In some fishery sectors people may be using strategies to avoid losses. In other words people perceive losses as a problem and are trying to do something to reduce or avoid losses.

To understand existing loss reduction strategies will be useful for planning any future loss reduction programmes. So while conducting fieldwork and especially SSIs try to establish whether loss reduction strategies are already being used, or whether they have been used in the past. Typical examples are the introduction of new and or improved technologies and processing methods. Box 7 shows some findings from a study of fresh fish retailing in Tanzania.

BOX 7

Fresh Fish Retailing

All spoilt fresh fish are usually thrown away (burying). However, fresh fish retailers tend to be more careful in ensuring that they do not purchase early night catches to avoid losses. Another strategy employed to curb losses in the fresh fish retail line is product promotion which allows for quick clearing of the lot. Retailers, on noticing the possibility of loss would reduce the selling price early to ensure that the entire lot is sold before fish go stale.

Observation

Direct observation of activities, the environment and behaviour of people is a useful tool in fish loss assessments. Observations can generate data for the study or can be used to formulate questions for SSIs. Observation can also be used to cross-check data from SSIs. Observation of the following activities can indicate to the team where losses may be occurring:

- *fishing*
- *landing of fish*
- *sorting and grading*
- *selling/auction*
- *condition or quality of fish at any stage*
- *fish handling and processing*
- *storage*
- *buying selling and distribution.*

Below are some examples of how observation can be used in fish loss assessments.

- "It was observed that prawns were being handled in a way that was causing some quality deterioration. Only by observing every stage in the supply chain from fishing to factory gate was it possible to gain a full understanding of the reasons why losses were occurring. "
- "At landings the fish are usually kept at the lake shore. Traders will arrive and normally sort through to check the quality of the perch before buying. The main quality indicator used by buyers is gill colour. Only fish with blood red gills are bought. Any fish with pale or pinkish gills are singled out as not acceptable and will usually be rejected and sold to salters."
- Observations made indicate that before freezing fish are exposed to high ambient temperatures for many hours. The fish are not washed before freezing which is likely to speed up microbial spoilage. The quality problems caused are likely to be noticed further down the marketing chain when some fish are unfit for selling fresh and are deep fried.
- A key indicator of dried *dagaa* quality is its colour. *Dagaa* stored for 3 days during the rainy season can change in colour from shiny silver to dull reddish brown. The latter is associated with a bitter taste and is probably a result of fat oxidation catalysed by a high moisture content. *Dagaa* that have changed colour will be sold for a reduced price. Even well-dried fatty *dagaa* will change colour fairly quickly compared to well dried lean *dagaa*. Lean *dagaa* can be stored for 3 months without changing colour.

- Mr X was met at Nyamisati having just arrived by dug-out canoe with his two polystyrene boxes containing around 45 kg of prawns. Mr X had run out of ice while collecting and had returned to re-ice and then wait for transport to Dar es Salaam. It had taken 4 days to collect these prawns and it would be another 24 hours before they would reach Dar es Salaam and be sorted. The prawns had already begun to produce off odours and the melt water that was drained off them was black. Some of the larger prawns were washed but the smaller prawns, which were in the majority, were taken from one box to another without washing. It later transpired that of the 45 kg of prawns, 20% were rejected by the factory because they were of poor quality.

Certain simple equipment can be used to assist in making observations. For example, a thermometer can be used to check the temperature of fresh fish. This is a useful way of checking the effectiveness of any chilling methods and of identifying factors that can lead to fish spoilage. Likewise, weighing scales can be used to measure traditional units of measurement or actual fish weights.

During a study it was observed that fish was sorted after landing according to quality. Poor quality fish were sold for a reduced price to fish processors. A sample of the fish was weighed and fishermen were asked the approximate number of fish. It was then possible to calculate the percentage of fish that was sold for a reduced price. This indicative quantitiative information could then be cross- checked during SSIs.

Demerit Scoring

Demerit scoring systems have long been used by fish buyers in some parts of the world to assess systematically fish quality. An extension of this has been used during fish loss assessments to give indicative quantitative data on the relationship between quality and price and hence revenue loss. Demerit scoring could also be used to monitor changes in fish quality that occur when intervention strategies are used to improve fish quality.

This tool relies on objective scoring of particular attributes of a fish such as gill colour, gill smell and eye shape. Each attribute is scored according to its condition and the total score of all attributes for a fish is calculated. The score for the freshest or best quality fish is always zero. As quality changes and the condition of attributes changes this will be reflected in the score. The higher the score then the more change in quality has taken place.

TIP 9

A demerit exercise requires a small notebook, a demerit score chart for the fish to be assessed, a pen, a weighing scale, a plastic bag for weighing the fish and a cloth to wipe the hands after finishing.

Some preparation will be needed beforehand for this tool. A score chart should be developed for the fish species or products to be assessed. Different scoring systems are used for fresh and cured fish as well as for crustaceans. An example of a score chart developed to assess the quality of gutted whole fish is given as Figure 2. It is important though that the same score sheet is used for a particular product or species and that all attributes are scored for each sample. It is also important to be objective about the scoring.

By weighing and pricing fish that has been assessed it will be possible to work out the price per kilogram of fish according to the demerit score. Standardising like this will make comparison between different samples easier. It is important to bear in mind how price can vary for the same species and the same quality score. For example, the size of fish can also affect price, as can the time at which samples are taken. Price can vary over time on a particular day due to supply and demand.

A problem with using this tool is that the owner or seller of the fish may be reluctant to let his or her fish be assessed, especially if the fish are on display for sale at the time of assessment. A way to overcome this problem is to purchase the fish to be assessed. It is important to buy fish for the correct market price and not pay inflated prices

It was found that retailed fish of the same species and size in one market with a demerit score of 13 were sold for an average price of 388 shillings per kilogram and fish with a score of 18 were selling in the same market for an average of 202 shillings/kg. This clearly shows that there is a relationship between price and quality, and that fish of good quality will generate more revenue for the seller. The seller suffers a loss in income if poor quality fish are sold.

Load Tracking

An extension of observation is load tracking which is a more rigorous investigation of a fish distribution chain to identify where and why losses are occurring.

Load tracking centres on the use of demerit scoring to assess the quality of a sample of fish at different stages of a marketing chain. It is a tool which can be used to:

- *assess how fish quality can change within a distribution chain*
- *why and where losses occur*
- *the value of losses in monetary terms*
- *to monitor the changes in the level of losses after intervention has been employed.*

A sample of fish should be marked in some way so that it can be identified at different stages of distribution or processing for assessment. If whole fish are used then a good way to mark them is to tag the fish with a piece of coloured string through the gills and mouth.

TIP 10 *Load tracking is used in collaboration with traders and owners of fish, who may allow a sample of their fish to be used. Otherwise buy the fish to make up a sample for the experiment.*

Figure 2 - Demerit Score Chart For Whole Fresh Gutted Fish

APPEARANCE	v.bright	bright	sl.dull	dull	
	0	1	2	3	
SKIN	firm	soft			
	0	1			
SCALES	firm	sl.loose	loose		
	0	1	2		
SLIME	absent	sl.slimy	slimy	v.slimy	
	0	1	2	3	
STIFFNESS	pre rigor	rigor	post rigor		
		0	1	2	
EYES	clarity	clear	sl cloudy	cloudy	
		0	1	2	
	shape	normal	sl sunken	sunken	
		0	1	2	
	iris	visible	not visible		
		0	1		
	blood	no blood	sl blood	bloody	
		0	1	2	
GILLS	colour	red	dull red	pale pink	
		0	1	2	
	mucus	absent	moderate	excessive	
		0	1	2	
	smell	fresh	fishy	stale	spoilt
		0	1	2	3
BELLY	discoloration	absent	detectable	moderate	excessive
		0	1	2	3
	firmness	firm	soft	burst	
		0	1	2	
VENT	condition	normal	exudes	opening	
		0	1	2	
	smell	fresh	neutral	fishy spoilt	
		0	1	2	
BELLY CAVITY	stains	opalescent	greyish	yellow/brown/ green	
		0	1	2	

The sample is allowed to pass through the chain and is treated in the same way as fish usually are in the distribution chain. The chain must now be characterised, noting the key conditions and processes the fish are being subjected too. The history of the samples should be sought. This can be done using SSIs and observation.

Useful data to collect:

- *the length of time fish spend at certain temperatures or in certain conditions*
- *the types of processing methods employed*
- *the type of packaging and transport used.*

TIP 11

One of the problems with this tool is that the fish may be given preferential treatment by the trader. This can be overcome by properly explaining exactly what is the reason for the exercise—which is to get a true picture of how quality changes during distribution.

Table 8 shows the results from a load tracking experiment. Sample A and B each consisted 10 fish. The samples were assessed for quality using a demerit score chart at the landing stage and then again at the sorting stage. Sample A scored 4 on average at the landing stage and then 12 at the sorting stage. Sample B scored 3 at landing and 12 at sorting. The table shows the different stages of the marketing chain the fish went through and the main quality influencing factors of time and temperature. The conclusion from this work was that both samples had spent over 10 hours at high ambient temperatures before being frozen and the fish were still of a quality to be sold for the highest price after sorting.

Table 8 - Load Tracking of Nile Perch (Lates niloticus) Between Mwanza and Dar es Salaam in Tanzania

Sample	Quality Influences	Demerit Score		Time (hours)		Temp (°C)	
		A	B	A	B	A	B
Fishing	hauling time to landing			3	8	20–25	20–25
Landing*	fish left on wooden table covered with mat no washing fish gutted	4	3	11	4	25–30	25–30
Processing	freezing			18.5	18.5	-15	-15
	cold storage			14.5	14.5	-10	-10
Packing	insulated with wood shavings			2	2	25	25
Weighing				7	7	25–30	25–30
Transport	ambient temperature			40	40	25	25
	train						
Unloading				4.5	4.5	25	25
Sorting*		12	12	1	1	25	25
Selling							
Total				101.5		99.5	

*Sample A and B each of consisted of 10 fish. The samples were assessed for quality using a demerit score chart at the landing stage and then again at the sorting stage.

By including samples in a load tracking experiment that are treated atypically it will be possible to identify how different conditions can affect fish quality and losses. In the example shown in Table 8 it may have been useful to assess the effect of chilling by icing a sample of fish between capture and up to the point of freezing to determine what effect this may have on the quality of fish at the sorting stage.

Data loggers are small devices that can be inserted into consignments of fish to record temperatures during load tracking. The data recorded are usually downloaded into a computer. The use of these devices can give the researcher an accurate picture of what happens to fish during distribution and help identify where problems leading to losses occur.

Mapping

Mapping can be used to stimulate discussion during an SSI and is an effective method to use at the start of such an interview.

Maps of the locality or fishing areas are best drawn by key informants and groups. They should be drawn on the ground, on paper or any medium appropriate in the interview situation. Materials and objects can be used to symbolise key features. Finished maps drawn on the ground should be copied onto paper by a member of the study team.

> "Maps drawn by local people are an excellent way of finding out what is regarded as important by them in the local environment. They can also provide valuable information about aspects that have been missed or not observed by outsiders" (Townsley, 1993).

BOX 8

Extract from an Exploratory Study

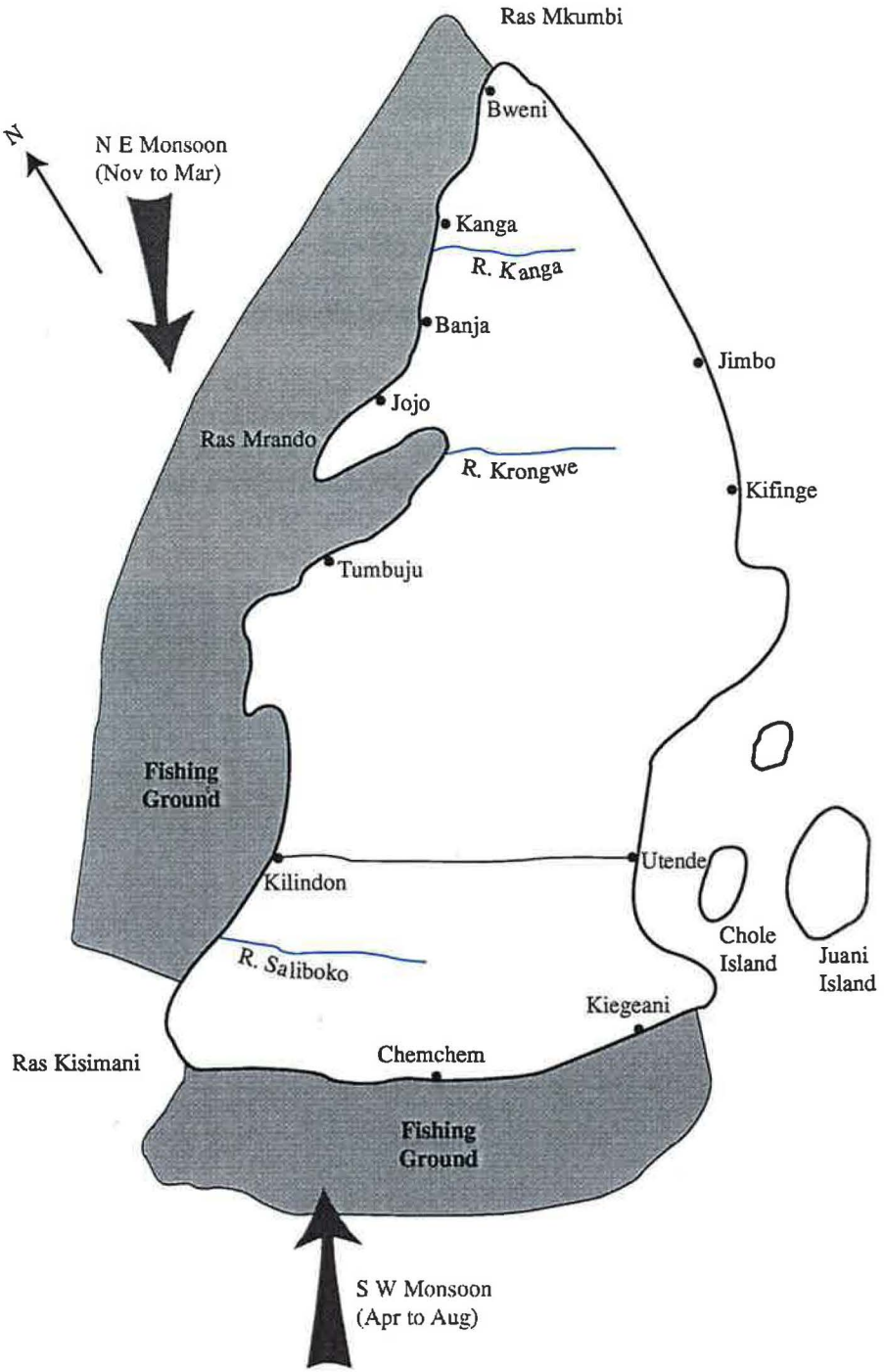
As well as generating useful general information on the fishery, particularly on the seasonal switch between fishing grounds, the important point about this exercise was that it 'broke the ice' and stimulated open discussion. It did not generate specific information on fish losses, but provided leads to follow and information that might help understand losses better.

It is felt that in future more could be made of this technique. Fishing grounds should be discussed in relation to the types of fishing gears used on them. More could be learnt of indigenous management of resources by villagers. For example, at the end of the session it came out during discussion that there were rivalries between different villages over access to fishing grounds which showed there are local access boundaries for fishing grounds. Such sensitive issues may be difficult to talk about in a semi-structured group interview and will be better discussed with individuals.

Mapping of resources and a locality with key informants and groups is a good way to generate information quickly about:

- *fishing grounds*
- *fishing gears used*
- *seasonal patterns*
- *processing sites*
- *social groupings.*

Figure 3 - Tumbuju Fishermen's Map of Mafia Island



In terms of learning about losses, mapping can be used to highlight general issues such as fishing gear type, processing methods and fish species. Once these general issues are known then either during the mapping process or during subsequent SSIs the general issues can be explored (probed) to find out if losses are occurring.

Fishing Cycle Calendar

Calendars are a type of diagram tool often used during SSIs. Two calendar methods that are useful in fish loss assessments are the **fishing cycle calendar** and the **seasonal calendar.**

Figure 4 shows a fishing cycle calendar for a marine inshore reef fishery which has four distinct stages in a cycle. However, the calendar is drawn to suit the particular cycle of a fishery being assessed which may have different stages.

This technique proved to have promise as a way of understanding catch fluctuations and fishing activity. It is possible similar methods, without tides, based on the phases of the moon could be developed for freshwater fisheries as the state of the moon can often be associated with differences in catch levels and fishing activity.

Figure 4 - Fishing Cycle Calendar

Phase 1 Spring Tide	Phase 2 Neap Tide
Phase 3 Spring Tide	Phase 4 Neap Tide

The outline of the calendar should be drawn on the ground and used as a focal point for discussion. Typically each stage of a cycle is discussed with a single of group of fishermen. Fishermen are asked to describe the key activities or features associated with each stage of the cycle. Typical topics to discuss are:

- catch levels
- species caught
- fishing gears used
- losses.

Once a discussion on losses has started efforts should be made to probe for information on the reasons why losses occur and indicative data on the magnitude of them.

Figure 5 summarises the results of using the fishing cycle calendar with a group of fisherfolk in a village on Mafia Island, Tanzania. The calendar was used to define the active fishing periods during a fishing cycle. Then semi-structured interviewing was used to define the key activities or features of each stage in the cycle.

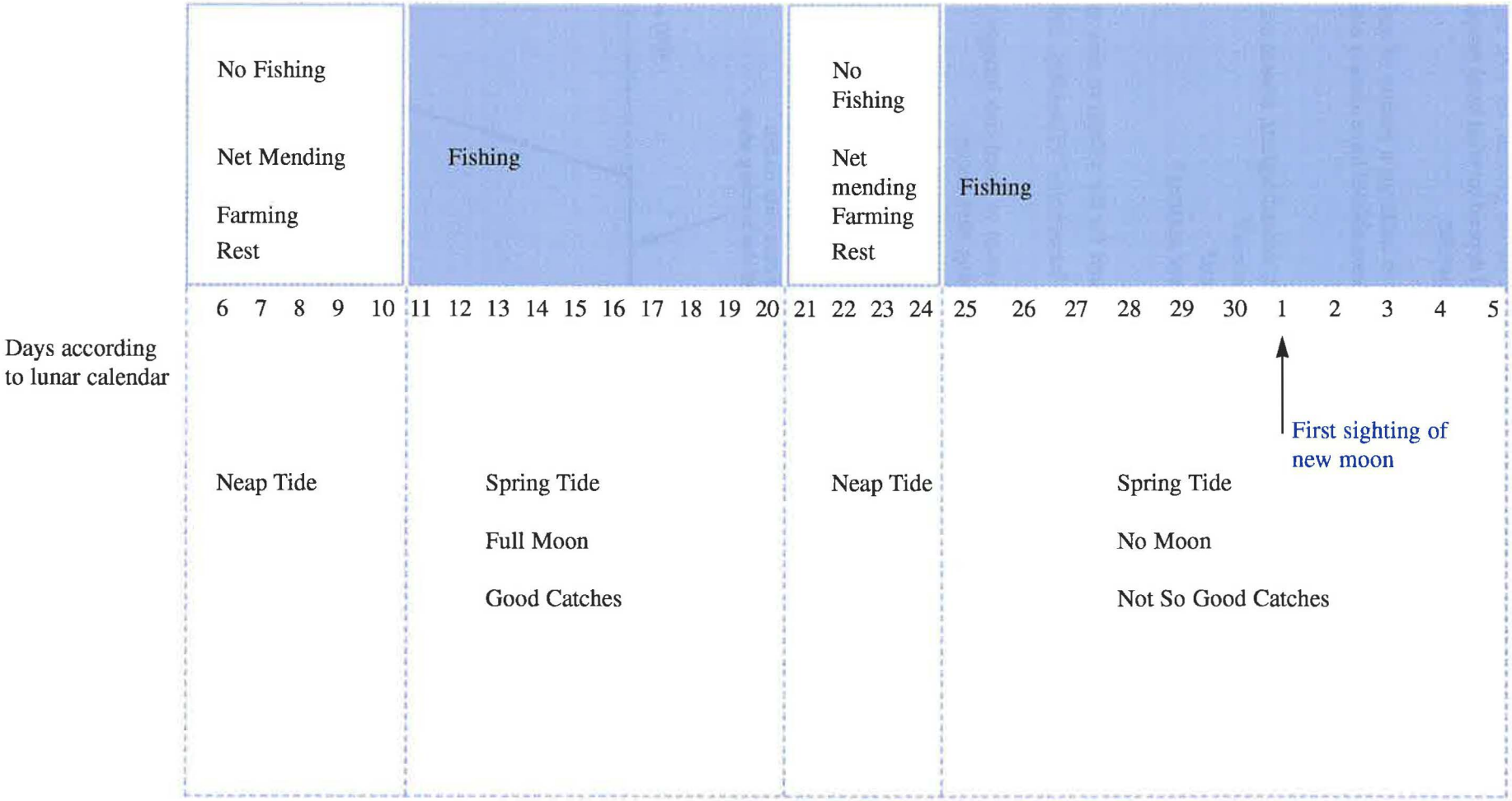
Seasonal Calendar

Seasonal calendars can be drawn by local people and are used to show links or patterns of activities according to seasons or time of year. They can be used to identify seasonal trends in:

- *fish catch/production, trading*
- *post-harvest losses*
- *fishing activity*
- *weather*
- *alternative employment and other relevant activities.*

Data on any trends or patterns can help the team in their understanding of fish losses.

Figure 5 - Activity Chart For Beach Seine Fishermen, Mafia Island, Indian Ocean



Seasonal calendars are normally drawn on the ground, the first step is to mark out a time-scale axis. The time-scale used will depend on what local people use; this may not always be the standard western style calendar.

