

# Post-harvest losses in small-scale fisheries

Case studies in five sub-Saharan African countries



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by

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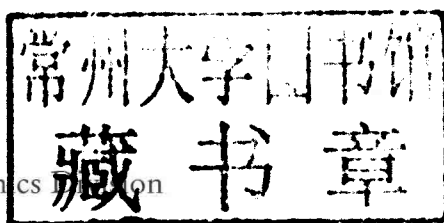
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# Preparation of this document

The post-harvest fish loss assessment studies presented in this report were conducted within the framework of the regional post-harvest loss assessment (PHLA) programme in small-scale fisheries in Africa, a Food and Agriculture Organization of the United Nations (FAO) regular programme activity to improve the utilization, safety and quality of fishery products. The objectives of this programme, planned, implemented and coordinated within the Products, Trade and Marketing Service (FIPM) of the FAO Fisheries and Aquaculture Department, were to develop a core of regional experts in fish loss assessment; generate fish loss data of socio-economic importance; enable the production of practical guides for fish loss assessment for extension officers and fishery operators; update an earlier researcher's manual for assessing post-harvest fisheries losses; and, provide normative guidance to support the implementation of the FAO Code of Conduct for Responsible Fisheries.

The studies were carried out in five sub-Saharan African countries (Ghana, Kenya, Mali, United Republic of Tanzania and Uganda) and were presented and discussed at two regional workshops which provided the outline for a consolidated document on data generated, lessons learned and key achievements for wider dissemination. A regional consultant was recruited for a comprehensive report, who then submitted a first draft in September 2009. It was reviewed several times before being edited and published by FAO.

# Abstract

In 2006, the Products, Trade and Marketing Service of the Fisheries and Aquaculture Department (formerly the Fish Utilization and Marketing Service) in FAO designed a regional post-harvest loss assessment (PHLA) programme to:

- develop a core of regional experts in fish loss assessment;
- generate fish loss data in fisheries of socio-economic importance;
- produce practical guides for fish loss assessment for extension officers and fishery operators;
- update the Ward and Jeffries (2000) manual; and
- provide normative guidance to support the implementation of the FAO Code of Conduct for Responsible Fisheries.

This regional programme began in October 2006 and lasted 18 months. It aimed to build on past initiatives and develop tools for practical loss assessment in artisanal fisheries. The programme provided capacity building for fishery officers in qualitative and quantitative fish loss assessments methods, planned support, and supervised the implementation of loss assessment studies in five sub-Saharan African countries (Ghana, Kenya, Mali, United Republic of Tanzania and Uganda). Data were generated on quality and physical losses – the main types of losses identified – and quantified by researchers using three assessment methods.

The fieldwork indicates that post-harvest fish losses in small-scale fisheries occur at all stages in the fish supply chain from capture to consumer. Huge physical and quality losses were found to occur in some supply chains assessed in all the countries, with quality losses reported to account for more than 70 percent of total losses. Concurring data are that physical losses seldom exceed 5 percent in some fisheries, but the findings from assessments of the Lake Victoria sardine (*Rastrineobola argentea*) fishery indicate much higher losses are occurring during the rainy season when poor drying conditions prevail.

Although the nutritional losses and human health problems were not the focus of the study, it can be easily admitted that these financial losses add to the food safety and quality concerns in small pelagic species (such as anchovies in Ghana), which form a noticeable part of the landings in question and are known to be prone to histamine accumulation under conducive uncontrolled time/temperature conditions.

To try and reduce or prevent losses, various coping strategies are used by fishermen, processors and traders with varying degrees of success. Despite these, as has been demonstrated by the study, losses still occur, hence the need for careful and continued technical and policy initiatives by international and national agencies. Balancing technical interventions to improve fish quality with the potential increase in selling prices, associated with better quality fish with the demand for cheaper fish by low income consumers, is an important dilemma. In this situation, a policy

intervention to encourage access to alternative cheap proteins to improve the food security of low income consumers would help mitigate any downbeat effects from price increases.

In conclusion, governments and development agencies should ensure that changes in post-harvest fisheries-related policy and practices take stock of the loss assessment tools, information generated and experience of the programme. Fish loss assessments should be incorporated into national data collection systems and used regularly to inform policy.

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# Acknowledgements

The post-harvest fish loss assessment studies presented in this report were conducted within the framework of the regional post-harvest loss assessment (PHLA) programme in small-scale fisheries in Africa, an FAO regular programme activity to improve the utilization, safety and quality of fishery products. It was implemented from October 2006 to March 2008 with twelve participating member countries. This programme aimed to develop a core of regional experts in loss assessment, and generate data, identify ideas for loss reduction and support the development of other proposed FAO loss assessment activities.

At the country level, the programme has been a collaborative effort involving fisheries institutions that provided the teams of fish loss assessors and local logistics. FAO provided capacity building and supported all fieldwork activities. In Ghana, Kenya, Mali, Uganda and United Republic of Tanzania, the fisheries officers (at central and local/extension levels) took time off from their routine duties to work for the programme and consult stakeholders, gather secondary source data and work tirelessly to complete the studies and process the data in addition to attending the capacity-building forum regularly organized within the PHLA programme. This valuable synergy is greatly acknowledged.

For FAO, planning, implementation and coordination of the programme was carried out by Ms Yvette Diei-Ouadi of the Products, Trade and Marketing Service of the Fisheries and Aquaculture Policy and Economics Division. The cooperation of Mr Alhaji Jallow from the Regional Office for Africa must also be underscored.