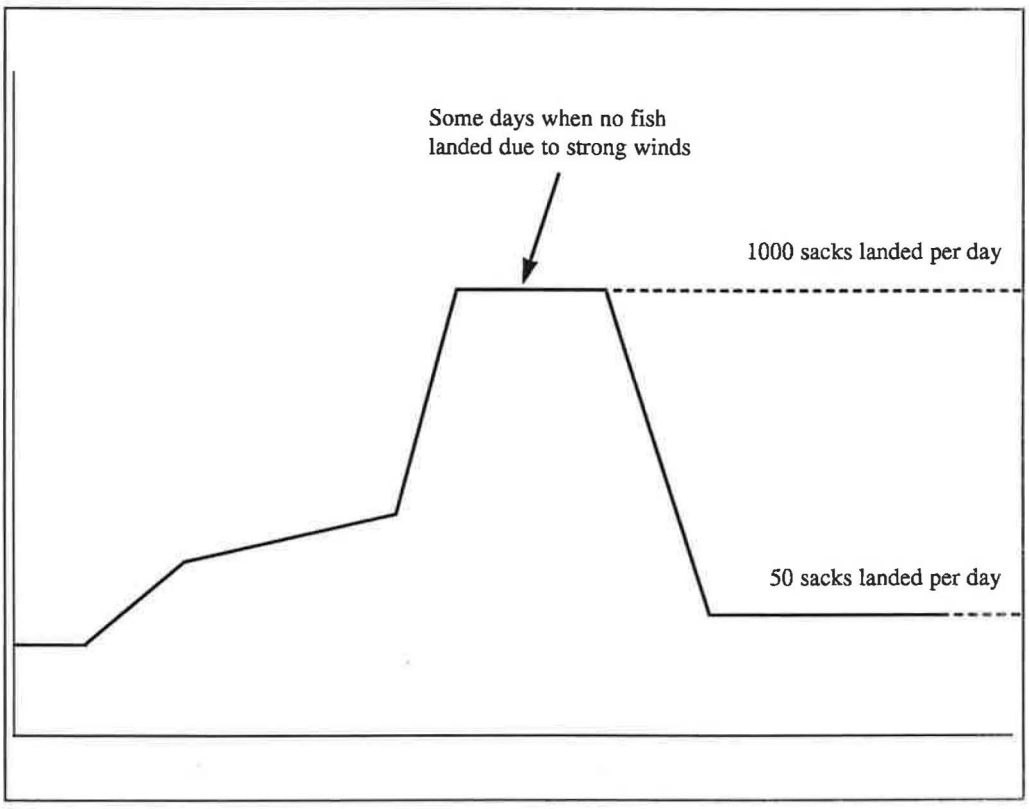
The following questions are then used to build up a picture of activities over a time period. Before asking about losses the team should have already established that these occur:

- *when is the fish catch highest, second highest, lowest, second lowest?*
- *when do post-harvest losses occur?*
- *when are losses highest, lowest?*
- *when and what are the different seasons?*

> "Seasonal calendars can be prepared for the village or area as a whole or for the activities of individuals or households" (Townsley, 1993).

Figure 6 shows the variations in the amount of dried fish brought to market and the times of year when losses at the processing sites occur.

Figure 6 - Dried Fish Landings and Losses



Ranking and Scoring

Ranking is a non-diagram method which is used by researchers to explore a key informant's or a group's perceptions and preferences for particular issues or aspects of a study, such as:

- *fishing gear used*
- *processing methods*
- *problems*
- *reasons for post-harvest losses*
- *importance of post-harvest losses*
- *cost of production*
- *important fish species.*

There are three types of ranking: wealth, preference or pairwise and matrix.

> "Analytical tools, such as ranking, complement semi-structured interviewing by generating basic information which leads to more direct questioning" (Theis and Grady, 1991).

Ranking is done once the alternatives to rank are known, i.e. types of fishing gear, important fish species, and reasons for losses. These can be identified using SSIs and the other methods mentioned in this section.

Preference Ranking

Once a list of the alternatives has been identified the key informant or group are asked to choose which is more important, second most important and so on.

> "Preference ranking allows the team to determine quickly the main problems or preferences of individual villagers and enables priorities of different individuals to be easily compared" (Theis and Grady, 1991).

Once the main reasons for post-harvest fish losses are known then ranking can be used to determine which is the most important in terms of causing the highest losses and which is the least important.

Table 9 shows the ranking of the constraints, in descending order of importance, to business as perceived by a frozen fish wholesaler. Although post-harvest losses were one of the constraints there were a number of other issues which were found to be more important, i.e. the losses due to non-payment of credit by small-scale fish retailers.

Table 9 - Ranking of Major Constraints by a Fish Trader

Losses due to non-payment of credit loans	1
Lack of adequate storage	2
Poor and unreliable transport	3
Stale fish losses	4
Electricity supply	5

Table 10 shows a relationship between capital cost, catch level and level of losses according to different types of fishing gear as perceived by a group of fishermen.

The % loss figures were derived using the % loss method described on page 49. Table 10 shows that handlines are relatively cheap to buy compared with the other gear types yet they are associated with the highest levels of post-harvest loss, up to 25% of the catch. Beach seines account for the highest catches and the least losses. During discussions as the ranking exercise was taking place, it was discovered that the reason for high losses with handlines was due to the fact that handline fishermen used sail-powered boats which sometimes took a long time to reach shore if the wind was poor or from the wrong direction. As no ice was used on board this delay caused fish to spoil in the high ambient temperatures.

Table 10 - Matrix Ranking of Fishing Gears by Fisherfolk in Tanzania

Gear	Cost	Losses	Catch	Indicative % Loss
Beach seine	2	4	1	> 5
Shark net	1	3	2	5
Trap	4	2	3	15
Handline	3	1	4	25

Note: 1 = highest and 4 = lowest

Ranking Fish Species

Ranking can be used to identify which species to target in an formal loss assessment questionnaire survey described in Chapter 3. As with all ranking exercises, it is important to first set the criteria which governs the ranking exercise. If the most important species in the fishery are to be identified by ranking then it must be clear what the definition of importance is and who decides this—the survey team or the fisherfolk. One species may be important to fishermen, but another species may be important to retailers.

Retailers may not think a species is important because its shelf-life is short and it tends to spoil quickly. Similarly the species that are important to the export sector may be very different from those of importance to indigenous consumers of fish.

Once a list of the main species in a fishery is known then the species should be ranked according to the criteria with as many key informants and/or groups as possible. A matrix is used to record the data.

The following is a general guide to ranking fish species.

- The first step is to determine the criteria of the species that are to be the focus of the survey. For example, 'the most commercially important, and this is determined from discussions with the client.
- Next, gain a broad understanding of the reasons why some fish species are more important than others, and the species involved. This is best done by SSIs with key informants and groups.

- Ranking with as many key informants and/or groups as possible can then be done to determine the type of species required. If the species are not to change each season during the survey, then ask respondents about the most commercially important species based on the 'whole year'. To help with recording the results *in situ* it may be useful to have ready a table drawn up on a piece of paper.

- Ranking of species by price, keeping quality, seasonality and abundance can also be used to determine the focus of the study, as these are some of the attributes associated with important fish species and inherently linked to why the fish were important. Table 11 shows an example of a ranking exercise done using several topics.

- If ranking is done on just one criteria such as the 'most commercially important' species then as the ranking is done the respondent should be asked why the species are ranked in the order they are and why one species is more important than another.

- Tabulate the results of the ranking exercise according to sub-sector, if appropriate. Use the highest score (4) to represent the most important species and the lowest (1) to represent the least important of the number of species required. Total the scores for each species to determine the overall rank of the species.

The species were ranked in descending order according to: best fish to sell, the most abundant fish species in the fishery and the species which had the longest shelf-life on ice. Another criteria not included here but which can be ranked is the highest price. According to this exercise the total shows that snapper scored highest and was therefore the most important species and mackerel the least important.

Table 11 - Ranking exercise done with a fisherman

Snapper	Trevally	Barracuda		Barracuda (small)	Mackerel
Preferred	5	4	3	2	1
Abundance	1	3	2	5	4
Keeping quality	5	3	4	2	1
Total	11	10	9	9	4

TIP 12

To ease analysis, the results from a number of interviews should be tabulated, see Table 12. The ranked order is then totalled for each species to give the overall rank. To help with recording the results in the field it may be useful to use a ready drawn matrix.

Table 12 - Tabulation of Results from Interviews

Criteria	Species A	Species B	Species C	Species D	Species E	Species F
Interview 1						
1	2	4	3	1	5	6
2	1	2	3	5	6	4
3	4	5	6	2	1	3
Interview 2						
1	3	5	6	2	1	4
2	6	5	4	3	2	1
3	3	4	5	1	2	3
Interview 3						
1	3	2	1	5	4	6
2	6	5	4	3	2	1
3	4	2	1	3	5	6
Total	**32**	**34**	**33**	**25**	**28**	**34**

From Table 12 it can be seen that species B and species F are the the most important species according to criteria 1, 2 and 3.

> "What counts is not so much the final scores but the process of discussion and debate that occurs as the matrix is being created" (Pretty *et al.*, 1995).

Pairwise Ranking

Table 13 shows the results of a pairwise ranking exercise conducted with a group of fishermen in a village in India as part of an exploratory study.

Table 13 - Pairwise Ranking of Five Different Fish Species According to 'Total Value to Community'

Sail fish	Seer fish	Tuna	Sardines	Total score
Mackerel	Mackerel	Seer	Mackerel	Mackerel	3
Sardines	Sardines	Seer	Sardines	-	2
Tuna	Sail / tuna	Seer	-	-	0.5
Seer fish	Seer	-	-	-	4
Sail fish	-	-	-	-	0.5

'Total value to the community' was determined by the fishermen interviewed and was a function of fish unit price, length of season, and size and frequency of catch. Seer fish were ranked highest with a total score of 4. It was established during the ranking exercise that seer fish commands a relatively high selling price and can also be

processed and sold for a good price if it is not sold fresh. Whereas sail fish was ranked low because few are caught, although the price is high. Alternatively, tuna are caught frequently but fetch a low selling price.

Scoring

An extension of ranking is to score criteria rather than simply rank then. In matrix ranking scoring criteria can show more clearly the relative importance of one alternative over another. So rather than having a 1 to 6 value as in Table 11 the respondent would be asked to give the species a score out of 10 for the different criteria.

Locally available materials such as pebbles, seeds, etc. can be used to score if the matrix is drawn on the ground.

Percentage Loss

Percentage loss is a quick method to get indicative quantitative data on levels of fish loss. It can be used during a SSI and is a simple estimate of how much fish is wasted or sold for a reduced price according to seasons or variables.

The most straightforward way to calculate percentage loss is to ask the question "if you landed or sold 100 fish how many on average would be thrown away (or sold for a reduced price)?" The calculation could be done in conjunction with a seasonal calendar to build up a picture of the relative loss levels over a set time period or according to seasons of the year.

The indicative loss levels shown in Table 9 were derived using the percentage loss method.

Daily Activity Chart

A daily activity chart is a diagram tool that is used to generate qualitative information about the day-to-day activities of a fisherman, trader or processor. The diagram is basically a graph of time against activity.

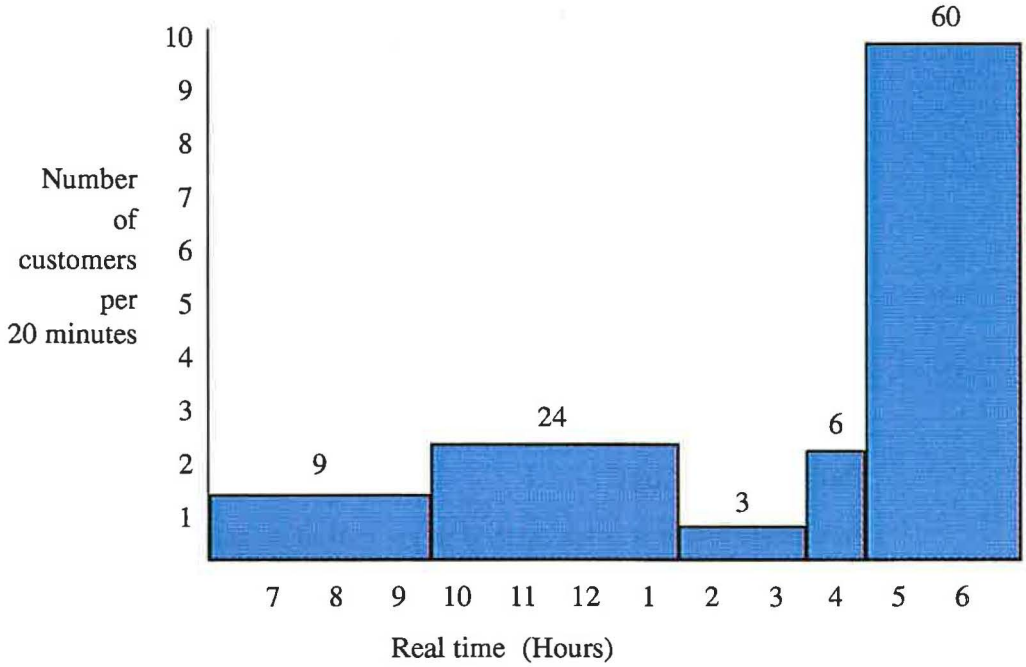
Sometimes it may not be easy to obtain data on the amount of fish in a certain sector. This activity chart can also be used to generate indicative quantitative data on fish turnover. This can be done by finding out at what times a trader has most and least customers during a day and roughly how many customers during peak, normal and low periods. Once a customer activity profile is known and the average amount of fish a customer buys is known it will be possible to estimate the daily turnover of fish. This is a useful way to cross check-data on turnover from observations or SSIs.

Figure 7 shows the number of customers per 20 minutes buying fish from a retail fish monger. There are estimated to be 102 customers per day and on average each is buying 1 kg of fish. Therefore, it can be assumed that turnover is about 100 kg per day.

Flow Diagrams

Flow diagrams are used to show the key activities and variables of a particular process or distribution chain. The process of constructing a flow diagram will often stimulate useful discussion.

Figure 7- Activity Chart to Estimate Fish Turnover of a Retail Shop in Tanzania

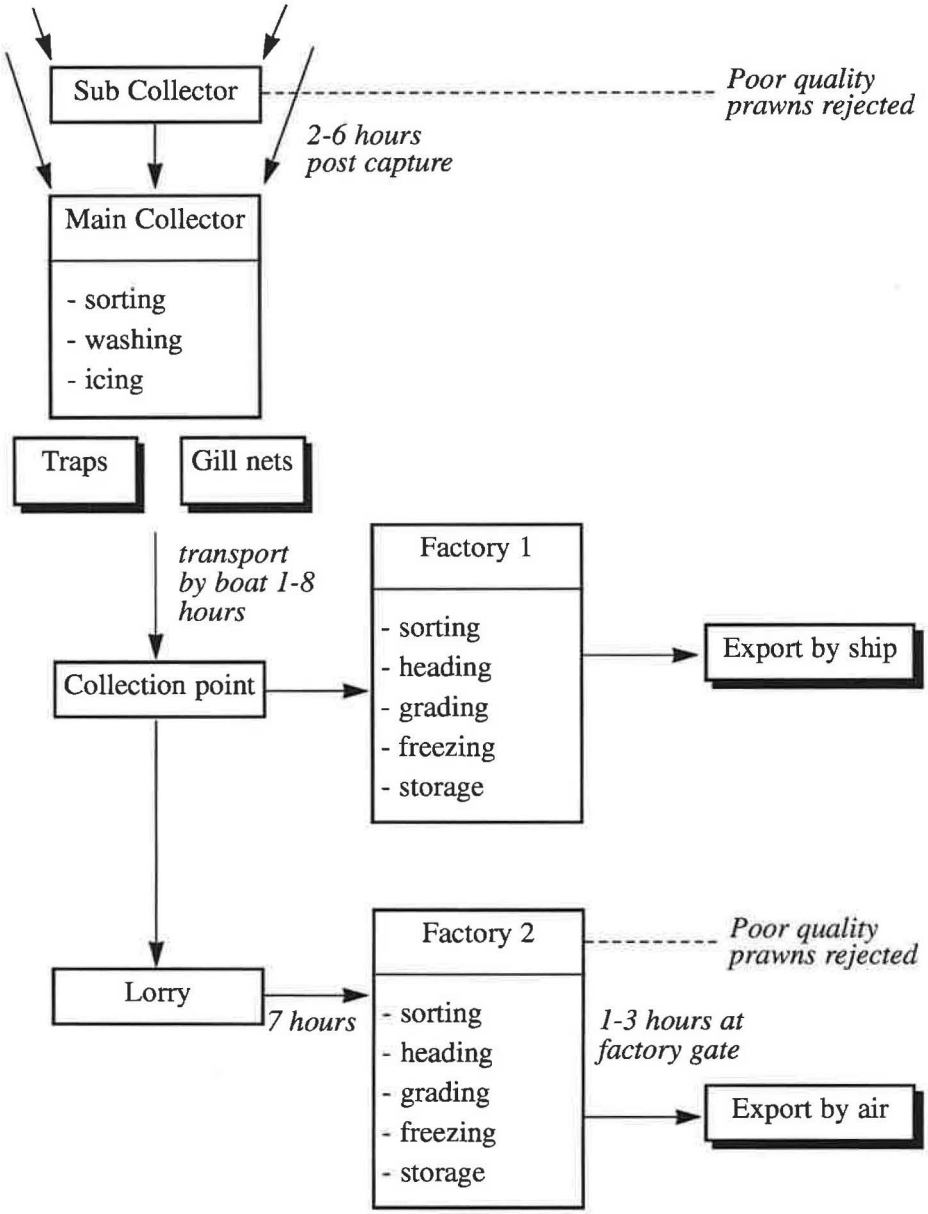


Note: The numbers over the shaded areas show the number of customers per area.

Flow diagrams can be useful tools for planning and analysing fishery sectors and processes. They can show where losses occur and help in determining why they are occurring. A good way to construct flow diagrams is to ask the respondents to set out the stages of a distribution chain or process; these can be determined from SSIs and observation. Once the stages are clear then time and temperature data (if available) can be added to each stage. Such data can be obtained using semi-structured interviewing, observation and load tracking (see pages 24-39).

Figure 8 shows a typical flow diagram from a loss assessment study. Flow diagrams can show where bottlenecks in fish distribution chains occur. For example, it can be seen in this diagram that prawns can spend up to 120 hours in ice with the main collector and that prawns are rejected at this stage. Any effort to reduce losses may do well to focus on this stage of the chain.

Figure 8 - Artisanal Prawn Fishery - Flow Diagram of Prawns to Exporters



Venn Diagrams

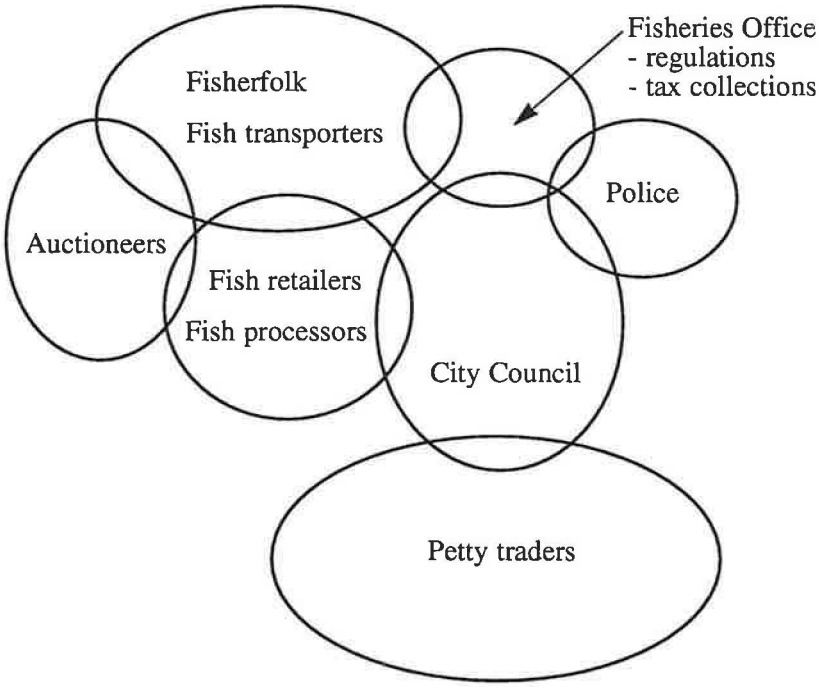
Venn diagrams can be used to show the relationships and decision-making processes within a fishery sector or within a fishing community. They can provide useful qualitative data for planning purposes.

The key individuals and institutions within a sector or at a site must first be identified. Each is represented by a circle, the larger the circle the more important the person or institute's role. The circles are then arranged thus:

- separate circles = no contact
- touching circles = information passes between
- small overlap = some co-operation in decision making
- large overlap = considerable cooperation

Figure 9 shows a venn diagram of the relationships between some of the key organisations and activities at a fish market.

Figure 9 - Venn Diagram of Relationships within a Fish Market



Principles

There are several principles that should be used in association with the methods and loss assessment approach discussed in this chapter. The principles are intended to assist in validating information, reducing bias and improve the quality of the study findings, i.e. in general terms to enhance the trustworthiness of the data.

> "Use of participatory methods without, for example, triangulation of sources, methods and investigators and participant checking of the constructed outputs should be judged as untrustworthy" (Pretty *et al.*, 1995).

The common principles are triangulation, flexibility, serendipity, avoiding bias, participation and data analysis. In addition to a description of the principles a more detailed analysis of the criteria for trustworthiness is given in Pretty (1995). A framework for judging trustworthiness is shown opposite.

A FRAMEWORK FOR JUDGING TRUSTWORTHINESS

1. *Prolonged and/or Intense Engagement Between the Various (Groups of) People.* For building trust and rapport, learning the particulars of the context, and to keep the investigator(s) open to multiple influences.

2. *Persistent and Parallel Observation.* For understanding both a phenomenon and its context.

3. *Triangulation by Multiple Sources, Methods and Investigators.* For cross-checking information and increasing the range of different peoples' realities encountered, including multiple copies of sources of information, comparing the results from a range of methods, and having teams with a diversity of personal, professional and disciplinary backgrounds.

4. *Expression and Analysis of Difference.* For ensuring that a wide range of different actors are involved in the analysis and that their perspectives and realities are accurately represented, including differences according to gender, age, ethnicity, religion and class.

5. *Negative Case Analysis.* For sequential revision of hypotheses as insight grows, until one hypothesis accounts for all known cases without exception.

6. *Peer or Colleague Checking.* Periodical review meetings with peers not directly involved in the inquiry process.

7. *Participant Checking.* For testing the data, interpretations and conclusions with people with whom the original information was constructed and analysed. Without participant checks, investigators cannot claim that they are representing participants' views.

8. *Reports with Working Hypotheses, Contextual Descriptions and Visualisations.* These are 'thick' descriptions of complex reality, with working hypotheses, visualisations and quotations capturing people's personal perspectives and experiences.

9. *Parallel Investigations and Team Communications.* If sub-groups of the same team proceed with investigations in parallel using the same approach, and come up with the same or similar findings, then these findings are more trustworthy.

10. *Reflexive Journals.* These are diaries that individuals keep on a daily basis to record a variety of information about themselves.

11. *Inquiry Audit.* The inquiry team should be able to provide sufficient information for an external person to examine the processes and product in such a way as to confirm that the findings are not a figment of their imaginations.

12. *Impact on Stakeholders' Capacity to Know and Act.* For demonstrating that the investigation or study has had an impact, for example, if participants are more aware of their own realities, as well as those of other people. The report itself could also prompt action on the part of readers who have not been directly involved.

Source: Pretty *et al.* (1995)

Triangulation

Triangulation is used to validate data and improve the quality of the study in the absence of systematic sampling for key informants and groups. There are three types of triangulation that should be applied during fieldwork.

1. The individuals of the study team will have their own specialist background and knowledge and should each be able to approach a topic from a different angle and so the research topic will be explored and covered more fully.

TIP 13 *A team consisting of a fish technologist, a socio-economist and a marketing specialist will be able to produce a more comprehensive and firmer study than a team consisting of only fish technologists.*

2. It is important to interview more than one key respondent or group about a subject as then the data will be cross-checked and validated. Likewise it is important to interview different types of key informants and groups to get a more overall picture of the key issues. By asking the same person or group the same question in different ways is also a way of triangulating.

TIP 14 *Wealthy fisherfolk may have a different view of fish losses from poor fisherfolk. Women processors may have different views and constraints compared with male processors.*

In a study in India a number of key respondents were asked about the same issues which led to the following conclusions.

> "It was recognised by traders and processors based in Visakhapatnam that seer fish landed in Gangavaram, Pudimadaka, Bhimili, Chintapalli and Thantadi villages was more likely to be of poor quality than fish from other landings closer to Visakhapatnam. Poor quality fish, which is termed 'soft' fish because of the firmness of the flesh, is downgraded on arrival in Visakhapatnam auction market and is bought by small-scale processors for salting and drying. This downgrading of fish is much more acute during the summer months, when ambient temperatures are higher and catches larger" (Ward *et al.*, 1996).

3. The third type of triangulation is to use different tools to find out about the same piece of information. For example, a fisherman may talk about the general quality of his catch, but observation can also be used to validate what is said verbally.

TIP 15 *A retailer can mention the turnover of fish in a shop, by using a customer activity chart (see page 49) it will be possible to cross check the information.*

Flexibility

Although a general framework for conducting an informal fish loss assessment has been described (see page 49) and there are a number of methods that are used for data collection, one of the principles of the methodology is flexibility, especially during

fieldwork. In other words the study team should choose and change data collection methods as they see fit according to the situation or circumstances. There may be scope for the research team to develop new methods to aid data collection. Similarly as the team learn about a sector the new knowledge should be incorporated and if necessary used to shape further fieldwork activity.

The research team's approach to data collection should also be flexible. It will be difficult to work to set hours in the field. When data collection and interviews take place should be determined by the respondents and their activities. For example, the best time to interview fish traders may be while they are waiting for fish to arrive at the market. This will mean the team are at the market at the appropriate time.

Serendipity

Serendipity means recognising or creating situations in which the researcher can take advantage of chance. It is being aware of chance opportunities and taking advantage of meetings with people or groups who may be able to provide useful information, but were not thought of as an obvious source of information in the first place. It may be tempting to stick to a set plan of action during fieldwork, but this can often exclude the opportunity to tap into new and different sources of data.

TIP 16 *During fieldwork be prepared to interview someone who may be met by chance and who may have interesting or useful information to offer.*

Avoidance of Bias

Bias can distort the focus and conclusions of a study. It is important that the major types of bias are recognised by the study team and are eliminated as much as possible from a study. Some examples of bias are presented here (see also site selection, page 19 and Chambers, 1994a and b).

Seasonal Bias

Try to avoid conducting fieldwork on the premise that the conditions in the field will be the most comfortable for the team to work. Conduct fieldwork at times that are likely to yield interesting data.

It may be tempting to carry out fieldwork during a certain time of year, for example during the dry season, when conditions in the field will be relatively comfortable. However, it may be more appropriate to conduct fieldwork at times of year when the weather conditions are not so favourable.

Wealth and Influence

When a study team arrives at a site, especially a fishing village, they may be received by the more influential villagers and leaders. These people are usually good at articulating the community's interests and concerns and are a very useful point of entry into a community. It is good protocol to accept their hospitality and to learn from their knowledge. However, the team should be careful to avoid being side-tracked too much by initial contacts. They should make sure that the fieldwork also involves other people from different backgrounds and levels in the community.

Male Bias

Most local-level researchers tend to be men. Once in the field it will often be easier for them to establish contact with male key informants and groups. This has the effect of excluding women from the study and gives the study a male bias. Bearing in mind that women sometimes dominate the processing and trading sectors in certain fisheries it would be wrong to exclude their views and knowledge from a study. This bias can be overcome to an extent if the study team comprises both men and women. Certainly a topical study to investigate how losses affect women in a fishery should be done by a study team of mixed sex or an all female team.

Expectations

Visitors to a village or fish landing will normally raise some level of interest or perhaps suspicion within the local population. Strangers are sometimes associated with revenue collection and taxation. The people may think that there is a project or some development about to start. It is therefore very important that the team explain clearly why they are at a site and what they will be doing otherwise people may get false expectations, which may distort the data they provide.

Participation

What do we mean by participation? There are a number of definitions of participation, but generally it refers to the level of involvement of people in the research or development process. The are various degrees with which people participate, the two extremes are:

- people being informed of what will happen or has happened
- people taking initiatives to create change independently of any institutions.

Outside professionals going to villages to collect information and take it away for processing and analysis without feeding back to those who provided the data is an extractive type process which is relatively easy and quick to do. However, this approach restricts the role the target population plays in the information exercise.

So often it is relatively easy to extract data and then not inform those who provided the data of the overall results and conclusions. Also the degree of participation will be related to the objectives of the assessment. If the assessment is to be extractive in that the data are taken and used for macro planning then this should be stated at the outset so that people are aware of the aim of the research. If people are to be involved in taking decisions about reducing losses then a greater degree of participation should be encouraged. This can be done by:

- stimulating more discussions with the target population
- research team sharing ideas with the target population
- research team spending as much time as possible with the target population
- target population encouraged to take an active part in data collection and analysis.

> "In a growing number of government and non-government institutions, extractive research is being complemented, and even replaced by investigation and analysis by local people themselves. Methods are being used not just for local people to inform outsiders, but also for people's own analysis of their conditions" (Pretty *et al.*, 1995).

Certain data collection methods, such as mapping (see page 39) and seasonal calendars (see page 42) are inherently participatory in that they involve local people in presenting and discussing information.

For more information on participation see Pretty *et al.*, (1995).

Data Analysis

Informal studies can generate a lot of data in a short space of time. The data will have often been collected in a random order in note form. Analysing the data and organising it can be a daunting task to a team using the methodology for the first time.

TIP 17 *It is worth deciding how data will be analysed ahead of time or field test analysis.*

There are two sets of analysts for an assessment: the external researchers and the local people. It is important to establish at the planning stage of an assessment who is to analyse the data. If the assessment is extractive in that data are collected by researchers and then taken away without the need of participation of the local people then the external researchers will be the ones concerned with analysis. If participatory planning is an objective of an assessment then the local people will be heavily involved in analysis and discussion.

If the research team is to analyse the data then one of the best ways of maintaining the focus of a study and ensuring its clarity is to hold regular team meetings during the fieldwork period—one a day is recommended. Sometimes it is a good idea to set aside a whole day for such an exercise. These meetings will provide an opportunity to go over and discuss and analyse the data that have been collected and to plan further fieldwork, deciding which issues are no longer of importance and which issues should receive more focus.

TIP 18 *It is better to take a day off from fieldwork in the middle of a survey if notes are not being compiled regularly than to leave it all to the end when salient points will have been missed.*

Large pieces of paper and a marker pen can be used to summarise the results of these meetings. Issues that need further research can be easily identified as can issues which need no further research. The papers should be kept and used when writing the study report.

Reporting

To an extent the planning framework developed by the team before fieldwork should be used as a guide to compiling a report. The report should address the objectives of the study and should support or disagree with the hypothesis formed during planning.

It is important that a report is produced jointly by the team and ideally a draft of the final report should be produced before the team disperses. The report should be concise and should only include the data that are relevant to the objectives of the study. Where necessary, data should be analysed and turned into information. This is especially important for indicative loss data. For example, different data from different sources may have been collected from primary and secondary sources and in this fragmented form an overall conclusion may not be clear. However, by assimilating the different sets of data it may be possible to form clearer conclusions.

Unlike a statistical survey it is less common to apply mathematical principles to the analysis of data generated from an informal fish loss assessment. Instead the field team will have a series of facts, opinions, observations, statements and data in the form of diagrams which has to be sifted, edited, assimilated and compiled in a clear and logical way so it can be readily understood by the intended recipient of the study data. The following are key points to bear in mind when producing a report:

- *a member of the team should write fieldwork notes up clearly and on a regular basis, probably the best time for writing up is either at the end of the fieldwork day or after a fieldwork meeting*
- *use data on quantities of fish, prices and losses to calculate indicative quantitative information on fish losses*
- *use case studies to highlight key issues*
- *try to use raw data to show trends in losses and indirect issues such as fish catches*
- *compare data from secondary sources with study data*
- *discard data that are suspected to be false*
- *be objective about data*
- *only use data relevant to the objectives of the study unless there are good reasons to do otherwise.*

Case studies are a detailed account of an important activity or subject related to the objectives of the study. The case study will help to highlight or support important issues identified by the study team. Below is an example of a case study included in a report of an informal fish loss assessment. It is derived from an SSI with fisherfolk and highlights some of the key issues in this sector, i.e. the migration of fisherfolk and the seasonal nature of fish loss.

BOX 9

Case Study: *Dagaa* Fishermen and Processors

Juma Hussein, Amri Kassim and Gideon Papa are three fishermen from Kigoma who fish for *dagaa*, a small anchovy-like fish. One reason why they are now fishing on Lake Victoria, they say, is because it is easier to fish here, particularly because they do not need to use an engine.

There are 75 fishing units (households) in this village. During a good season each can produce 80–100 35 kg sacks of dried *dagaa* per month. Buyers from all over Tanzania, from Zaire and from Kirumba come to buy *dagaa* here.

At the time of this study a 35 kg sack of good quality *dagaa* was selling here for 6500 Tsh; this is about 185 Tsh per kg. But price varies according to supply and demand.

In a month the running costs for fishing are 20 000–30 000 Tsh. In a peak season when 100 sacks could be sold then, assuming a price of 6500 Tsh per sack, the owner of the fish could realise a profit of 300 000 Tsh and the fishermen could earn roughly 70 000 Tsh each.

When fishing stops some fishermen will leave the camp for Mwanza or Kigoma and others will remain to look after things. The fishing gear is normally owned by someone who does not actually fish. The fishing is left to four fishermen.

The rainy season (October to May) is a difficult time to fish and process and this deters people from fishing then. Some fishermen stop fishing during the rainy season and go to farm instead. As for losses, up to 60–70% of a catch can be discarded during the rainy season because it is not possible to dry the catch properly.

The fishermen are usually involved in the processing of the *dagaa*. The women, who are resident in the camp, cook and assist in unloading the *dagaa* from canoes and in the drying. The *dagaa* can take from 8 hours to 2 days to dry depending on the weather conditions.

Generating Indicative Quantitative Data on Losses

In order to be able to estimate accurately the levels of post-harvest fish loss in a given fishery the following basic data are required:

- types of loss
- loss percentages according to seasonality
- quantities of fish according to seasons
- frequency of loss
- frequency of operation, i.e. number of fishing days per year
- average selling price for good quality fish/product
- average selling price of poor quality fish/product.

Once the data are available it will be possible to calculate average annual percentage and monetary values of losses in given fishery sectors.

The most practical way to measure loss is either as a percentage or as a monetary value. Percentage figures show how significant a loss maybe and are useful when comparing losses in different sectors. Monetary values of loss can also be used to do this, in addition, they add a value and can be useful in decision making.

Data Collection Methods for Quantification

There are a number of data collection tools associated with informal approaches to development research and data collection. Not all of them have been experimented with by the author. The ones that have and that have been found to be appropriate to fish loss quantification are:

- semi-structured interviews (see page 25)
- calendars (see page 41)
- observation (see page 34)
- secondary sources (see page 18)

Defining the Type of Loss

At the beginning of the data collection process it is necessary to explore and define the type of losses occurring in a system. There are three types of primary loss to consider. These are:

- physical
- quality
- market force.

The list of topics on the check-list should include these three types of loss.

It is possible that more than one type of loss occurs at the same time. A fisherman may throw away fish due to spoilage and sell some for a reduced price. These two types of loss can be combined to give a **total loss**. This is the monetary value of both losses expressed as a percentage of the maximum value of the catch or batch of fish. It is recommended as a standard measure of post-harvest fish loss.

There are a number of informal data collection tools that can be used to define the type of losses in a sector under study. The most widely used is the SSI. Through discussion, guided by a checklist if necessary, it will be possible to generate data on the types of loss that operators experience, or determine that there is no loss.

The subject of 'loss' can be a sensitive one and may need to be broached indirectly. For example, people may be reluctant to discuss losses, even though they occur, because there are by-laws or regulations that control fish wastage, i.e. physical losses. Misunderstandings about the reasons why data on losses are being collected can usually be reduced by a clear explanation of the reasons for the work.

A way to overcome the stigma that can be associated with losses is to use certain phraseology (and hope this translates into a local language accurately). For example, instead of discussing losses it is better to discuss grades of fish. The following are examples of the sort of question that can be asked in an SSI:

- how many grades of fish do you buy or sell?
- can you tell us about the different grades?
- do you ever not sell any fish for any reasons?
- do you ever have any difficulty selling your fish/product?

The answers to these sorts of question will give the researcher strong clues as to the type of losses and, to an extent, how significant are the losses. Observing how a respondent talks about loss will also give some insight into the significance of the losses.

Another tool that can assist the researcher identify the types of losses in a system is **observation** (see also page 34). Typical activities to observe for clues of losses are the:

- landing of fish
- sorting and grading
- quality of fish
- handling and processing
- selling and distribution.

Any observations that indicate losses occurr should be followed up by questioning in a SSI. The observations can assist in framing questions to be asked during the interview. If the quality is poor at an early distribution stage then losses will often occur further down the marketing chain. Observation of processing and storage can disclose whether insect infestation is a problem, which can be a cause of both physical and quality losses.

Seasonality

Once a loss has been identified then data are required on its seasonality and its size. This information and data on the quantities of fish that are being traded will be used in a simple calculation to give indicative loss levels.

Seasonality can be borne out during interviews. For example, in the marine trap fishery of Jibondo Island, Tanzania:

> "Losses are highest during the SE monsoon when there can be a strong continuous wind for 3–7 days. During the the NE monsoons there are usually only strong winds at night over a 2–3 day period. Rock cod, a fish that can grow to a large size, can sometimes break traps. Once a year traps are broken by net fishermen and the whole catch is then often lost".

The seasonality of losses can be explored using **calendars** (see also page 42). Typically respondents identify when the maximum and minimum losses occur, according to seasons, over a time period which is typically 12 months (the calendar used should be that used and best understood by the fisherfolk). Data are then added for the times in between, giving a full picture of how loss levels can change over time. Calendars can be built up to show trends in fish catch and other related issues such as weather patterns, income levels and activities. The example shown in Figure 6 shows that losses occur for about 6 months of the year.

If fishing, processing or trading, etc. are done according to a pattern or cycle then loss levels can be discussed in relation to this. For example, in some fisheries fishing is done according to the phases of the moon or tides. The different phases or tides together represent a cycle which can be diagramatically represented and then used as a focus for an SSI.

Loss Levels

Once seasonal trends have been clarified then data on loss levels should be sought. This can be done by using proxy examples or questions in SSIs and can be done at the same time as seasonal calendars are developed. The % loss approach is a proxy method

which involves asking the fisherman that if he landed/sold 100 fish then how many on average did he:

- sell for a reduced price?
- physically lose?

The exercise is done according to seasons and it may be more practical to lower the number to 10. The exercise can be done as a diagram where the numbers are written out on the earth or sand by the researcher.

Data on levels of loss can also be generated from observation. It may be possible to count, or quantify, fish that are sold for a reduced price (different grades) or fish that are physically lost. A set of pocket-size weighing scales can be useful for weighing samples of fish and quantifying loss levels.

Quantities of Fish and Number of Operators

Information on the quantities of fish that are being caught, processed or traded is also needed so that meaningful monetary values of losses can be determined. The quantities may also vary according to season and so data on quantities can be best generated using calendar techniques (see also pages 41–44) as well as SSIs. Often quantities of fish will be measured using local (traditional) units. It is important to get data on these units, especially if more than one traditional unit is used for buying or selling the fish, so that values can be converted to standard units such as kilograms. It may be possible to physically weigh fish to get data on traditional units.

If conclusions on losses are to be used as representative of a given sector or area then data will be required on the number of operators in that sector. This data may be available from secondary sources, such as reports and government statistics. It is often impossible to collect data on an entire population, unless the sector is small. By assuming that the sample frame from which the data were sourced is representative of a population will often be an assumption based on faith, which may be difficult to justify. It is recommended that care should be taken to make sure the results and conclusions on losses are presented in light of the assumptions made and that data is not extrapolated beyond reason.

Frequency of Losses and Operations

Losses may occur in a particular fishery, but they may not occur every time an activity is carried out. So it is important to find out the frequency with which a loss occurs. This is best done using a SSI.

The frequency of a loss or an operation, i.e. fishing or transportation, may also vary according to weather conditions or other variables such as fishing gear type, so it is important that these issues are also explored and for this tools such as seasonal calendars are useful.

In order to apply realistic data on the volumes of fish moving in particular sectors data are also required on the frequency with which fishing, trading and processing of fish is carried out. Some data may be available from secondary sources, such as statistical reports. This data will be used with the data on quantities of fish to determine volumes of fish over a period of time, such as a year. Frequency data is usually obtained from SSIs, by asking simple questions like:

- how often do you fish?
- do you ever stop processing?

Cycle diagrams such as those associated with fishing activities are also useful ways of finding out how often an activity is carried out. For example, fishing may be carried out according to a predictable cycle, which may be linked to the lunar cycle. Consequently there are times of fishing activity and times of rest.

Prices

Price data are required for the calculation of monetary losses. Prices are another sensitive topic and it can be difficult to get data on them, particularly as some business people are secretive about prices. People will often become suspicious when asked about prices, especially if you have no intention of buying the product. Misunderstandings about the nature of the research will only excarcerbate this problem. So it is important that the research team provide a clear explanation of the research to respondents before interviewing them.

There are three main sources of price data. It can be derived from questioning during SSIs. It can also be gleaned from secondary sources of data, such as market records or buyers records. Otherwise, observation during fieldwork can be used to pick out price data by listening to transactions. Prices may also be displayed.

If price data are not easy to get directly from respondents then it may be worth talking to people with indirect involvement in the activity. For example, a fishermen may sell fish through an auctioneer. The auctioneer will be less impartial than the fisherman about prices and may disclose the data more easily. Consumers will also be able to give price information, as will market officials and traders of other fish products in the same site. If all else fails then buy a fish!

Data is only required on two prices. These are:

- the price at which the best quality fish were sold
- the price at which the poorer quality fish were sold.

The best price is used as a bench mark to work out the maximum value of the fish, under local conditions. Then if fish are sold for a lower price, perhaps because of quality reasons, then the loss in value can be easily worked out. The 'best price' is also used to calculate the economic value of physical losses. If 10 kg of fish are physically lost then the value would be simply 10 multiplied by the best price per kilogram.

If fish are graded for selling according to quality then there will automatically be several different prices. In which case it is important that a practical approach is taken and that average prices are derived and then used to calculate the value of losses.

Another factor which can complicate determining the right price to use in calculations is the fact that the selling price of fish may fluctuate over a short space of time. Furthermore, the price of fish may be lowered towards the end of a selling session simply to sell the fish off because the costs of keeping the fish until the next session are prohibitive. One option in circumstances like this is to determine the average price of best and poor quality fish over the selling period.

To make price data user friendly it should be in standard units such as kilograms. To achieve this in situations where traditional units are used for fish measurement samples of fish may have to be weighed, in which case a set of small weighing scales is a useful tool to have at hand.

Extracts From Loss Assessment Studies

This section shows how data from informal fish loss assessment studies can be presented in reports. The examples are taken from several studies undertaken in Tanzania.

Summarising Post-harvest Fish Loss Levels

One of the most important aspects of a loss assessment study is to produce indicative quantitative data on losses (see page 59 for a guide to generating indicative quantitative data).

Example 1

Table 14 shows how loss data, mainly derived from SSIs with groups of fishermen, can be summarised.

Table 14 - Summary of Jibondo Island Fishery Post-harvest Fish Losses

Sub-sector	Total Loss (%)	Number of Operators	Annual Sector Monetary Loss (Tsh)
Octopus fishing	0	unknown	0
Surround net	0	3	0
Box trap	6	13	93 600
Collector boat	40	1	4 100 000
Octopus collection	23	1	322 800
Sharknetters	6	17	435 200
Processors	5	8	432 000

The losses affect fishermen and collectors. The total loss refers to the combination of physical losses with losses due to the fish being sold for a reduced price.

To show how the figures in the table are calculated let us look at the collector boat operator who on average loses 40% of his potential income every year.

Box 10 is taken from the study report. It shows the sort of data that are needed to estimate losses and it shows the assumptions that have to be made at the same time.

TIP 19

A point to make here is that prices are sometimes a sensitive issue. In some cases it may be practical to get price information from indirect sources, at the very least make sure price data are cross-checked.

The first example is taken from fieldwork in an artisanal marine fishery in Tanzania. It draws on data on the:

- seasonality losses
- levels of loss

- frequencies of activity
- prices
- traditional units

BOX 10
Fish Collection During the NE Monsoon
Season 1

During the SE monsoon the trader makes 14 trips, one every spring tide. During each trip 22 *tengas* of fish are collected. Of these 4 are discarded and 11 are sold for a price which is 50% of the best price, because of quality deterioration. These losses are an average per trip. The other 7 *tengas* are sold for a good price. The average selling price for a *kikapu* (basket) of fish in Dar es Salaam is 3250 Tsh.

The theoretical maximum returns for this fish for this season, which assumes they are sold for the best price, is:

tengas x *kikapus* x price per *kikapu* x no. of trips

22 x 6 x 3250 x 14 = 6 006 000 Tsh

The total loss in monetary terms is the physical loss plus the loss in revenue due to fish being sold for 50% of the best price.

The physical loss is calculated by:

tengas discarded x *kikapus* per *tenga* x best price x no.of trips

4 x 6 x 3250 x14 = 1 092 000

The reduced price is calculated by:

tengas x *kikapus* per **tenga** x best price x reduced price percentage x no. of trips

11 x 6 x 3250 x 50/100 x 14 = 1 501 500

The total monetary loss for the SE monsoon is:

1 092 000 + 1 501 500 = 2 593 500 Tsh.

continued overleaf

Season 2

During the NE monsoon 22 *tengas* of fish are transported and 10 trips are made on average per trip, only 0.5 of a *tenga* is discarded, but 14.5 are sold for a price 50% that of the best price.

The potential maximum revenue for this season is:

22 x 6 x 3250 x 10 = 4 290 000 Tsh.

The physical loss is:

0.5 x 6 x 3250 x 10 = 97 500 Tsh

The reduced price loss is:

14.5 x 6 x 3250 x 50/100 x 10 = 1 413 750 Tsh.

The total monetary loss is 97 500 + 1 413 750 = 1 511 250 Tsh.

Annual Losses

Annually, the maximum potential revenue to the trader is:

SE monsoon + NE monsoon

6 006 000 + 4 290 000 = 10 296 000 Tsh

Annually, the total loss is:

2 593 500 + 1 511 250 = 4 104 750

Annually the average **total loss** in percentage terms is:

4 104 750/10 296 000 x 100 = 40%.

Annually, the **physical loss** is:

Monetary value of physical loss/maximum potential value of fish x 100

(1 092 000 + 97 500)/ 10 296 000 x 100 = 11.5%

It is assumed the data on losses are accurate and that the selling price remains constant all year round regardless of quantity supplied. However, this is indicative data and in the context of this study it showed that in terms of percentage and monetary significance the collector boat operator is suffering high losses.

Example 2

In another example for fish wholesalers who were dealing in frozen fish transported by train, where the data on losses are again taken from SSIs, the seasonal loss data are used to calculate indicative annual monetary losses. This example shows the importance of SSIs and the data required to produce indicative quantitative information on fish losses. Table 15 shows the average sizes of a consignment during the hot and cool seasons, the average amount of fish sold for the best price available and fish that is sold for a reduced price and discarded. Once again the total loss is calculated, which is the combination of reduced price losses and the physical loss. The reduced price is on average half of the best price. The loss is the loss in revenue to the wholesalers.

The consignment size varies so the overall average loss for the two seasons is 11% and is calculated by dividing the equivalent total weight of fish lost by the total weight of consignments multiplied by 100:

$$714/6447.5 \times 100 = 11\%$$

Table 15 - Average Sizes of a Consignment during the Hot and Cool Seasons

Season	Consignment Weight (kg)	Best Price (kg)	Reduced Price (kg)	Physical Loss (kg)	Total Loss (%) and (kg)
Hot	1000	870	130		6.5 (65 kg)
Cool	600	570	30		2.5 (15 kg)
Hot	1000	800	200		10 (100 kg)
Cool	1000	950	50		2.5 (25 kg)
Hot	1000	700	270	30	16.5 (165 kg)
Hot	1847.5	1504	343.5		18.6 (344 kg)
Total	6447.5		**Weighted Average loss**		**11 % (714 kg)**

Table 15 shows the difference in loss level according to season and that the most common loss is due to selling fish for a reduced price.

Taking the data for each season the weighted average total loss for the 'hot' season is 7% and for the 'cool' season is 4%.

Example 3

In a third example the loss due to rejection of prawns by a processing factory is calculated in terms of gross income lost to the factory. This example is from a study of the Tanzanian artisanal prawn fishery and the collection and supply of prawns to processing factories. The study was for the manager of a factory who was concerned about the poor quality of prawns offered for sale to the factory.

BOX 11

Loss Due to Rejection of Prawns in a Processing Plant

On average 3% of a consignment of prawns arriving at the factory is rejected. Observations suggest that these are a mixture of 50% small and 50% poor quality. Therefore 15 kg of prawns are rejected for every 1000 kg accepted because of poor quality rather than size. Multiplying up, if the factory receive on average 3 tonnes of prawns per week this equates to 45 kg of rejected prawns. In a year therefore, as much as 2340 kg of prawns are rejected. If these prawns could have been sold headless at 10 US$/kg (the export market price) then, taking in to consideration the 40% weight loss due to processing, the gross income to the factory could be

2340 x 60/100 x 10 = US$ 14 000

From the text it can be seen that observations were used to calculate the proportion of prawns rejected by the factory because of size and quality. Data on the average size of consignment of prawns and the number of consignments per week were taken from SSIs. Price information was from secondary sources. Again there are some assumptions, i.e. the factory receives a steady supply of raw material all year round and that there is no seasonal variation in the proportion of prawns rejected.

Reasons For Losses

An important part of a loss assessment is to find out why the losses occur.

Example 1

Table 16 shows how the key findings of a study can be summarised in table form. The study was of the Tanzania artisanal prawn fishery and the subsequent collection of prawns by traders who in turn transport and sell them to factories. The data in the 'Findings' column is derived from actual direct observations by the study team and from SSIs with fisherfolk, collectors and factory management.

Table 16 - Artisanal Prawn Fishing and Collection - Key Findings

	Findings	Effect	Comments*
Fishing	No ice used by fisherfolk but some shading of the prawns before landing. Prawns kept at high ambient temperatures in canoe for several hours.	Onset of spoliage rapid with up to 20% of the prawns rejected by buyers.	Fisherfolk should be encouraged to use better evaporative cooling methods and possibly ice.
Collection	Prawns not washed or poorly washed before icing.	Maintenance of a potentially high bacterial load and hence acceleration of the spoilage rate.	Prawns should be washed in clean water before icing.
	Large chunks of block ice used for chilling.	Poor icing of prawns and mechanical damage causing general quality deterioration.	Better icing practice employed, possible use of block ice crushers.
	Prawn to ice ratio 3:1 to 5:1.	Ineffective chilling enhancing spoilage.	Use 1:1 prawn to ice ratio.
	Not enough ice available.	Rejection of good quality prawns during periods of high landings.	Make more ice available.
	Collection time:		
	2 days	8% of prawns sold for a reduced price to factory.	
	4 days		
Factory	4 days +	15% sold for a reduced price to factory.	
	General quality deterioration	30% sold for a reduced price to factory.	
	Prawns downgraded—headed and frozen.	1.5% of prawns totally rejected by factory.	
	Prawns downgraded—peeled and frozen.	40% weight loss and a loss in value of 20%.	
		50–60% weight loss and a loss in value.	

* Basis for recommendations from the study.

Table 16 shows there is a relationship between the time spent collecting prawns and the proportion of prawns bought by the factory for a reduced price. It also highlights some of the handling practices that are contributing to poor quality prawns.

Example 2
In a second example, SSIs with traders and fisherfolk combined with observations have been used to show the reasons why fish is subjected to high ambient temperatures and hence why higher fish losses occur during the warmer months of the year.

BOX 12

Case Study: Warm Weather Losses

The onset of organoleptic changes (gill colour) associated with spoilage is facilitated by the time the caught fish spends at high ambient temperatures. Fish caught early in gill nets (set at 6 pm (18.00 hours) for anything from 8 to 24 hours) will spend several hours after death in relatively warm water before being hauled into a canoe and then transported, possibly for several more hours without ice to the buyer. The buyer in turn may then spend a couple of hours deliberating before actually buying the fish. In the case of traders who air-freight frozen fish from Mwanza to Dar es Salaam it can take anything from 5 to 16 hours between the time the fish has been caught until it enters a freezer. During this period the fish will be left at ambient temperatures. It is not surprising then that the warmer months of the year tend to be associated with higher levels of loss.

The reasons for loss may be linked to other variables such as the biological nature of the fish species. Exporters indicated that rejections vary according to fish species and the time of year. Seer fish, for example, are more prone to belly bursting, while smaller fish like pomfret are more prone to bruising and crushing (Digges and Clucas, 1995).

Perceptions

What people think about fish losses is one of the most important issues to be addressed in loss assessment studies if a real understanding of losses is to established. If people are concerned about losses they are more likely to be interested in reducing them. In essence this involves asking people what they think.

One method of putting losses into perspective is to carry out a ranking exercise in which losses are ranked alongside other problems. For example, Table 9 shows the ranking of constraints in a fish wholesale business in Dar es Salaam. The losses due to non- payment of credit loans were seen as the most important problem and stale fish losses the fourth most important. This shows that losses are perceived as a problem but there are more important issues at stake.

Another study came up with the following conclusion about fish processors perceptions of losses.

> "As for the perception of losses by fishermen and traders, most seemed to accept losses as a normal part of the business and work. Some of the more fatalistic described losses as Gods work".

An SSI with a fish wholesaler revealed the following:

> "In the late 1980s losses were high. This was before freezing became more organised and efficient in Mwanza. Up to 50% of a consignment could be lost because of spoilage. Now losses are rare and not perceived as a significant problem."

Background Data

Background data are important in understanding the context in which losses may be occurring. This sort of information is useful in planning any loss intervention strategies. The detail and scope of the information will depend largely on the type of study. For exploratory studies the background data may be broad in terms of coverage, whereas for a topical study it will be more focused.

A study of the fishery of Jibondo Island of the Tanzanian coast produced the following background data for the artisanal processing sector. As well as describing the processing operations it highlights the relationships between fisherfolk and processors and describes the traditional units of fish measurement. The latter is useful in any loss calculations.

BOX 13

Background Data for a Fishery

On Jibondo Island there are three indigenous processors and five from other areas. The processors rely on half-processed fish from sharknet fishermen and fresh fish from the box trap fishery. Most fish (over half) comes from the sharknetters. The indigenous processors have relatives who fish and so can secure a supply of fish much easier than processors who have come from outside Jibondo. The latter sometimes rely on fish caught by fishermen who are also not from Jibondo.

Rays are the most commonly processed fish followed by sharks and then parrot fish (*pono*). Altogether seven types of dried product are produced: pieces of large sharks, whole small sharks, pieces of large ray, pieces of small ray, whole large fish, medium whole fish and small whole fish.

Local names for Common Fish Species Processed.

Large rays	*tenga, hamama*
Small rays	*kite, kapungu*
Large sharks	*amrani, maviru, upanga* (saw shark), *pingeusi* (hammerhead)
Small sharks	*kinengwe*, juveniles of large sharks

continued overleaf

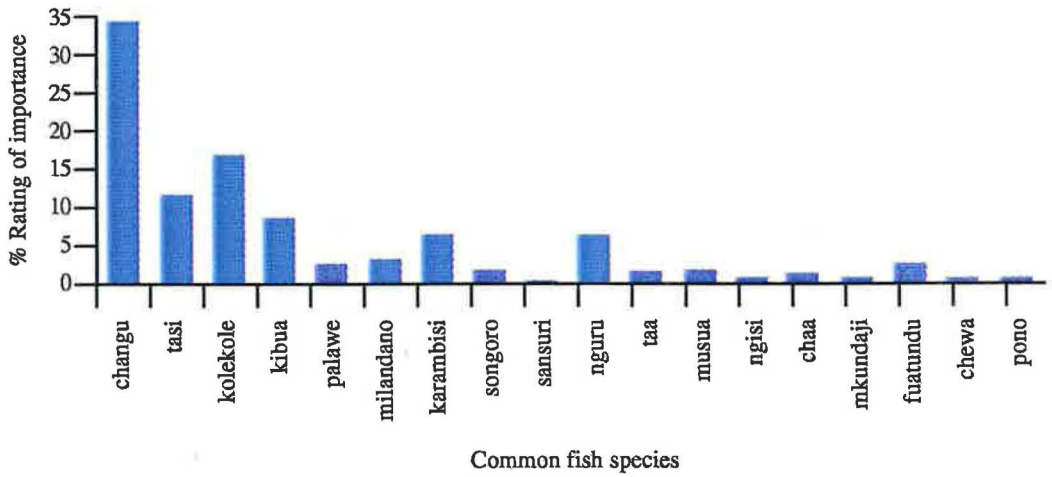
Normally the fish are sun-dried for between 3 and 15 days. After which they are stored for a further 5 days before being sold in Jibondo to visiting traders or taken to Dar es Salaam, a journey of 1–3 days by sailing boat. Selling in Dar es Salaam can take 1–3 days also. On average two vessels per month take dried fish from Jibondo to the mainland.

A *jafaa* is the unit of measurement by which dried fish are sold in bulk and is equal to 20 *korijas*. A *korija* is equal to 20 pieces of dried fish. A piece being about 0.5 kg. During the NE monsoon (5 months), about 15 *jafaas* are processed per processor, but during the SE monsoon only 5 *jafaas* on average are processed.

Ranking of Fish Species

Ranking of fish species against set criteria can help determine which fish species should be targeted in a formal questionnaire survey. Figure 10 shows how the results of a ranking exercise can be presented. The species were ranked according to importance in terms of business and ranking was carried out from discussions with retailers, fisherfolk and fish collectors/transporters. The respondents were asked to rank the four most important species, the most important scored 4, while the least out of the four scored 1. The ranked totals for each species after 24 ranking exercises were converted into percentage figures. For example the species *changu* (snappers) had a total ranking score of 79 out of a total of 228. This 79 was converted to a percentage of 228. This is seen as a more logical presentation of the results.

Figure 10-Commercially Important Fish Species, Mafia Island Fishery



Note: Fish species names in swahili.

The questionnaire survey aimed to focus on the four most important species in the fishery. From the results shown in Figure 10, it was clear that the species to target were *changu* (snappers), *kolekole* (trevally), *tasi* (spinefoot) and *kibua* (mackerel).

Some Common Problems Associated With Informal Fish Loss Assessments

This section analyses some of the reasons why some informal loss assessment studies do not always produce good quality results.

One of the reasons why it is open to criticism is that it is seen as being less scientific than formal approaches to data collection, especially since it lacks a statistical sampling component, although this problem is addressed by the trustworthiness criteria (see page 53)

One of the main reasons for weak studies is the failure to address the objectives set during planning. Generally, if planning has been weak, or data collection during fieldwork has not been rigorous, then the results of a study will be weak, there will be gaps in the data, the study will be inconclusive, and at worst it will provide misleading information.

The data collection tools may be used as a means to an end rather than to collect data that will fulfil the objectives of the study.

The methodology is demanding in terms of commitment from the team. The quality of the study is just as much reliant on the commitment and human relationships within the team as it is on the application of good planning, and the tools and techniques of data collection.

The check-list can be used as a questionnaire rather than as a guide. Similarly the check-list is sometimes used as a means to an end so topics that arise during an interview or study that may be relevant but because they are not on the check-list are ignored.

If probing (see page 31) is neglected the study will probably have gaps and be weak. Once a group or person starts to talk about an issue that is important to the study the issue should be thoroughly explored by probing.

During analysis and report compilation a lack of discussion between team members, either because of personality differences or because there was not enough time set aside for the purpose after fieldwork, will often lead to a weak report.

Other reasons why studies may produce poor quality data are:

- *an inadequate use of secondary sources of information*
- *too rigid a schedule for fieldwork*
- *poorly defined objectives*
- *the team did not understand the objectives*
- *bias has not been tackled well*
- *wrong team was used*
- *non multidisciplinary team used*
- *team members chosen had been involved in law enforcement and or revenue collection so people were suspicious of them*
- *the team was inadequately trained in the use of data collection tools and techniques*
- *conducting fieldwork too quickly*
- *lack of communication between the team members*
- *not interviewing a representative cross-section of people*
- *raising expectations and not explaining reasons for the study*

- *lack of interest in the work*
- *poor analysis of data*
- *having insufficient time for analysis of data and report writing.*

Chapter 3 *Questionnaire Methodology*

The formal recall questionnaire survey is used to generate primarily quantitative data on post-harvest fish losses. The raw data are collected at selected sites by enumerators who interview a sample of respondents using a questionnaire. Interviews are conducted at regular intervals over a set period of time, i.e. 1 year. The data are stored in a computer database and analysed to give information on the:

- *financial value of fish losses per operator*
- *physical loss*
- *reduced price loss*
- *total loss*
- *reasons why losses occur*
- *end use of fish classified as a loss.*

The methodology can be divided into the following components:

- *Resources required*
- *Pre-survey appraisal*
- *Questionnaires*
- *Recording answers*
- *Data collection*
- *Data management*
- *Data analysis*
- *Financial management*

Resources Required

A typical survey will require:

- *human resources*
- *computer system*
- *finance.*

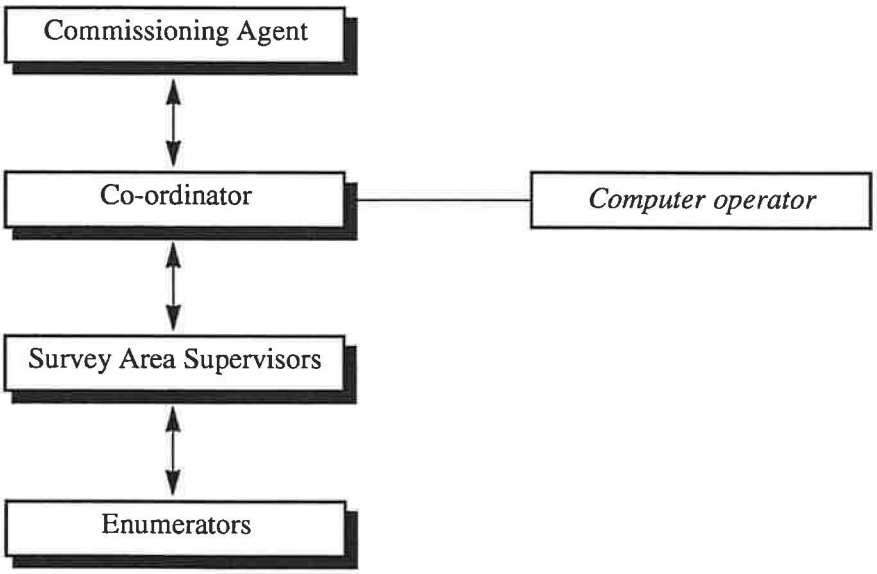
TIP 20

One of the basic requirements of a survey is someone who can train the survey staff in the use of the methododology. This should be someone with previous experience of survey work and training.

It is recommended that survey staff are given formal training in the various aspects of the methodology.

A survey will require a co-ordinator, supervisors to monitor data collection and enumerators to conduct interviews. Figure 11 shows a typical arrangement of survey staff. The number of supervisors and enumerators depends on the the number of sites, where the sites are and the frequency of data collection. The commissioning agent is the person(s) who decides what the survey should cover and the data required.

Figure 11-Typical Arrangement of Survey Staff



For small surveys supervisors may not be necessary or the co-ordinator could also act as supervisor.

Co-ordinator

A survey co-ordinator, based in a national or regional centre, will be responsible for making sure the survey is carried out effectively and that the data are analysed and the results reported. The co-ordinator will work closely with the person responsible for managing the computer database. If the survey uses several data collection sites, the co-ordinator should be supported by survey supervisors who are responsible for monitoring the survey at particular sites.

If the co-ordinator is stationed away from the survey sites it may be impractical for them to devote sufficient time to monitoring the data collection process. This involves making sure that any problems that arise in the field are dealt with swiftly and properly.

Computer Operator

As the most practical way of storing and analysing the data from a questionnaire survey is to use a computer there needs to be a person with good computing skills working with the co-ordinator. This person should be familiar with the software used for the surveys, as well as understanding the data analysis procedure.

The computer operator will be responsible for:

- *designing and setting up a computer database*
- *inputting the data*
- *analysing the data and reporting the results to the co-ordinator.*

Supervisors

Survey supervisors monitor data collection in the field, making sure the data are collected properly. They act as a link between the enumerators and the co-ordinator. There should be at least one supervisor for a particular survey area. This is so that if one supervisor has other commitments then another can take responsibility for the survey.

Enumerators

Enumerators interview respondents. They should be stationed at the data collection site or are within easy travelling distance of sites. They should preferably be stationed at a data collection site or be able to reach a site easily. Enumerators should not have any involvement in revenue collection at sampling sites as this can make respondents wary of giving information, as it will be suspected that what they say will be used for tax assessment purposes.

Computer System

The most efficient way of storing and analysing data is by way of a computer database. The basic requirements of a computer system are a 386 computer with a hard disk of at least 120 MB and a RAM of 4 MB. It is recommended that either a database or spreadsheet software be used, but software choice will depend upon what is available locally and what skills and training are available. A good printer will be invaluable for producing reports. If the electricity supply is irregular, then power protection devices should be used to protect the computer against surges. These should include an uninterruptable power supply (UPS), which will help to avoid loosing data as a result of power failures. As it is essential that backup copies are made of data a supply of floppy disks will be needed.

There are three general types of software that could be used in a survey like this; spreadsheets such as Microsoft Excel, databases such as Borland Dbase and Microsoft Access and statistical analysis packages such as Statistics Package for Social Science (SPSS). The advantage of spreadsheets is that they can be better for mathematical analysis of the data, but errors during data inputting are more common. Whereas, with database software it is usually possible to design data inputting screens, which reduce the chance of errors during the inputting process.

It should be possible to transfer data between a database and a spreadsheet and *vice versa*. This is quite useful if a database package has been used that is not capable of compiling graphs. The data can be downloaded to a spreadsheet for graph compilation.

For a reasonably large survey it is worth investing in a good statistical analysis package such as SPSS. This will enable data to be analysed much quicker than if spreadsheet or database software were used. However, data entry may not be as easy with a statistics package. Statistical analysis can also be accomplished using spreadsheet and database packages.

Statistical analysis will be easier if the data is in what is called a 'flat' file rather than in a relational structure where the data is split between related tables.

Other factors to bear in mind when choosing software are the skills of the people who will be doing the inputting and analysis. Whoever is taking care of data inputting and analysis should be computer literate and conversant with the software to be used and be familiar with statistics. If people need training then it is sensible to invest in a software that is locally available for which training and backup advice is readily available.

The choice of hardware and software to use is up to the commissioning agent and should be thought about in advance of any survey. There are many software packages that could be used for storing and analysing questionnaire data and new software is constantly being produced.

The Role of Computer Programming

Computer programming can be a useful tool to aid data analysis. Programming can be used to create screen displays and enable the researcher to analyse data quickly. Access to data will be quick and easy, important for people who are not familiar with the software used. When there are a lot of data to analyse, especially if several questionnaires have been used, it should be possible to use a standard programme to analyse all questionnaires if the fields are the same.

Finance

A survey will incur certain expenditure on stationery, travel, postage and computer accessories.

The sort of expenditure that supervisors could make is on the following:

- *enumerator allowances*
- *supervisor allowances*
- *photocopying*
- *postage*
- *travel*
- *stationery*
- *typing.*

At the co-ordinator level expenditure is on the following:

- *allowances*
- *data inputting allowance*
- *photocopying*
- *computer software*
- *stationery*
- *travel to the field*
- *postage and communications.*

In order for this expenditure to be covered in an accountable and efficient way there should be a proper system for disbursement of funds. This probably will entail opening bank accounts to be controlled by supervisors in the survey areas. Funds can then be transferred by the co-ordinator from a main survey account to the supervisory accounts as the survey progresses. The opening of bank accounts can be done during a pre-survey appraisal.

It is important that funds are accounted for at all levels. Therefore receipts must be obtained for all expenditure and staff should sign for any allowances. Proper records of expenditure must be kept and accounts should be sent promptly by supervisors to the co-ordinator.

The accounts should include the closing balance and the following for each expenditure:

- *item*
- *date*
- *amount*
- *receipt number.*

To aid financial planning the co-ordinator should be able to estimate a core amount of funding that will be required for the work for a particular period in a survey area.

If resources permit, and the prevailing situation is such that financial incentives for survey staff would improve the survey efficiency, then survey staff should be paid allowances for their work and allowance payments should be kept in line with inflation.

Supervisors should be responsible for paying the enumerators and for local survey expenditure. The supervisors should only pay enumerators when they have received and are satisfied with the data. In this way some control over data quality can be exerted by supervisors. Likewise the co-ordinator should only disburse funds when he or she is satisfied with the data received.

The co-ordinator is responsible for checking that supervisors accounts are in order before any transfers of funds are made to supervisory accounts. Transfers should be planned so that supervisors are not waiting for funds to cover expenditure. If the supervisors send data that the co-ordinator has no need to query then this mean funds can be transferred quickly. On the other hand if the co-ordinator has queries about the data sent by the supervisors then the co-ordinator may delay transfers creating an unnecessary backlog of payments. If a backlog means that staff are not receiving their allowances then staff may in turn become disillusioned with the survey work. This should be avoided.

The cost of a survey will depend upon the size of the survey, i.e. how many people are involved. The major components of a typical survey are shown in Figure 12. The staff costs are based on local rates.

Pre-survey Appraisal

Before a survey is undertaken, an appraisal should first be made of selected fishery sectors. It is suggested the informal methodology described in Chapter 2 should be used for this exercise, which would:

- *identify sites where data will be collected*
- *identify staff who will be involved in the collection*
- *develop questionnaires and generate some background qualitative data on the fishery sectors*
- *establish the data and financial management components of the survey*

- *characterise the fishery or sector in terms of species, catches or amounts of fish dealt with*
- *characterise the major fish distribution channels, generating qualitative information as well as assessing the quality of data that could be used as raising factors*
- *identify broadly where losses are occurring, why and who are they affecting.*

Figure 12 - Costing For a 12 month Questionnaire Survey

	Person days Staff training	**US$**
Instructor 2 days x 4 regions	16	1600
Survey staff 8 staff per region	128	2560
Stationery, communications, photocopying		
Stationery 30 x US$5		150
Communications 12 x 10 x US$2		240
Photocopies 4 x 30 x 12 US$0.08		115
Computer hardware/ software/training/consumables		
Computer + printer + software		4000
Training		400
Consumables		100
Staff time		
1 Co-ordinator @ 8 days per month	96	1200
8 Supervisors @ 2 days per month	192	960
21 Field recorders @ 2 days per month	504	3000
Travel		
30 staff x US$ 10 per month		3600
National Co 4 field visits x US$ 250		1000
Monitoring		
8 Regional Supervisors 2 days per month	192	960
Computing		
Data inputting @ 30 records per hour. 5000 records = 167 hours	24	240
Data checking @ 100 records per hour. 5000 records = 50 hours	7	70
Analysis 8 man weeks	40	400
Contingencies		1500
TOTAL	**1199**	**22 095**

If a fishery has a large number of fish species then a decision must be taken about which species the survey is to target. Is it to focus on selected species of fish or fish in general, regardless of species?

Identifying the species or products is to an extent up to the commissioning agent of the survey. It may be that the fish species must be the most commercially important species. In which case these species will have to be defined. This could be done by a separate study or it could be something done during a pre-survey appraisal. Ranking is a good way of identifying the fish species which are to be the focus of a questionnaire survey. Ranking is described in the informal methodology section on page 72.

Survey Site Selection

Sites where enumerators will conduct interviews with fisherfolk should be identified in advance of the survey. Typical sites are:

- *where fish are landed*
- *where fish are processed*
- *where fish are traded*
- *markets*
- *transport points*
- *where fisherfolk congregate.*

Ideally sites should be selected at random. A list of all available sites should be made, preferably with an indication of 'population', e.g. fishing boats or fish traders, size at each site, etc. The sites can then be selected at random, possibly with probability proportional to size so that large sites have a greater chance of being included.

Some problems with site selection are:

- poor definition of what is a 'site'
- there are only a small number of sites which vary greatly in size
- some sites are inaccessible for survey purposes.

If site selection is done purposively, e.g during a pre-survey appraisal, then it is very difficult to obtain confident estimates for the total population. This is because the selected sites will not be truly representative. Strictly speaking, any estimates made will refer only to selected sites and not to the whole population. Using population estimates in such situations requires an act of faith which may or may not be justified.

In reality the choice of data collection sites can be affected by :

- *accessibility of the site for an enumerator and supervisors*
- *relationship between sample population and enumerator*
- *size of the sample population*
- *resources available in terms of transport*
- *how representative the sites are of the fishery sector.*

It is important to be aware of bias with regard to survey sites. It might be attractive from an administrative point of view to have all survey sites within easy access of supervisors, but excluding sites that are less accessible may mean the survey sites are not representative of the sectors being surveyed.

It is likely that sites within easy access of markets where distribution and sale of fish are relatively easy and which are easily accessible may have different loss levels to sites which are further away from markets where distribution is more problematic and access difficult.

If enumerators are not stationed full time at a site they will have to travel to a site for data collection. For this to happen, transport has to be reliable all year round or transport should be provided, which is an extra cost to the survey.

It might be possible to identify a site where a good representative sample population can be found, but because it is not possible for trained enumerators to visit the site easily and frequently, and no enumerator is stationed there, the site has to be excluded from the survey for practical reasons.

The transient nature of fisherfolk can mean that a sample population who are regularly interviewed may suddenly shift to another site, perhaps because of better business prospects. This can upset the survey flow, but can be identified by a pre-survey appraisal.

Questionnaires

The methodology relies on trained enumerators using questionnaires to interview fisherfolk about post-harvest fish losses they have recently experienced. The questionnaires have to be tailored to the particular fishery and the marketing stage at which they will be used. They ask the respondent about the last catch or load of fish dealt with and give instructions to enumerators to assist the interview process.

A respondent should not be interviewed if a certain time period has elapsed between the last time the respondent dealt or caught fish and the interview date. This time-lag should be set according to local experience.

The questionnaires should be developed and then tested to reduce the problem of data being recorded wrongly. Draft questionnaires should be used to interview a number of respondents, about 10, at a potential data collection site. Testing should be done to eliminate the following problems:

- *the questions are worded correctly*
- *respondents do not understand the questions*
- *enumerators do not understand the questions*
- *the questionnaires are too long and complicated.*

Long complex questionnaires can make the interview process too time consuming for both the respondent and the enumerator causing interviewer and respondent fatigue leading to poor quality data.

After testing, the questionnaires should be revised if necessary and final versions produced.

Ideally the questionnaires should be in the language best understood by the enumerator and the respondents. The complete questionnaire should fit onto one sheet of A4 size card or paper, this will make interviewing easier. The questionnaires should be laminated in plastic so that they can withstand field conditions.

A questionnaire consists of five types of question. Many questions are made up of several parts each requiring a coded answer. Coded answers are quicker to note down and are easier to enter into a computer database.

An example of a typical questionnaire is shown in Figure 13. It was used to interview fishermen who caught a single species of fish. It includes a question on physical losses before landing (question 6) and questions on physical losses after landing (questions 9,10 and 13). The letters in square brackets, i.e. [c] refer to the column on the answer form in which the answer for that part of the question should be written.

Figure 13-Typical Questionnaire

RECORDER: MAKE SURE ALL ANSWERS RELATE TO A SINGLE BOAT THAT THE PERSON HIM/HERSELF FISHED IN.

1. What is the number of the boat you fished in?

   [a] number

2. When was the last time before today you went fishing for Nile perch?

   [a] date (estimate)

RECORDER: IF MORE THAN 14 DAYS AGO, END OF QUESTIONS

SAY: ALL QUESTIONS WHICH FOLLOW REFER TO THAT LAST TIME YOU FISHED FOR WHICH ALL FISH HAVE BEEN SOLD ALREADY

3. Which gear was used in the boat you went fishing in?

   [a] gear **1=gill nets; 2=beach seine; 3=long line; 4=other.**

4. How many hours was the gear in the water?

   [a] hours

5. What time did you land the fish?

   [a] time (e.g. 9 am (09.00 hours); 6 pm (18.00 hours); 9.30 pm (21.30 hours))

6. Did you throw any fish into the lake before landing because of spoilage?

[a] number	**[b] unit**	**[c] reason**
	1=piece 2=other	1=rotten 2=stale 3=other

7. Were any Nile perch taken by the fisherfolk to be consumed or otherwise used?

[a] number	**[b] unit**
	1=piece 2=other

8. How many Nile perch did you land at the beach?

[a] number	**[b] unit**
	1=piece 2=kg 3=*debe* 4=*tenga* 5=other

RECORDER: Q 8 SHOULD INCLUDE THOSE TAKEN FOR OWN CONSUMPTION (Q7)

9. Were any fish *thrown away* **immediately** after landing *due to spoilage?*

[a] number	**[b] unit**	**[c] reason**
	1=piece 2=kg 3=*debe*	1=rotten 2=stale 3=other 4=*tenga* 5=other

10. Where any fish thrown away later due to spoilage?

[a] number	[b] unit	[c] reason
	1=piece 2=kg 3=*debe* 4=*tenga* 5=other	1=rotten 2=stale 3= other

11. What price did you sell the *good fresh fish* for?

[a] price	[b] unit	[c] number
	1=piece 2=kg 3=*debe* 4=*tenga* 5=other	

12. Did you sell any fish for a lower price (e.g. for processing or to fishmongers)?

[a] price	[b] unit	[c] number	[d] use	[e]reason
	1=piece 2=kg 3=*debe* 3=other 4=*tenga* 5=other		1=smoking 2=frying 3=salting 4=sun-drying 5=scorching 6=fishmongering	1=no buyers 2=stale

13. Were any fish not sold (except those used by fisherfolk or thrown away due to spoilage)?

[a] number	[b] unit	[c] reason
	1=piece 2=kg 3=*debe* 4=*tenga* 5=other	1=no buyer 2=shared out 3=self-processed 4=theft 5=other

RECORDER: END OF QUESTIONS FOR FISHERPERSON

14. RECORDER: FILL IN THE TABLE BELOW, YOUR ANSWERS SHOULD BE BASED ON WEIGHTS AND PRICES OF TODAY AND FOR ONLY THE UNITS MENTIONED IN THIS INTERVIEW.

[a] unit	[b] average weight (kg)	[c] average price for good fresh fish
1=piece 2=kg 3=*debe* 4=*tenga* 5=other		

Types of Question

The following description of the types of question used on a questionnaire uses the example questionnaire in Figure 13 as a guide.

(a) The first type of question on a questionnaire asks about the respondent: who he or she is or which fishing boat they worked in.

From Figure 13

1. What is the number of the boat you fished in?
   [a] number

Or

For example: What is your name?

[a] name

It is useful to be able to identify a respondent at a later date so that they can be traced if there is any need to check data. There can be a drawback in asking a respondent's name especially at the start of an interview. Some people may be reluctant to give their names, especially if they are not clear about the reasons for the survey. It may, therefore, be more appropriate to ask a question like this at the end of an interview rather than at the beginning, but there is a danger of forgetting to put the question at all.

(b) There should be questions about fish catch or batch including date of landing or purchase, the quantity, value and quality influencing variable such as time and the processes the fish are subjected to or the fishing gear type. There should always be a question that establishes the price at which good quality fish were sold. (The best price may not necessarily be the maximum price. It could be the average price over a range of prices obtainable during the selling hours of the day.)

From Figure 13

For what price did you sell the *good fresh fish*?

[a] price	**[b] unit**	**[c] number**
	1=piece	
	2=kg	
	3=*debe*	
	4=*tenga*	
	5=other	

Or for a processing questionnaire:

How many fish of which type did you process?

[a] fish	**[b] process**	**[c] unit**	**[d] number**
1=perch	1=smoked	1=piece	
	2=fried	2=kg	
	3=salted	3=*debe*	
	4=sun-dried	4=*tenga*	
	5=scorched	5=sack	
		6=other	

Usually early on in an interview the respondent is asked when was the last time he or she went fishing or processed fish or sold a batch of fish. This is to avoid asking the respondent twice about the same fish. It can also be used to make sure the respondent is not asked to remember data from too far back, reducing the chances of poor recall.

If the answer to the question below is more than, in this case 14 days, then the interview goes no further and another respondent is sought.

From Figure 13

2. When was the last time before today you went fishing for Nile perch?

[a] date (estimate)

RECORDER: IF MORE THAN 14 DAYS AGO, END OF QUESTIONS

Or

When was the last time you processed fish which have now all been disposed of

[a] date (estimate)

RECORDER : IF MORE THAN 14 DAYS, END OF QUESTIONS

(c) A typical questionnaire usually has at least two questions on losses. One asking about physical losses and the other about losses due to fish being sold for a reduced price.

Physical loss

From Figure 13 (see also Questions 9, 10 and 13)

6. Did you throw any fish into the lake before landing because of spoilage?

[a] number	**[b] unit**	**[c] reason**
	1=piece	1=rotten
	2=other	2=stale
		3=other

Or

Did you *throw away* any fish due to spoilage or for any other reason?					
[a] number	**[b] unit**	**[c] fish**	**[d] process**	**[e] reason**	**[f] end use**

Reduced price loss

From Figure 13

12. Did you sell any fish for a lower price (e.g. for processing or to fishmongers)?

[a] price	**[b] unit**	**[c] number**	**[d] use**	**[e] reason**
	1=piece		1=smoking	1=no buyers
	2=kg		2=frying	2=stale
	3=*debe*		3=salting	3=other
	4=*tenga*		4=sun-drying	
	5=other		5=scorching	
			6=fishmongering	

Or

Did you sell any fish for a reduced price *due to spoilage ?*						
[a] price	**[b] unit**	**[c] no**	**[d] fish**	**[e] process**	**[f] reason**	**[g]end use**

(d) Without data on the weight of traditional units used for fish measurement it will be difficult to carry out data analysis and determine loss levels. The simplest way of recording data on traditional units is to include relevant questions in the questionnaire.

From Figure 13

14. RECORDER: FILL IN THE TABLE BELOW, YOUR ANSWERS SHOULD BE BASED ON WEIGHTS AND PRICES OF TODAY AND FOR ONLY THE UNITS MENTIONED IN THIS INTERVIEW

[a] unit	**[b] average weight(kg)**	**[c] average price for good fresh fish**
1=piece		
2=kg		
3=*debe*		
4=*tenga*		
5=other		

Or

RECORDER: ANSWER THE FOLLOWING ABOUT *ONLY* THE UNITS RECORDED IN THIS INTERVIEW

[a] unit	**[b] average weight (kg)**
1=piece	
2=pile	
4=cup/tin	
5=*debe*	
6=*tenga*	
7=sack	
8=other	

Data on units may also be available from secondary sources. Another way of collecting data on units is by conducting a separate survey to weigh units at the data collection sites periodically.

(e) The final type of question is one that determines the price good quality fish were sold for if the respondent did not actually sell any fish for a good price. The question is usually answered by the enumerator rather than the respondent. Question 14 from Figure 13 asks about traditional units, but also about the price good fresh fish were sold for and so the question has a dual role.

If fish were not sold for a good price estimate the price of good quality fish on the day concerned.

price[a] unit [b]

Without this data it would be difficult to calculate the monetary value of the reduced price loss. In cases where no fish were sold because of a lack of buyers, then the average price for good quality fish on the day of the interview must be determined by the enumerator. The enumerator should ask the respondent for the relevant price or find the price from an alternative source.

Multi-species Fishery

In fisheries where several species are surveyed another variable to questions will be included under the heading 'species' to identify the species concerned. For example Question 6 in the preceding questionnaire would appear as:

6. Did you throw any fish into the lake before landing because of spoilage?

[a] species	**[b] number**	**[b] unit**	**[c] reason**
		1=piece 2=other	1=rotten 2=stale 3=other

In a survey of several different fish species a coded list of the species will be used by enumerators. Instead of writing the species name, the enumerator will record the species code on the answer form.

Yields

The questionnaires focus on particular sectors or sub-sectors of a fish distribution chain. In some cases fish will be processed and its physical appearance may change. For example, unless the fish is small it will usually be eviscerated before it is dried or smoked. The evisceration will result in a weight loss. The drying process will also result in a weight loss as moisture is removed from the fish. The yield of processed product in terms of weight will be less than the original weight of fish.

If the enumerators are instructed to record data according to the final product in a sector then the quantification of losses will be straightforward. If fish are lost during processing then the respondent should be asked to quantify the amount lost in terms of final product. Similarly large fresh fish may be cut into smaller pieces for processing. The data for an entire interview should be recorded according to the smaller processed pieces to avoid confusion over yields.

Additional Instructions on Questionnaires

There are two types of instruction for enumerators on the questionnaires. Those that are underlined and in bold type are instructions for the enumerators during the interview. These instructions should not be spoken during the interview.

For example:

RECORDER: MAKE SURE ALL ANSWERS RELATE TO A SINGLE BOAT THAT THE PERSON HIM/HERSELF FISHED IN.

The other instructions are statements the enumerator should make during the interview to alert the respondent to exactly what information is required. These statements are in bold but are not underlined.

For example:

SAY:ALL QUESTIONS WHICH FOLLOW REFER TO THAT LAST TIME YOU FISHED FOR WHICH ALL FISH HAVE BEEN SOLD ALREADY

Recording Answers

This section explains how data should be recorded during interviews. Everyone involved in a survey should have a good understanding of how to record data. This will reduce errors and assist supervisors and co-ordinators to spot errors when checking data.

There are two approaches to recording data during an interview. The first is to use a matrix answer form whereby the data is kept separate from the questionnaires. The

advantage is that it makes computerisation of the data easier and it cuts down on the amount of paper being moved between recording sites and the co-ordinator. However, it does make recording data more difficult as there is more room for error compared to the second approach which is to record answers on the actual questionnaire. This approach is easier to implement in the field and less prone to error. However, producing a questionnaire for every interview generates a lot of paperwork and makes more work for the survey co-ordinator.

Figure 14 shows an example of a matrix answer form. The letters in the top row correspond to the parts of the different questions of a questionnaire. Recording data on a matrix like this makes recording interviews quick and inputting data into a computer easier.

The answers to questions are pre-coded, and this makes recording easier as the enumerators do not have to write out whole answers but simply write either a single digit code or a figure in the appropriate box on the answer form. Enumerators should record the answers given by respondents directly onto the answer forms. The answers should be recorded neatly and preferably in black ink as this will produce better quality photocopies.

Figure 14 - Matrix Answer Form

Questionnaire: Data Collection Site: Date: Enumerator:

Interview no. **Int**

Quest	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**Quest**	**a**	**b**	**c**	**d**	**e**	**f**	**g**

Other Information

Checked (sign & date)

Supervisor: Co-ordinator: Data Inputter:

Do not mix answers to different questionnaires on the same answer form as this may lead to confusion and problems later during checking and inputting. Similarly, even if an answer form has room for recording more data, it must not be used on another recording day.

TIP 21 *A rule of thumb is a separate form for each data recording day.*

The answer forms should be of a manageable size, i.e. A4, and should have space for the answers from several interviews. They should be made from card and have a matrix on both sides. The data is recorded on both sides, saving paper and postage.

In terms of equipment, enumerators should be provided with work materials: clipboard, calculator, pens, notebook, plastic folder and ruler, and draft copies of questionnaires as well as answer forms. These should be replaced by the supervisors when necessary.

The supervisors will check the answer forms and must also be given the necessary stationery items required for the survey, including calculators and copies of the questionnaires and answer forms.

Weighing scales, preferably of a size that can be carried easily in the field are another useful item of equipment to asist enumerators. They can be used to weigh samples of traditional units of fish measurement that are recorded in interviews.

Special Marks

All parts of a question must be answered on the form and to assist this there are some characters that can be used to make the meaning of answers clear:

'0' is used as the number zero

'-' a dash is used where a question is not applicable or relevant

For example, if a question asks about the amount of fish discarded after landing due to spoilage and no fish are discarded, and if the interview is the seventh of the day and the question is number 10 on the questionnaire, then the answer should be recorded as below:

	a	b	c	d	e	f	g
7.10	0	-	-				

If a question does not have to be answered then an 'X' is used to indicate this.

	a	b	c	d	e	f	g
7.10	X	X	X				

More than One Answer to a Question

In some cases there may be more than one answer to a question. The enumerator must record all these answers on the form. Using the question below as an example.

10. What price did you receive for fish sold in *good condition*?

[a] price	**[b] unit**	**[c] fish**	**[d] process**	**[e] end use**
	1=piece	1=perch	1=fresh	1=food
	2=kg	2=sardines	2=smoked	2=livestock
	3=*debe*	3=fried	3=don't know	4=*tenga*
	4=salted		4=other	
	5=sack		5=sun-dried	
	6=other		6=frozen	
			7=other	

If the interview is the third one and the respondent answers about perch and sardines and each fish was sold using two different units, and the prices were different for the units, then the answer should be recorded as below. The interview number and question number are recorded in the left-hand column.

	a	b	c	d	e	f	g
3.10	300	1	1	1	1		
	120	2	1	1	1		
	5000	5	2	5	1		
	120	2	2	5	1		

Price Recording and Units

The enumerator should understand exactly what is being asked in order to know whether the answer given is appropriate. For example, if a fish processor is to be asked about the price of good quality fish that has been sold as in the question below:

4. What price did you sell the *good quality* sardines for?

[a] price	**[b] unit**	**[c] number**	**[d] end use**
	1=kg		1=food
	2=*debe*		2=livestock
	3=sack		3=other
	4=other		

He or she may answer according to the amount of dried product sold. If half a sack has been sold rather than a complete sack and the fishermen received 3000 for the half sack it would be *wrong* to record the answer as follows:

	a	b	c	d	e	f	g
1.4	3000	3	0.5	1			

The mistake is that in column 'a' the price of the whole unit should be recorded, not the price for a half unit which is what the processor in this case sold. The price of units and the income received to the seller must not be confused.

The correct way to record the answer is as follows:

	a	b	c	d	e	f	g
1.4	6000	3	0.5	1			

The price of a unit is 6000.

When recording the price for which the fish are sold, and there are several sizes of fish, then use an average price. This will be more straightforward to record and less onerous for both the recorder and respondent. It will also make data analysis much easier. However, the price should be worked out after an interview not during it. Use the following guidelines.

(a) If the number of different prices is an odd number, the 'price' is the middle one of those numbers, irrespective of how many fish were sold at each price. For example, if fish were sold for the following prices per piece, according to size:

280, 260, 240, 220, 200, the average price would be selected as *240 shillings* per unit.

(b) If the number of different prices is an even number, then the middle two values are taken and divided by two to give the 'price'. For example, if fish are sold for the following prices:

280, 260, 240, 220, 200, 180 the price would be: (240+220)/2 = 230 shillings per unit.

These methods have been adopted because data are difficult to collect or unavailable. The value of losses for each individual questionnaire will have unknown bias. When results are aggregated it could be expected that the number of interviews exaggerating loss would be counteracted by those giving an underestimate. This applies as long as there is no reason for suspecting that the bias is systematic. The errors will therefore be cancelled out and the figure given will be a reliable estimate of the underlying population mean.

Comments and Further Information

At the end of the answer form a space is provided for comments and further information. This area should be used by the enumerator to record additional information which is thought to be useful. For example, some questions have an answer 'other'. The enumerator should clarify what 'other' is in the 'comments' area of the answer form.

For example:

6. What kind of container was the fish transported in?

[a] container	[b] weight in one container (kg)
1=*tenga*	
2=sack	
3=other	

	a	b	c	d	e	f	g
1.6	3	100					

In the comments section then the following would also be recorded:

1.6a = 3 Insulated box

Average Prices

In some fisheries the price of fish varies according to the size of fish. A respondent may sell fish of different sizes for different prices in which case the enumerator should record the price and number of fish sold for each price. During data analysis an average price will be calculated, or the enumerator should calculate the average price and record it as the answer.

TIP 22 *Making calculations during an interview should be avoided as this may stop the flow of the interview making the respondent lose interest.*

Traditional Units

One of the most important questions on a questionnaire is about the traditional units used by the respondent during the interview. This question is usually last and is often left for the enumerator to answer. Below is a typical question.

8. **[a] unit** **[b] average weight (kg)**

1=piece
2=pile
4=*debe*
5=*tenga*
6=sack
7=other

It is important that the weights of all the units mentioned in the answers to an interview are recorded. The weights will often have to be informed estimates as the fish referred to in the interview will already have been sold. The enumerator will have to make an estimate of the average weight of each unit after consulting the respondent.

When to Collect Data

Once the data collection sites have been identified and the questionnaires prepared, then data collection times or dates should be selected. The choice of when data collection takes place and how often will be influenced by the following:

- *resources available*
- *frequency that target sample population operate, i..e go fishing*
- *when sample population operates*
- *other data collection exercises*
- *local holidays and festivals.*

If fish processors only process and sell one batch of fish per month then it will not be sensible to conduct interviews twice a month otherwise a processor may be interviewed about the same batch of fish twice.

It may be pragmatic to set data collection days according to a fishing cycle or pattern of activity so that the job of the recorder is made easier as the respondents will be more easily located.

TIP 23

In a marine fishery a neap tide may be synonymous with rest periods for fishermen and a time for gear repair. At such times it should be easy to locate and interview fishermen who are more relaxed and have time talk.

Survey supervisors should know or get to know the patterns of activity in the fishery and the activities of the enumerators. If other surveys or data collection are going on at the same sites then this will influence when survey data collection should take place.

If a survey is to run for a year or longer, then interviewing people too frequently may become tiresome for the sample population, particularly if they are being disturbed during the course of their work and are not seeing any tangible benefits from answering questions. Finally, as a rule of thumb, it is probably a good thing to avoid data collection during public holidays and weekends.

Who to Interview

Enumerators must interview people who will definitely know the full history of the fish catch or batch. For example, in the fishing sector the questionnaire should be used to interview people who are aware of what has happened to the fish from the time of capture until when it is sold. Therefore, it would make sense to interview the fishermen who did the fishing rather than the owner of a fishing boat who did not actually go fishing and will not know what exactly happened.

Sampling

How many people should be interviewed? To an extent this will be related to the size of the sample population at a site. If a sample population is small then it might be feasible to interview all the sample. If a population is over 10 and 10 interviews are

required but there is only one enumerator, then a valid sampling technique will be needed to identify who to interview, avoiding bias (see page 55) in the sample.

Two different methods of sampling have been adopted for choosing respondents, with the method chosen being determined by the ease of production of a sample frame in each site and for each questionnaire.

Random Sampling

Where a complete sub-population list is available, sampling should be randomised by drawing lots. Each person/sampling unit in the list will be allocated a number, and each number will then be written on a separate piece of paper which will be folded and put aside. Pieces of paper will then be drawn one by one, and the numbers written down to give a list of respondents to sample.

Recorders should be trained in this method, and advised to select more potential respondents than are actually required (and to write them in the order in which they are drawn) to ensure that adequate numbers of respondents are selected. The importance of the completeness of a list and possible bias introduced should be highlighted during training.

Where random sampling by drawing lots is practised, recorders should submit the list used to the supervisors and should note down in their monthly reports which method was used on each sampling occasion.

Linear Sampling

Where a list of the population is not available, for example, in a retail market where traders change from day to day, a linear sampling technique will be used. Recorders should be trained to calculate a number n by dividing the population number of available respondents by number of respondents required (plus spares) to get a good spread of physical locations. The recorder then walks along the line of potential respondents and interviews every nth person/unit. For example, a retail market may have 26 stalls or retail outlets. If 10 interviews are to be conducted then divide the number of stalls by 10 to give 2.6. Round this up to a whole number, 3 and so interview every 3rd retailer. To account for any retailers who are not able to be interviewed it may be practical to use 12 rather than 10. Thus every 2nd retailer is interviewed until the required 10 have been covered.

If a respondent refuses to be interviewed then another respondent should be chosen and interviewed instead.

Conducting Interviews

It is very common for fisherfolk and traders to be wary of answering questions concerning livelihood, especially questions relating to income and prices. To try to overcome this problem it is important that the interview technique is good.

The enumerators must identify the best time to interview respondents according to the respondents' activities. If a respondent is busy then the enumerator should either wait until the respondent is not busy or arrange a suitable alternative time later for the interview. Under no circumstances should enumerators stop a respondent from work or

other activities to interview them. This is impolite and may lead to poor quality data as questions may be rushed and the respondents may form a bad impression of the survey.

Recorders should also avoid interviewing respondents under time constraints. In cases that can be justified recorders should be given extra time to interview the correct number of respondents.

At the start of every interview the enumerator must introduce his or herself to the respondent and state clearly the reasons for the interview and the survey. At the same time the enumerator must not make any false statements about what the survey may lead to in terms of benefits to the respondent or community at large.

The enumerator must be careful when asking sensitive questions such as those concerning income. It may be necessary to ask the question indirectly in order to get an answer. In some cases asking about prices is often best left until the end of an interview.

Another sensitive question can be asking the respondent's name. Asking someone's name at the start of an interview can make the respondent suspicious of the reasons for the interview. It may be better to ask a respondent's name at the end of the interview. Enumerators should explain the reason for having the name of a respondent which is so that follow-up interviews may be made in case some of the data needs re-checking.

Throughout the interview the enumerator should:

- *be patient*
- *be polite*
- *be ready to answer any questions the respondents may have*
- *keep the interview flowing*
- *not rush*
- *not go so slow that respondent becomes agitated or bored.*

At the end of an interview the respondent should thanked for his or her time.

If a respondent refuses to be interviewed then the enumerator should locate an alternative respondent. An attempt to interview the required number of respondents should be made and a note made on the reason why respondents preferred not to be interviewed.

Training

Training of survey staff in the methodology is very important. This section assumes that neither co-ordinator, enumerators or supervisors have had experience of survey work and that they will require training in some, if not all, aspects of data collection, including interview techniques and the principles of financial management.

Training should be conducted before a survey begins by someone who has questionnaire survey experience and is conversant with the fish loss assessment survey methodology. It should include as much practical interviewing work as possible.

The practical sessions should be backed-up with appraisals to identify strengths and weaknesses of the trainees. It is important to make sure that the trainees are fully conversant with the data collection process before the survey begins.

One of the main reasons why mistakes during data collection are made by enumerators is the lack of proper training in the data collection exercise, especially in conducting interviews and recording answers. Another reason is that enumerators do not fully understand the survey objectives.

It is important that during pre-survey training enumerators are made fully aware of what the survey objectives are.

TIP 24

To reduce the problems that could occur after training, a written guide to data collection should be produced and given to all staff engaged in the survey.

It is good practice to train more enumerators than are actually required for the survey. Reserve enumerators will then be available in case of any changes. As training proceeds it may be obvious that some enumerators are not able to do the work and have to be excluded.

Below is a guide to the contents of a typical training seminar for enumerators and supervisors. Much of the contents of the seminar can be gleaned from the information in this manual. Other information will be location specific and should be added by the trainers.

Training Seminar Agenda

DAY 1

Introduction

- *Recorders*

Post-harvest Fish Losses Research

- *Background to fish loss assessments*
- *Previous work (if any) in the country/area including pre-survey appraisal*
- *Survey objectives*
- *What information the survey will provide*
- *Importance of that information*

Shape of the Research

- *Areas and fisheries involved: the reason behind site selection*
- *Data management regime/hierarchy*
- *Different stages for losses: overview of the questionnaires*

Role of each level of staff

- *Requirements*
- *Expectations*
- *Job descriptions: no fabrication; record at right time; clean, legible data sheets; make additional interesting notes on losses and any explanations; tell supervisor immediately of any problems or difficulties; send data quickly every month, with any interesting notes to supervisor*

DAY 2

Payments

- *Level of enumerator payment*
- *How payments are organised*
- *Accountability*
- *How often, depending on data timeliness and quality*
- *f delay, do not worry, it will arrive soon*
- *New books, pens, etc. from supervisors*

Questionnaire Rationale. For each questionnaire:

- *Who to interview; who not to interview*
- *Reason for focus*
- *Sampling: practice for random and linear methods*
- *Method of data collection: questions, answers and codes*
- *Run through each one on a board*

Interview Technique

- *Nature of data collection: favour, confidence, no obligation*
- *Introduction: who you are, what you are doing,*
  - assurance of confidentiality, no negative effects
  - answer any questions politely and correctly
- *Manner: polite, patient, not critical, not aggressive*
  - appear interested, speak clearly
- *Their work is more important: wait if necessary*
- *All leads to better quality data*
- *Understanding what information is required is more important than learning directly. Then you can be flexible if necessary * How to do each one, including filling answers on board * How not to do each one * Recorders try on each other*

DAY 3

Visit the data collection sites

- *Enumerators practise filling in questionnaires*
- *One interviews and fills, the others fill*

DAY 4

If resources permit, the enumerators and supervisors should spend an extra day practising the interviewing technique, preferably in the field.

Data Management

A system is required to take the data from the collection site *via* supervisors to the co-ordinator and analysis. The system will depend largely on who is responsible for overseeing the survey and where they are located.

After data has been recorded by the enumerators, the completed answer forms should be delivered to the supervisors. If data collection is to be done every month then the completed answer forms should be passed by enumerators to supervisors every month, or sooner if the survey is conducted over several days each month. There should be a time limit between the data collection time and when the supervisors receive the data.

In rural areas, where transport may be unpredictable, it is suggested that 5 days be a reasonable time-lag.

The enumerators should write a report that outlines any interesting occurrences relevant to the survey which were not recorded on the answer forms. Such occurrences could include the migration of sample populations and the introduction of new technologies in the fishery. The report should be sent with the completed answer forms to the supervisor.

The supervisors should check the answers on the forms against the questions to see if they make sense. They should also ensure that all answers are legible and clear and the answers are mathematically correct. The other important thing is to check for evidence of falsification of data.

Data fabrication is an important issue. It is not easy to detect false data, but the following are clues:

- *answers are repeatedly similar with little variation compared with previous records or answer sheets filled by other recorders*
- *the absence of unusual results*
- *absence of expected results.*

Evidence of any of the above does not necessarily mean that the data has been fabricated, but may mean that further investigations should be made. If an enumerator is found to have fabricated data then they should be excluded from the survey and a suitable replacement found and trained.

It is important for supervisors to resolve problems with data at this stage, as it will save a lot of time later on. If the co-ordinator spots problems with the data and has to communicate with supervisors, who then have to refer back to enumerators, then a backlog of data will begin to form.

Once the supervisors are happy with the data they should indicate that the data has been checked thoroughly by signing and dating the bottom of the answer form in the designated place (see Recording Answers, page 90).

The forms should then be photocopied and the originals sent with a report to the co-ordinator by the quickest and most practical means possible. The photocopies should remain with the supervisors, and should be filed and referred to if the co-ordinator has any queries about the data. They should be filed according to recording station, recorder and date, to allow rapid tracing in the event of any query.

The supervisors report to the co-ordinator should include:

- *progress during the data collection period*
- *any problems that have arisen*
- *any observations*
- *the sites visited by supervisor*
- *summarise the reports from the enumerators*
- *financial summary and accounts.*

The first task of the co-ordinator is to check a sample of answers for correctness. If there are any queries the co-ordinator should communicate with the supervisors concerned to reach a solution. Once the co-ordinator is satisfied with the data it will be passed to the data inputter who will be responsible for entering the data into a computer database.

Data Collection Monitoring

The data collection process should be monitored throughout the survey, especially during the first few data collection days. This is to make sure that enumerators are recording data according to the methodology. The supervisor's role is to monitor the data collection exercise in the field.

Supervisors can monitor the data collection exercise by making unannounced spot checks at data collection sites at times when interviews are being conducted. These visits should check the:

- *presence of the enumerator at the site*
- *time at which the enumerator starts interviewing*
- *correctness of the sampling method*
- *interview technique*
- *tidiness of the answer forms.*

If the names of respondents have been recorded on the answer forms as part of the interview, then supervisors can try to locate respondents who have been interviewed on previous occasions to ask them about the interview process. This should be done without the knowledge of the enumerator concerned.

Financial Arrangements

A survey will incur certain expenditure on stationery, travel, postage and computer accessories.

The sort of expenditure that supervisors could make is on the following:

- *enumerator allowances*
- *supervisor allowances*
- *photocopying*
- *postage*
- *travel*
- *stationery*
- *typing.*

The co-ordinator's expenditure could be on the following:

- *allowances*
- *data inputting allowance*
- *photocopying*
- *computer software*
- *stationery*
- *travel to the field*
- *postage and communications.*

In order for this expenditure to be covered in an accountable and efficient way there should be a proper system for disbursement of funds. This will probably entail opening bank accounts to be controlled by supervisors in the survey areas. Funds can then be transferred by the co-ordinator from a main survey account to the supervisory accounts as the survey progresses. The opening of bank accounts can be done during a pre-survey appraisal.

It is important that funds are accounted for at all levels. Therefore receipts must be obtained for all expenditure and staff should sign for any allowances. Proper records of expenditure must be kept and accounts should be sent promptly by supervisors to the co-ordinator.

The accounts should include the closing balance and the following for each expenditure:

- *item*
- *date*
- *amount*
- *receipt number.*

To aid financial planning the co-ordinator should be able to estimate a core amount of funding that will be required for the work for a particular period in a survey area.

If resources permit, and the prevailing situation is such that financial incentives for survey staff would improve the survey efficiency, then survey staff should be paid allowances for their work. It is important that allowance payments are kept in line with inflation.

Supervisors should be responsible for paying the enumerators and for local survey expenditure. The supervisors should only pay the enumerators when they have received and are satisfied with the data. In this way some control over data quality can be exerted by supervisors. Likewise the co-ordinator should only disburse funds when they are satisfied with the data they receive.

The co-ordinator is responsible for checking that the supervisors' accounts are in order before any transfers of funds are made to supervisory accounts. Transfers should be planned so that supervisors are not waiting for funds to cover expenditure. If the supervisors send data that the co-ordinator has no need to query then this mean funds can be transferred quickly. On the other hand if the co-ordinator has queries about the data then the co-ordinator may delay transfers creating an unnecessary backlog of payments. If a backlog means that staff are not receiving their allowances then staff may in turn become disillusioned with the survey work. This should be avoided.

Computer Database

Because of the amount of data a survey can generate, and the lengthy process of analysing it on paper, the most obvious tool to assist the co-ordinator in analysing and storing the data is a computerised database. The types of software and hardware have already been mentioned.

The first task for the computer operator, once the software has been installed, is to design and create a database or spreadsheet for the survey data. Many database software packages allow the user to design data entry screens. These screens allow someone to type data easily and with a minimum of error into a database.

TIP 25

It is suggested that if a database is used each part of a question on the questionnaire should have a separate field (allocated space) in the database. In addition the extra fields that are mentioned in the data analysis section should also be included at the design stage even though these will not be needed initially.

If more than one type of questionnaire has been used, and the questionnaires are different in layout and number of questions, then the easiest action to take is to create separate database files for the data from each questionnaire. Later during analysis it will be possible to join several different databases together by virtue of the fact they will have common fields. (See Appendix 1.)

Data Inputting

Data inputting is the process of typing the data written on answer forms into the computer database. It can be a time-consuming task and if there are a lot of data it is useful to plan ahead and decide how much time is needed. It is a good idea to set deadlines by when data should be inputted.

TIP 26

As a guide to planning it takes about 1 hour to input 30 records or interviews.

It is important to make make backup copies of the data on floppy disks at regular intervals. If there is only one copy of the files on the hard disk of a computer and for some reason the hard disk fails, then unless copies of data are available on floppy disk all the data may have to be inputted again—a soul destroying and time-consuming task. It is good practice to backup files after every inputting session.

Data Checking

After the data has been entered in a database it should be checked again. This time for errors that have occurred during typing. It is very easy for data to be wrongly entered, even with the aid of data entry screens.

TIP 27

As a guide, it takes about 1 hour to check 100 interviews.

Data Analysis

Data analysis converts raw data from questionnaire interviews into quantitative information on post-harvest fish losses. This information can be used by policy makers and planners to make informed decisions on intervention strategies to reduce losses. Data analysis is best done after a survey has been completed and all data have been correctly entered into a computer database. Trial analysis is advisable as the survey progresses to highlight any shortcomings that can be rectified before the final data analysis.

The analysis procedure set out in this section will produce quantitative information on:

- *physical losses, i.e. fish thrown away*
- *losses due to fish being sold for a reduced price, i.e. due to poor quality*
- *total losses, i.e. the monetary value of the physical loss plus the loss in revenue resulting from fish being sold for a reduced price*

- *reasons for the different types of loss*
- *relationship between losses and variables such as season and fishing gear type*
- *statistical analysis.*

The basic steps to data analysis are as follows, these are normally done using a computer database or spreadsheet:

1. *convert data on traditional units into standard units (kg)*
2. *calculate fish prices*
3. *calculate weight and financial values for the total amount of fish per interview*
4. *calculate the physical, reduced price and total losses per interview*
5. *calculate average values of losses for sectors and sites according to variables*
6. *summarise data on the reasons for losses*
7. *use raising factors, if available, to amplify average losses to a fishery level.*

These steps are now described. Many of the examples shown are for only a few interviews. It is likely that the researcher will have a larger amount of data and many records and that due to the power of modern computer software the analysis steps described can be applied to large datasets. This will greatly speed up the analysis process. The data used in the examples in this section are realistic but not from a particular survey.

Calculating Weights of Fish Using Traditional Units

In order to make the calculation of losses easy all data on quantities and weights of fish must be standardised. If the data from interviews are recorded in traditional units of measurement then fish weights should be converted into a standard unit, i.e. kilograms. This can only be done if there are data on the weight in kilograms of the traditional units (see Questionnaires, page 82).

To standardise units multiply the number of traditional units by the kilogram weight of the unit. Do this for all quantities of fish in all questions for all interviews. The resulting kilogram values should be stored in a new 'field'.

For example, the question shown below (Q5) is from a survey of a fish processing sector. The answers to this question for three interviews are shown in Table 17 (5a, 5b, 5c and 5 d correspond to answers for parts a, b, c and d of the question.

The important columns for the calculation are 5a, 5b, Piece and WT_5. Column 5a shows that 'piece' (or 1) was the unit in which the fish were measured. 5b shows that in the first interview three pieces were lost. The PIECE column shows that in interview 1a 'piece' weighs 3.5 kg. So the weight of fish lost for any other reason for interview 1 is:

5b x PIECE = 3 x 3.5 = 10.5 kg

The resultant weight is stored in the WT_5 field.

5. Did you lose any fish for any other reason?			
[a] unit	**[b] number**	**[c] reason**	**[d] process**
1=piece		1=eaten by birds	1=smoked
2=pile		2=eaten by animals	2=fried
3=kg		3=theft	3=salted
4=*debe*		4=other	4=sun-dried
5=*tenga*			5=scorched
6=sack			
7=other			

Table 17 - Answers to Q5 (shaded columns are calculated data from database)

Interview	5a	5b	5c	5d	WT_5	PIECE
1	1	3	2	3	10.5	3.50
2	1	20	3	3	50.0	2.50
3	1	3	3	3	1.5	0.50

The weight of a unit can vary from one interview to another, as can be seen in the PIECE column in Table 17 above. The weight of a piece of processed fish varies from 0.5 kg to 3.5 kg so calculations must be done using the value of unit specific for a particular interview.

When data on traditional units are missing it is suggested that average values for that unit are calculated from the data that are available.

TIP 28 *One of the preparations to data analysis is to create additional fields like WT_ fields into which the results of calculations can be stored.*

If there are several different units recorded for the same questionnaire then care must be taken to calculate weights in kilograms separately for each question for each unit.

If there is more than one answer to a question then the answers should be combined to give one overall kilogram equivalent answer. Take the previous example, but this time in interview 1 there are two answers for Question 5. Table 18 shows that fish was lost for two different reasons: 5c = 2 which indicates the fish were 'eaten by animals' and c1 = 3 indicating that some fish was also lost because of 'theft'. In both answers the unit used to measure fish was the 'piece' (5a = 1).

Table 18 - Two Answers to Q5 (shaded columns are calculated data from database)

Interview	5a	a1	5b	b1	5c	c1	5d	d1	WT	WT1	WT_5	PIECE
1	1		3		2		3		10.5		17.5	3.5
		1		2		3		3		7		3.5
2	1		20		3		3				50.0	2.50
3	1		3		3		3				1.5	0.50

In order to standardise weights we now have 3 WT columns:

WT = the weight of fish lost in the first answer to a question

WT1= the weight of fish lost in the second answer

WT_5 = the total weight of fish lost for the question for that interview (WT + WT1).

Table 19 below shows a different scenario where there are two answers to Question 5 for interview 1 but the reason is because the fish lost was quantified according to two different traditional units: 5a = 1 = piece and a1 = 4 = *debe*. As in the previous example there are 3 WT columns. There is also a DEBE column in which the kilogram weight of a *debe* is recorded and used to calculate WT1:

WT1 = b1 x DEBE = 2 x 6 = 12 kg

Table 19 - Two Answers to Q5 (shaded columns are calculated data from database)

Interview	5a	a1	5b	b1	5c	c1	5d	d1	WT	WT1	WT_5	DEBE	PIECE
1	1		3		2		3		10.5		22.5	6	3.5
		4		2		3		3		12		6	3.5
2	1		20		3		3				50.0		2.50
3	1		3		3		3				1.5		0.50

The previous two examples show how to standardise units where there is more than one answer to a question in an interview. By having weights for each answer and a total weight for the question per interview it will be easy to calculate losses according to the general type of loss, for example, 'loss for any other reason' as well as for the specific reasons for loss.

Calculating Prices

The next step is to standardise the prices of fish. The two prices important in loss calculations are the:

- *'best' price at which fish was sold*
- *'reduced price at which any fish was sold*

See the section on Pricing, page 5, for information on how prices are determined.

The question below (Q6) is designed to collect data on the price of good quality fish. Table 20 below shows the answer to the question from one interview. The important columns are 6a (the price), 6b (the unit), GD_PR (field in which standardised price will be stored) and the unit field which in this case is PIECE. See the section on Calculating Weights of Fish Using Traditional Units, page 00, for an explanation of the WT_6 field. The standardised price is calculated by dividing the price by the weight of the unit used:

6a/PIECE = 150/0.75 = 200

The best price is 200 per kg and this is stored in the GD_PR (good price) field.

6. What was the average price you received for fish sold in good condition?

[a] price	[b] unit	[c] number	[d] fish	[e] process	[f] end use
	1=piece 2=pile 3=kg		1=perch	1=smoked 2=fried 3=salted	1=food 2=livestock 3=don't know
	4=*debe* 5=*tenga* 6=sack 7=other			4=sun-dried 5=scorched	4=other

Table 20 - Answers to Q6 (shaded columns are calculated data from database)

6a	6b	6c	6d	6e	6f	WT_6	GD_PR	PIECE
150	1	180	1	1	1	135.0	200.00	0.75

Another example is the question below (Q7). This question is designed to collect data on the loss due to fish sold for a reduced price. An answer to the question is shown in Table 21 which shows that a 'piece' of smoked fish is sold for 50 and that a piece weighed 0.75 kg. Therefore the reduced price per kg is:

7a/PIECE = 50/0.75 = 66.7

The reduced price is 66.7 per kg. This figure is stored in the LW_PR (low price) field.

7. Did you sell any fish for a reduced price because of spoilage?

[a] price	[b] unit	[c] number	[d] fish	[e] process	[f] reason	[g] end use
	1=piece		1=perch	1=smoked	1=stale	1=food
	2=pile			2=fried	2=broke	2=livestock
	3=kg			3=salted	3=mouldy	3=don't
	4=*debe*			4=sun dried	4=rotten	know
	5=*tenga*			5=scorched	5=burnt	4=other
	6=sack				6=insects	
	7=other				7=other	

Table 21 - Answers to Q7 (shaded columns are calculated data from database)

7a	7b	7c	7d	7e	7f	7g	WT_7	LW_PR	PIECE
50	1	55	1	1	2	1	41.3	66.7	0.75

For some questions there may be more than one answer because the fish has been sold in more than one unit. For example, Table 22 is an example based on question 6 above where fried fish has been sold for two prices: 6a = 50 and a1 = 40. The unit in both cases is a 'piece' weighing 0.4 kg.

Table 22 - Answers to Q6 - Fried Fish

6a	a1	6b	b1	6c	c1	6d	d1	6e	e1	6f	f1	GD_PR	PIECE
50		1		35		1		2		1		117.5	0.40
	40		1		15		1		2		1		0.40

In this example the best price (GD_PR) per kg is calculated by: dividing the total value of the fish by the number of units to give the weighted average price per unit.

((6a x 6c) + (a1 x c1))/(6c + c1) = ((50 x 35) + (40 x 15))/(35 + 15)

= 1750 + 600 / 50 = 47

47 is the average price per unit (piece).

The price per unit is then divided by the weight of the unit to the give the best price (GD_PR) :

47/PIECE = 47/0.4 = 117.5 / kg.

By the end of this step all the 'best' and reduced prices of fish recorded in answers should be in standard units with a single answer for each question.

Calculating the Total Weight and Value of the Fish per Interview

Once the weights and prices of fish have been standardised, it is necessary to calculate the total weight and value of a batch or catch of fish per interview before loss calculations can be worked out.

Table 23 shows the standardised weight values (WT_) for questions 3, 4, 5, 6 and 7 for five interviews. These are the only questions which produce data on fish weight. It also shows the 'best' price (GD_PR) data for fish from these interviews.

All the WT_ and GD_PR has been calculated during the previous two analysis steps. What we are now concerned with is the calculation of TOTAL CATCH AND TOTAL VALUE.

TOTAL CATCH = the weight of fish recorded in an interview before loss.

TOTAL VALUE = the value of the fish recorded in an interview before loss

TOTAL VALUE = TOTAL CATCH x GD_PR

Table 23 - Results from Interviews with Fish Processors

WT_3	WT_4	WT_5	WT_6	WT_7	GD_PR	TOTAL CATCH	CATCH VALUE
200.00	5.000	0.0	167.5	27.5	240.00	200.00	48000.00
225.00	5.300	0.0	135.0	84.7	200.00	225.00	45000.00
150.00	5.000	0.0	100.0	45.0	160.00	150.00	24000.00
100.00	6.000	0.0	52.5	41.5	280.00	100.00	28000.00
70.00	1.500	0.0	50.0	18.5	240.00	70.00	16800.00

Where *WT_3 = weight in kg of fish processed*
WT_4 = weight of fish thrown away during or after processing
WT_5 = weight of fish lost for other reasons
WT_6 = weight of fish sold for a good price
WT_7 = weight of fish sold for a reduced price
GD_PR = the best price that processed fish were sold for
Total catch = amount of fish processed
Catch value = amount of fish processed x best price

In this example TOTAL CATCH is simply WT_3, the weight of fish processed. In some cases the WT_ answers for different questions may need to be combined to give a 'total catch' figure.

Calculating Total Values for Quantities and Value of Fish per Interview

Now that the weight of fish for each question is standardised and the best and low prices are known, the total weight and value of a batch or catch of fish, per interview, must be calculated, to enable loss values to be calculated.

Table 24 shows the standardised weight values (WT_) for questions 6 and 8 of the Fishing Questionnaire on page 84 from five interviews. These are the only questions on this particular questionnaire which are used to determine the total amount of fish for an interview. Q6 refers to fish thrown away before landing and Q8 refers to the fish actually landed. Adding together the quantities of fish measured in these two questions will tell us how much fish was actually caught (TOTAL CATCH). Also shown in Table 24 is the 'best price' for good quality fish (GD_PR). This is required in order to calculate the value of the total catch (TOTAL VALUE). All this data will have been calculated during the previous stages of analysis: in this step the TOTAL CATCH and TOTAL VALUE figures will be calculated.

TOTAL CATCH = WT_6 + WT_8

TOTAL VALUE = TOTAL CATCH x GD_PR

Table 24 - Fishing Questionnaire - Results from Five Interviews

WT_6 (kg)	WT_8 (kg)	GD_PR Sh (kg)	TOTAL CATCH	CATCH VALUE Sh
5.000	167.5	240.00	172.5	48000.00
5.300	135.0	200.00	140.3	45000.00
5.000	100.0	160.00	105.00	24000.00
6.000	52.5	280.00	58.5	28000.00
1.500	50.0	240.00	51.5	16800.00

Where
WT_6 = weight in kg of fish thrown away before landing
WT_8 = weight of fish landed
GD_PR = the best price at which the fish was sold
Total catch = amount of fish caught
Catch value =value of fish caught

Calculating Physical Loss

A typical questionnaire will include at least one question about physical loss. The Fishing Questionnaire on page 84 has three questions which clearly target physical loss. These are:

Question 6 enquiring about loss before landing

Question 9 referring to loss just after landing

Question 10 referring to losses some time after landing.

In this case the loss can be calculated according to the question, or by adding the losses from all three questions together to give an overall physical loss.

Table 25 shows data for Questions 6, 9 and 10 from five interviews.The important data needed to calculate the % physical loss for each question are the WT_ values and TOTAL CATCH.

Table 25 - Calculating Physical Loss

WT_6	WT_9	WT_10	TOTAL CATCH	% Physical Loss
5.000	4	0.0	200.00	4.5
5.300	2	2.0	225.00	4.1
5.000	3	0.0	150.00	5.3
6.000	1.5	4.0	150.00	7.6
1.500	4	0.0	70.00	7.9

BOX 14

Physical Loss Calculation

The overall percentage physical loss for an interview is calculated by dividing the total weight of fish physically lost by the total weight of fish then multiplying the answer by 100.

(WT_6 + WT_9 + WT_10) /TOTAL CATCH x 100

Taking the first interview in Table 22:

(5 + 4 + 0) / 200 x 100 = 4.5 %

The % physical loss can also be calculated according to question. For example in interview 2 the loss before landing is:

WT_6 / TOTAL CATCH x 100

5.3 / 225 x 100 = 2.6 %

Reduced Price Losses

There are two loss calculations that can be done to summarise losses due to the sale of fish for a less than 'best price'. The losses are termed the **% reduced price loss** and the **% loss in income**.

% Reduced Price Loss

The % reduced price loss is the proportion of fish sold for a reduced price expressed as a % of the total amount of fish sold per interview. Table 26 shows data for Question 12 of the Fishing Questionnaire on page 00. The weight of fish sold for a reduced price is shown in the WT_12 column and the weight of fish for the interview is shown in the TOTAL CATCH column.

% Reduced Price = Weight of Fish Sold at Reduced Price/Weight of Fish Caught x 100

= WT_12 / TOTAL CATCH x 100

Table 26 - Answers to Q12

WT_12 (kg)	TOTAL CATCH (kg)	% Reduced Price Loss
27.5	200	14
84.7	225	38
45	150	30
41.5	100	42
18.5	70	26

% Loss in Income

Table 27 shows data from five interviews for Question 12 of the Fishing Loss questionnaire on page 84. Question 12 specifically targets reduced price loss. The weight of fish that was sold for a reduced price is shown in the WT_12 column.This fish was sold for a low price (LW_PR) (see Calculating Prices, page 107). Before being able to calculate % Loss in Income two values need to be known: Actual Income and Potential Income.

Actual Income is calculated by multiplying the weight of fish by the price for which they were sold (LW_PR):

Actual Income = WT_12 x LW_PR

Potential Income is the revenue that could have been earned had all the fish sold for a low price been sold instead for the 'best price':

Potential Income = WT_12 x GD_PR

In order to calculate the % Loss in Income the Loss in Income must first be calculated. This is done by subtracting the Actual Income from the Potential Income.

Loss in Income = Potential Income - Actual Income

The Loss in Income is expressed as a percentage of the TOTAL VALUE of the fish from that interview.

% Loss in Income = Loss in Income/ CATCH VALUE x 100

Table 27 - Data on Reduced Price Losses

WT_12 (kg)	LW_PR (Sh)	GD_PR (Sh)	Actual Income	Potential Income (Sh)	Loss in (Sh) (Sh)	% loss Income Income	Total Catch (kg)	Catch Value (Sh)
27.5	100	240	2750	6600	3850	8	200	48000
84.7	93	200	7877	16940	9063	20	225	45000
45	30	160	1350	7200	5850	24	150	24000
41.5	200	280	8300	11620	3320	12	100	28000
18.5	200	240	3700	4440	740	4	70	16800

Total Loss

The total loss is a summary of physical and reduced price losses together. It is the monetary value of the physical loss plus the loss in income from fish sold for less than the 'best price' expressed as a percentage of the maximum value of the catch

Total Loss = (value of physical loss + loss in income)/CATCH VALUE x 100

Table 28 shows the monetary value of the physical loss, the loss in income and the total loss for five interviews. The monetary value of the physical loss is calculated by multiplying the weight of fish lost by the 'best price' (GD_PR).

Table 28 - Physical, Reduced Price and Total Losses from Five Interviews

Physical Loss (TSh)	Loss in Income (Sh)	Batch Value (Sh)	Total Loss (%)
1200	3850	48000	11
1060	9063	45000	22
800	5850	24000	28
1680	3320	28000	18
360	740	16800	7

TSh = Tanzania Shillings

The total loss is calculated by adding the physical loss and loss in income together and then expressing the total as a percentage of the CATCH VALUE (the maximum value of the fish per interview).

Total Loss = Physical Loss + Loss in Income/ TOTAL CATCH x 100

Post-harvest Fish Losses and Variables

The database will now contain data on:

- *% Physical Loss*
- *% Reduced Price Loss*
- *% Loss in Income*
- *% Total Loss*
- *Maximum Value of the Fish*
- *Total Weight of Fish*
- *Best Price*
- *Low Price*

The next stage of analysis focuses on interrogating the database to show losses vary according to variables such as:

- *type of fishing gear used (if there are data on more than one gear type)*
- *location (spatial)*
- *time (temporal)*
- *reason for loss*
- *type of processing method*
- *transportation times*
- *survey site*
- *fish species.*

It is up to those who will use the survey data to decide which variables are used for further analysis.

Averaging Data From Interviews

Whatever variables are used data will usually need to be averaged. There are two general approaches to averaging data on losses from interviews. The first approach will give the **straight mean** and the second will give the **weighted mean.**

The **straight mean** is the average of number of values. For example, if the % physical loss values for a number of interviews are simply added together and then divided by the number of interviews then the resulting average will be the straight mean. In this case the straight mean will be the average physical loss per interviewee.

The **weighted mean** is used to express average losses per site, sector fishery, etc. For example, to work out the physical loss per sector over a certain time period the weight of fish lost from all relevant interviews is added together as is the weight of the total amount of fish for each interview. The total weight of fish lost is then divided by the total fish and multiplied by 100 to the give the weighted mean.

Loss Variation Over Time

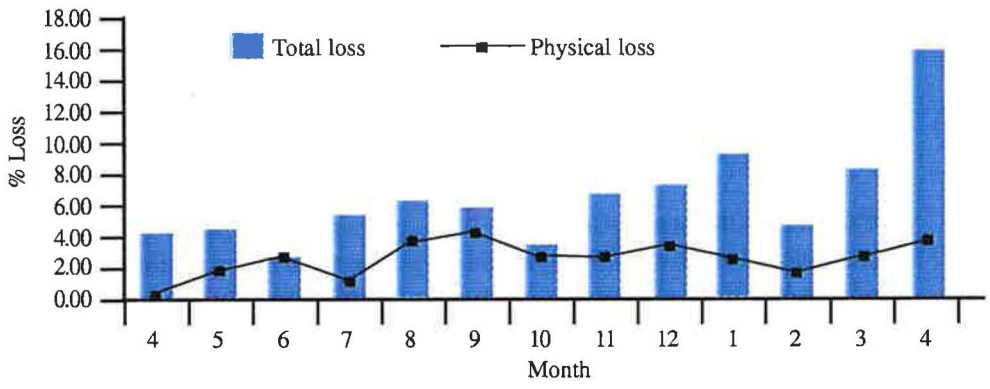
Table 29 shows data recorded at one fishing village called Igombe over a period of 13 months. A number of interviews with fishermen were conducted each month. The data from these interviews have been averaged according to month to give the straight mean.

Table 29 - Data Recorded at One Fishing Village over 13 Months

Site	Month	Year	Av_catch kg	Catch_vl Tsh	Gd_pr Tsh	Tot_loss (%)	Phyloss (%)
IGOMBE	4	1993	261.57	21874.60	83.30	4.11	0.22
IGOMBE	5	1993	402.44	42945.42	109.11	4.47	1.62
IGOMBE	6	1993	551.11	57540.43	107.91	2.63	2.63
IGOMBE	7	1993	969.26	70893.25	73.19	5.44	1.19
IGOMBE	8	1993	607.27	62859.09	109.36	6.36	3.69
IGOMBE	9	1993	441.76	70951.04	162.98	5.96	4.11
IGOMBE	10	1993	333.49	62808.39	189.89	3.50	2.63
IGOMBE	11	1993	461.76	89822.79	192.87	6.88	2.65
IGOMBE	12	1993	448.67	85987.09	190.74	7.37	3.38
IGOMBE	1	1994	560.51	108388.80	193.19	9.36	2.42
IGOMBE	2	1994	874.40	152454.70	173.83	4.78	1.65
IGOMBE	3	1994	622.96	104009.50	164.67	8.47	2.59
IGOMBE	4	1994	690.40	146338.90	209.38	16.27	3.62

Average loss data like this can also be presented in graph form. Graphs can clearly show spatial and temporal variations and trends in losses. Most computer spreadsheet software packages will allow data to be presented in graph form. Figure 15 shows the temporal variation of physical and total loss displayed in Table 29. This graph shows the total loss is rising over time while the physical loss is not. Since total loss is a combination of reduced price loss and physical loss this trend indicates that reduced price losses are increasing over time.

Figure 15 - Total Loss and Physical Loss of Dried Fish at the Processing Stage



Reasons for Losses and End Uses

Another two variables that can be used as a basis for analysis are the reasons why fish is lost and the end use of fish classed as a loss. The simplest way to do this is to analyse the data on reasons according to weight of fish lost for each reason to produce weighted means.

For example, in the question below (Q12) fish could have been physically lost for seven different reasons (part [e]).

12. Did you *throw away* any fish due to spoilage?

[a] unit	[b] no.	[c] fish	[d]process	[e] reason	[f] end use
1=piece		1=perch	1=fresh	1=rain	1=food
2=kg		2=*dagaa*	2=smoked	2=rotten	2=livestock
3=*debe*			3=fried	3=stale	3=no use
4=*tenga*			4=salted	4=broken	4=don't know
5=*gunia*			5=sun-dried	5=mouldy	5=other
6=other			6=other	6=insects	
				7=others	

The weight of fish lost for each reason should be totalled. These totals are then each divided by the total amount of fish physically lost for all reasons and the answer multiplied by 100. This will give the proportion of fish lost for each reason as a percentage mean of loss.

Table 30 shows the proportion of dried and smoked fish physically lost for various reasons. It shows that of the fish physically lost, 41% was lost because of insect infestation. and 20% was lost because it was eaten by animals.

Table 30 - Reasons for Physical Losses of Fish

Reason	%
Insect infestation	41
Eaten by animals	20
Other	20
Spoilage	8
Mould	5
Burnt	3
Theft	2
Eaten by birds	2
Broken	1

In a questionnaire there may be several different questions about physical loss. To summarise, physical loss the weights of the different questions should be combined and the different reasons calculated as a percentage, as outlined above.

The end use data are a measure of what happens to the fish after it has been physically lost or sold for a reduced price. An example is part 'f' of Question 12 above which is designed to generate data on 'end use'. The percentages of each end use are calculated in the same way as the reasons for loss. Looking at the End Use column in Table 31, 88% of the fish physically lost is used for animal feed.

Table 31-End Use of Fish

End Use	%
Animal feed	88
Food	11
Other	1

Raising Factors and Overall Monetary Loss

By this stage the following will be known:

- *the levels of physical, reduced price and total loss*
- *the relationship between losses and some key variables*
- *the major reasons for losses*
- *what happens to fish after it has been thrown away or sold for a reduced price.*

This data will be cover the sample population surveyed at particular sites. Assuming the sites chosen were representative then the data will be representative of the fishery or sector as a whole.

A further stage of analysis can now be done to calculate monetary losses for a fishery or sector. This will indicate how much money is being lost in general terms because of fish losses.

Raising Factors

In order to calculate monetary values of loss for a fishery or sector additional data are required on the number of operators in a sector and the frequency with which they operate.

This additional data, termed **raising factors,** may be readily available from statistical records and other secondary sources. In cases where the data are not available, or are incomplete or out of date, then informed estimates can be used as raising factors. If resources are available then a separate study could be initiated to generate data on raising factors.

If a comprehensive list of sites is available and estimates of poulation size known then an estimate of the total population can be made and thus a reliable estimate of raising factors can be made. If site selection is done purposively rather than randomly then it

will not be easy to determine confident estimates for 'total population' as the sites will not be truly representative. Using population estimates in such cases requires an act of faith which may or may not be justified.

Table 32 shows how raising factors can be used to calculate losses on a sector level for a year. The data in the first four columns have been generated from previous analysis steps. The data summarises losses for a survey of the fishing sector according to the variable 'fishing gear type'. There are three types of fishing gear: gill nets, beach seines and longlines. The raising factor data are in the number of operators and frequency of operation columns. The number of operators is the number of fishermen using a particular type of gear. The frequency of operation refers to the number of times in a year that the fishermen use the gear or go fishing.

The origin of the raising factor data gives the reader an indication of where the data on operators and frequency was found. For example, the data on gill net fishermen are from a secondary source, such as a report. The data for beach seines and longlines have been estimated in this case from field observations.

The annual sector loss column is calculated by multiplying the average total loss by the number of operators and then by the frequency of operation. The annual sector loss is an estimation of the amount of money lost overall to fisherfolk as a result of post-harvest fish losses.

Table 32 - Use of Raising Factors in Calculating an Annual Sector Loss

Variable Fishing Gear	Total Loss (%) Sh	Aver Max Value Sh	Aver Total Loss	Number Operators	Freq of Oper	Origin of Raising Factor	Annual Sector Loss Sh
Gill net	4.1	10 865	445	2000	300	Secondary source	267 27900
Beach seine	0.3	8469	25	500	300	Estimate	3 811 050
Longline	4.1	12 134	497	200	200	Estimate	19 899 760

Table 32 shows the gill net sector has highest sector loss. The longline fishery has the same percentage total loss, but in monetary terms the loss is smaller because there are fewer fishermen fishing less frequently.

The Role of Statistical Analysis

Most of the objectives of surveys such as this can be met by simple tabulation and/or cross-tabulation of frequency counts, percentages and means. It is also useful to calculate standard deviations and 95% confidence limits for losses. This will allow better comparisons to be made between losses, for example, could differences in loss be due to survey variation?

The next level of analysis may include:

(a) simple *t*-tests or one way analysis of variance to test for differences in mean losses between two or more groups;

(b) c^2 -tests to test for association between two catergorisations, for example, does the type of gear depend on site;

(c) correlation to test for association between continuous measurements, for example, are losses of one species related to losses of another?

Problems

A drawback with a questionnaire approach is that if statistically valid data are required on a few fish species or products from a multi-species fishery then, unless a survey is going to be very large, it should only concentrate on a few fish species or products. Otherwise the survey may collect data on a large number of different species and there may not be enough data on particular species of interest.

Appendices

Appendix 1 - Computer Programmes

A Computer Programme for Analysing Losses According to Month and Fishing Gear

*This programme is written in Dbase IV and allows the user to calculate several average values including losses for a month and year *and fishing gear type specified by the user. The average values calculated are stored in a database file. This file can be used for *further analysis.

*the following commands alter the operating parameters of the computer to facilitate running a programme

set status off

set talk off

set scoreboard off

set safety off

set date British

clear all

* the databse file that contains the data is A.dbf

use A

* the following are all memory variables that will be used to store data temporarily

a1 = 0

catch=0

yer =0

loss = 0

STORE SPACE(10) TO A2

catchvl=0

losvl =0

lossphy=0

lossrd=0

redper=0

gdpr=0

store space(1) to Q

G=0

* the @ commands are use to design the screen layout and allow the user to choose the variables for calculating average losses and other data

@ 2,5 say "FISHING SECTOR LOSSES: Nile Perch: April 1993 to March 1995."

```
@ 4,5 say "The sites covered in this survey were:"
@ 6,10 say "Igombe, Kayenze & Lugezi (Mwanza);"
@ 8,10 say "Mwisenge & Guta (Mara)."
@ 10,10 say "Choose site                "
@ 10,25 get A2
@ 12,10 say "Choose month:     "
@ 14,10 say "Choose year:      "
@ 12,25 get a1
@ 14,25 get yer
@ 16,10 SAY "Choose fishing gear:        "
@ 16,35 get G pict "9"
@ 18,10 SAY "Gear Type: Gill Net = 1; Beach Seine = 2; Longline = 3."
read
CLEAR
* the following are dbase commands to calculate average values from the data
aver tot_cat for site= A2.and. month(q2)=a1 .and. year(q2)= yer.and.q3=G to catch
aver catch_vl for site=A2.and. MONTH(Q2)=A1.AND.YEAR(Q2)=YER.and.q3=G TO catchvl
aver tot_losper for site=A2.and. MONTH(Q2)=A1.AND.YEAR(Q2)=YER.and.q3=G TO LOSS
aver tot_los_vl for site= A2.and. month(q2)=a1 .and. year(q2)= yer.and.q3=G to losvl
aver loss_per for site=A2.and. MONTH(Q2)=A1.AND.YEAR(Q2)=YER.and.q3=G TO lossphy
aver red_per for site= A2.and. month(q2)=a1 .and. year(q2)= yer.and.q3=G to lossrd
aver red_pr_per for site=A2.and. MONTH(Q2)=A1.AND.YEAR(Q2)=YER.and.red_pr_per<100.and.q3=g TO redper
aver gd_pr for site=A2.and. MONTH(Q2)=A1.AND.YEAR(Q2)=YER.and.q3=G TO gdpr
* the following @ commands create another screen. This time to display the results of * the previous calculations
Q="A"
@ 1,10 say "QUESTIONNAIRE:" +Q
@ 1,30 SAY "GEAR:"+STR(G)
@ 2,10 SAY "SITE: " +A2
@ 2,25 SAY "MONTH:" +STR(A1)
@ 2,45 SAY "YEAR:"+STR(YER)
@ 4,10 to 4,30 double
@ 6,10 say "average catch:              KG"
@ 6, 25 get catch pict "99999999.99"
@ 8,10 say "maximum value of the average catch:          TSH"
@ 8,46 get catchvl pict "999999.99"
@ 10,10 SAY "average total loss:          %"
@ 10,32 get loss pict "999.99"
@ 12,10 say "value of the total loss:          TSH "
@ 12,34 get losvl pict "99999.99"
@ 14,10 say "average physical loss is:          %"
@ 14,37 get lossphy pict "999.99"
@ 16,10 say "average sold for reduced price is:          %"
@ 16,45 get lossrd pict "999.99"
@ 18,10 say "reduced price was on average        % of the best price"
@ 18,39 get redper pict "999.99"
@ 20,10 say "average price good quality fish is:          TSH/KG"
```

```
@ 20,47 get gdpr pict "9999.99"
Q="A"
read
wait
* the next commands transfer the calculated data displayed on the screen to a database  file called SUM
USE SUM
APPEND
REPLACE QUEST WITH Q
REPLACE SITE WITH A2
REPLACE MONTH WITH A1
REPLACE YEAR WITH YER
REPLACE PRODUCT WITH G
REPLACE CATCH_VL WITH CATCHVL
REPLACE AV_CATCH WITH CATCH
REPLACE GD_PR WITH GDPR
REPLACE LOSS_VL WITH LOSVL
REPLACE PHYLOSS WITH LOSSPHY
REPLACE RED_PER WITH LOSSRD
REPLACE TOT_LOSS WITH LOSS
REPLACE RED_PR_PER WITH REDPER
* the data in the SUM file is now transferred to another database file called SUMMARY
USE SUMMARY
APPEND FROM SUM FOR QUEST="A"
* the user is now given the option of continuing or stopping. The main menu mentioned refers to a screen displaying all the
different questionnaires used for this survey.
X=0
@ 10,5 SAY "DO YOU WISH TO CONTINUE OR RETURN TO MAIN MENU?    "
@ 14,5 SAY "ENTER [1] TO CONTINUE OR [2] FOR MAIN MENU OR [3] TO QUIT."
@ 20,20 GET X PICT "9"
READ
IF X=1
DO LOSSA
ELSE
IF X =2
DO SUMMARY
ELSE
IF X=3
* the following commands set the computer back to its normal operating parameters
set status on
set safety on
set scoreboard on
set talk on
close all
ENDIF
ENDIF
ENDIF
```

Computer Program in DBase IV Summarising the Losses in Several Different Fishery Sectors

```
SET STATUS OFF
SET TALK OFF
SET SCOREBOARD OFF
SET SAFETY OFF
SET DATE BRITISH
CLEAR ALL
CHO =0
@ 4,5 SAY "THE NRI/TANZANIA POST HARVEST FISH LOSSES PROJECT."
@ 6,5 SAY "A SUMMARY OF QUESTIONNAIRE SURVEY DATA FOR LAKE VICTORIA."
@ 8,10 SAY "MAIN MENU:"
@ 10,2 SAY "[1] FISHING SECTOR"
@ 10,32 SAY "[6] FISHING MAFIA I"
@ 12,2 SAY "[2] DAGAA PROCESSING"
@ 12,32 say "[7] TRANSPORT MAFIA I"
@ 14,2 SAY "[3] TRANSPORT SECTOR"
@ 14,32 SAY "[8] PROCESSING MAFIA I"
@ 16,2 SAY "[4] PROCESSING SECTOR"
@ 16,32 SAY "[9] RETAIL MAFIA I"
@ 18,2 SAY "[5] RETAIL SECTOR"
@ 18,32 SAY "[10] END SESSION"
@ 20,10 SAY "CHOOSE SECTOR:  "
@ 20,26 GET CHO PICT "99" RANGE 1,99
@ 22,2 SAY "TO VIEW DATA ON REASONS FOR LOSSES ENTER [11] FOR FISHING,[22] FOR DAGAA ETC"
READ
IF CHO =1
    DO LOSSA
    ELSE
    IF CHO =11
    DO REASA
    ELSE
    IF CHO=2
        DO LOSSB
        ELSE
        IF CHO=22
        DO REASB
        ELSE
        IF CHO = 3
            DO LOSSC
            ELSE
            IF CHO=33
            DO REASC
            ELSE
            IF CHO =4
```

```
DO LOSSD
ELSE
IF CHO=44
DO REASD
ELSE
IF CHO = 5
      DO LOSSE
      ELSE
      IF CHO=55
      DO REASE
      ELSE
      IF CHO = 6
            DO MAFA
            ELSE
            IF CHO=66
            DO MAFA_R
            ELSE
            IF CHO = 7
             DO MAFB
                  ELSE
                  IF CHO=77
                  DO MAFB_R
                  ELSE
                  IF CHO = 8
                  DO MAFC
                        ELSE
                        IF CHO=88
                        DO MAFC_R
                        ELSE
                        IF CHO = 9
                        DO MAFD
                              ELSE
                              IF CHO =99
                              DO MAFD_R
                              ELSE
                              IF CHO = 10
            CLEAR ALL
            SET STATUS ON
            SET TALK ON
            SET SCOREBOARD ON
            SET SAFETY ON
            SET DATE BRITISH
            CLOSE ALL
```

```
ENDIF
ENDIF
ENDIF
ENDIF
ENDIF
ENDIF
ENDIF
ENDIF
ENDIF
ENDIF
ENDIF
ENDIF
ENDIF
ENDIF
ENDIF
ENDIF
ENDIF
ENDIF
ENDIF
```

Appendix 2 - Co-ordinator Terms of Reference

The co-ordinator should be well educated and have good administrative and communication skills. The co-ordinator's role can be best summed up by the following responsibilities and duties.

1. To play an active part in the planning, design and preparation of all stages of the survey, including the development of suitable questionnaires and research protocol.

2. To conduct training for enumerators and supervisors as necessary so that all are fully aware of their duties and responsibilities within the project.

3. Overseeing the work of supervisors to ensure that data are collected, and that it is sent at the specified frequencies to the co-ordinator.

4. To receive completed data forms from regional supervisors every month and to cross- check for correctness, logic and potential inaccuracy.

5. To ensure accurate and timely inputting of data into a computer database, and to re-check inputted data for errors (may be done by supervisors).

6. Report on the survey progress to the commissioning agent.

7. To manage the financial aspects of the project thus ensuring that payments to staff are correct and timely, and that necessary materials are distributed to the regions before stocks have reached a level where data collection is interrupted.

8. To visit periodically data collection sites (frequency to be decided) to supervise data collection and to deal with any matters arising.

9. To assume responsibility for the care of computing and other equipment purchased for the survey.

10. To address any other issues, or undertake any other duties, which are necessary to ensure the smooth running of the project and the regular, accurate collection and assimilation of data.

Appendix 3 - Supervisor Terms of Reference

Supervisors should have a good standard of education and administrative skills. They should be familiar with the enumerators—who they are and where they stay.

Supervisors have specific responsibilities and duties.

1. To receive completed data forms from enumerators each month, to check each one for correctness, and to advise on and rectify any misunderstandings or problems as may arise.

2. To make a copy of all completed forms, and to send the original data forms to the co-ordinator, at agreed intervals.

3. To visit recording sites and to supervise data recording so that it is carried out correctly and at the specified times.

4. To ensure that arrangements are made for data collection in event of any disruption to the planned schedule, for example, illness, transfer, training, or any other absence of enumerators.

5. To facilitate arrangements made by the co-ordinator for payment of recorders, and for provision of materials essential for their work. At the end of every month all receipts and details of payments should be sent to the co-ordinator for auditing.

6. To write a short note each month discussing progress, any unusual occurrences in data collection or trends, explanations for abnormal results, and any problems encountered, and to send it to the co-ordinator each month.

7. As far as possible to resolve any problems that arise, and to alert the co-ordinator immediately of any problems which may require action.

8. To address any other issues, or undertake any other duties, which are necessary to ensure the smooth running of the project and the regular, accurate, collection and dispatch of data.

Appendix 4 - Enumerator Terms of Reference

Enumerators should have at least a reasonable standard of education, be honest, patient and have a good attitude to work.

The role of enumerators is summarised by the following responsibilities.

1. Collect data at specified sites at the times decided upon by the supervisors and co-ordinator.

2. Arrive at the data collection site punctually for data collection.

3. Use the proper sampling procedures to identify respondents to interview.

4. Make sure the supervisors receive the collected data at the agreed times.

5. Write any important or useful information on the bottom of the answer forms, in the space provided.

6. If practical, be at the data collection site the day before collection day to observe the activities and quantities of fish to assist in understanding the answers given by the respondents.

7. Discuss any difficulties with data collection with the supervisors.

Bibliography

AMES, G. R. and WARD, A. R. (1995) Problems of utilizing shrimp by-catch in the Tropics. *Tropical Science*, **35**.

AMES, G., CLUCAS, I. and SCOTT PAUL, S. (1991) *Post-harvest Losses of Fish in the Tropics.* Chatham, UK: Natural Resources Institute.

BOSTOCK, T. W., WALKER, D. J. and WOOD, C. D. (1987) Reduction of losses incured fish in the tropics - guide for extension workers. *Report of the Tropical Development and Research Institute* G204.

CHAMBERS, R (1983) *Rural Development: Putting the Last First.* Harlow, UK: Longman.

CHAMBERS, R (1994a) The origins and practice of participatory rural appraisal. *World Development*, **22** (7).

CHAMBERS, R (1994b) Participatory rural appraisal (PRA): analysis of experience. *World Development,* **22** (9).

CONWAY, G. R. (1986) *Agroecosystem Analysis for Research Development.* Bangkok: Winrock International.

DIGGES, P. and CLUCAS, I (1995) Report on a training course on rapid appraisal techniques and a survey of fresh fish marketing between Veraval and Bombay. Chatham, UK: Natural Resources Institute. (unpublished report)

FAO (1981) The prevention of losses in cured fish. *Fisheries Technical Paper* No 219. Rome: Food and Agriculture Organization of the United Nations.

GILLING, J. and CROPLEY, J. P. (1993) *Needs Assessment for Agricultural Development: Practical Issues in Informal Data Collection.* NRI Socio-economics Series 1. Chatham, UK: Natural Resources Institute

INFOPECHE (1996) Bonga market flash. *Monthly Bulletin* No. 6. Abidjan, Côte d'Ivoire: WADAF.

INTERNATIONAL INSTITUTE FOR ENVIRONMENT AND DEVELOPMENT *RRA and PLA Notes. Sustainable Agricultural Programme.*3 London: International Institute for Environment and Development.

MORRISSEY, M. T. (ed.) (1988) *Postharvest Fishery Losses. Proceedings of an International Workshop Held at the University of Rhode Island.* Kingston, Rhode Island: ICMRD.

NABASA, J., RUTWARA, G., WALKER, F. and WERE, C. (1995) *Participatory Rural Appraisal: Principles and Practicalities.* Chatham, UK: Natural Resources Institute.

POULTER, G. R., AMES, G. R. and EVANS, N. J. (1988) Post harvest losses in traditionally processed fish products in less developed countries. In: *Postharvest Fishery Losses. Proceedings of an International Workshop Held at the University of Rhode Island.* Kingston, Rhode Island: ICMRD.

PRETTY, J. N. (1995) Participatory learning for sustainable agriculture. *World Development*, **23** (8).

PRETTY, J. N., GUIJT, I., THOMPSON, J.and SCOONES I (1995) A trainers guide to participatory learning and action. *IIED Participatory Methodology Series.* London: International Institute for Environment and Development.

SHEPHERD, A.W. (1993) *A Guide to Marketing Costs and how to Calculate Them.* Rome: Food and Agriculture Organization of the United Nations.

SHUBERT, B. (1983) Market information services. FAO Agricultural Services Bulletin, **57**. Rome: Food and Agriculture Organization of the United Nations.

THEIS, J. and GRADY, H. (1991) *Participatory Rapid Appraisal for Community Development: A Training* Manual based on Experiences in the *Middle East and North Africa.* London: International Institute for Environment and Development and Save the Children.

TOWNSLEY, P (1993a) Training of rapid appraisal teams. Notes for trainers. *FAO Fisheries Circular* 868. Rome: Food and Agriculture Organization of the United Nations.

TOWNSLEY, P. (1993b) *Rapid Appraisal Methods for Coastal Communities - A Manual.* Madras: Bay of Bengal Programme.

WARD, A. R., PAPADOPULOS, V., KHASIM, D. I. and DAMLE, S. P. (1996) Report on a survey of fresh fish marketing between Visakhapatnam and Madras and a workshop on rapid appraisal techniques. Central Institute of Fisheries Technology India. Chatham, UK: Natural Resources Institute. (unpublished report)

WOOD, C. D. (1986) Methodology for the assessment of losses in cured fish and the evaluation of counter measures. In: *Fish Processing in Africa, Proceedings of the Expert Consultation on Fish Technology in Africa, Lusaka, Zambia, 21-25 January. FAO Fisheries Report* 329. Rome: Food and Agriculture Organization of the United Nations.