The studies were presented and discussed at two regional workshops organized by FAO and facilitated by Mr Ansen Ward, a post-harvest fisheries specialist whose professional expertise and experience of small-scale fisheries in the tropics contributed immensely to the programme. Mr Joseph Ndenn, another post-harvest fisheries specialist with experience in the region, also provided valuable advisory support.

Unless otherwise indicated, the photographs have been provided by the authors.

# Acronyms and abbreviations

<b>CCRF</b>	FAO Code of Conduct for Responsible Fisheries
<b>CEWEFIA</b>	Central and Western Fish Improvement Association
<b>DFID</b>	Department for International Development (United Kingdom)
<b>FAO</b>	Food and Agriculture Organization of the United Nations
<b>FIU</b>	Fish Utilization and Marketing Service (former)
<b>FIPM</b>	Products, Trade and Marketing Service
<b>IFLAM</b>	Informal Fish Loss Assessment Method
<b>LT</b>	Load Tracking
<b>NEPAD</b>	New Partnership for Africa's Development
<b>PHFRP</b>	Post-harvest Fisheries Research Programme
<b>PHLA</b>	post-harvest loss assessment
<b>PRA</b>	Participatory Rural Appraisal
<b>QLAM</b>	Questionnaire Loss Assessment Method
<b>SFLP</b>	Sustainable Fisheries Livelihoods Programme
<b>SSI</b>	semi-structured interview



# Executive summary

The objectives of the post-harvest loss assessments (PHLAs) carried out in five sub-Saharan African countries were essentially to:

- develop a core of regional experts in fish loss assessment;
- generate fish loss data of socio-economic importance;
- enable the production of practical guides for fish loss assessment for extension officers and fishery operators;
- update an earlier researcher's manual for assessing post-harvest fisheries losses; and
- provide normative guidance to support the implementation of the FAO Code of Conduct for Responsible Fisheries (CCRF).

In developing regional expertise during an 18-month period from October 2006 to mid-2008, the PHLA programme provided capacity building for fishery officers from 12 African countries in fish loss assessment. The programme provided training in qualitative and quantitative fish loss assessment methods, planned support and supervised the implementation of loss assessment studies. Further development of existing systematic and practical tools to assess post-harvest fish losses and assist development practitioners to plan appropriate control measures has been a key focus of the FAO regional post-harvest fish loss assessment programme for Africa. The reason for such an initiative is that loss reduction, which is clearly reflected in the FAO CCRF, will contribute to the improved utilization of resources and to the livelihoods of those working in the post-harvest sector as well as the food security of the population as a whole.

Data were generated on quality and physical losses (these being the main types of losses identified) and quantified by researchers using three assessment methods. The Informal Fish Loss Assessment Method (IFLAM) is based on the Participatory Rural Appraisal (PRA) and provides qualitative and indicative quantitative data on a wide range of issues related to fish loss. At the same time it fosters participation of primary stakeholders in the planning and development process and the use of indigenous knowledge. Load Tracking (LT) produces statistically representative quantitative data on loss levels during handling, processing, distribution and marketing. The Questionnaire Loss Assessment Method (QLAM) provides quantitative data on a wide range of issues and enables the validation of qualitative and quantitative data over a wide geographical area.

The fieldwork in Ghana, Kenya, Mali, Uganda and United Republic of Tanzania indicates that post-harvest fish losses in small-scale fisheries occur at all stages in the fish supply chain, from capture to consumer. Huge physical and quality losses were found to occur in some supply chains assessed in all the countries, with quality losses reported to account for more than 70 percent of total losses. Concurring data are that physical losses seldom exceed 5 percent in some fisheries, but the findings from assessments of the Lake Victoria sardine (*Rastrineobola*

*argentea*) fishery indicate that much higher losses are occurring during the rainy season when poor drying conditions prevail. Physical losses in this fishery account for more than 20 percent, sometimes higher during the main fishing season. Much of the fish is processed as fishmeal and is lost for direct human consumption, but also substantial quality nutrients are lost for the poultry industry. This remark underscores the need for proper handling of fish products regardless of their intended use (for direct human consumption or animal feed). In the fresh tilapia and fresh Nile perch fisheries quality losses were found to affect all stakeholders significantly; however, fresh tilapia traders were less affected compared with other operators because they bargained prices according to the freshness of fish collected from the fishermen. The frequency of losses is also lower among the fresh Nile perch traders because most of them use ice and handle the fish hygienically, which is sold to factories for export purposes. In Mali, quality loss in fresh fish during the main and lean seasons was put at 17 percent and 25.7 percent, respectively. For smoked fish, 21 percent is lost during the main fishing season (302.4 tonnes dry weight) as against a negligible loss during the lean season because of the capacity of the processing facilities to cater for the volume of catches. The quality loss in smoked fish is a result of uneven smoking thereby leading to downgrading of the price.

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

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

fishing effort. Despite coping strategies, as has been demonstrated by the study, losses still occur, hence the need for careful and continued technical and policy initiatives by international and national agencies. Balancing technical interventions to improve fish quality with the potential increase in selling prices, associated with better quality fish with the demand for cheaper fish by low-income consumers, is an important dilemma. In this situation a policy intervention to encourage access to alternative cheap proteins to improve the food security of low-income consumers would help mitigate any downbeat effects from price increases.

The major output from the programme was the general improved understanding of post-harvest fish assessment methods and practical skills as well as information on key losses in certain countries.

The PHLA has achieved the following:

- Through practical application, it developed further the existing loss assessment methods. The combination of PRA with LT raised awareness and helped identify critical issues in distribution chains. QLAM/LT also validates IFLAM data.
- It identified priority losses and where interventions can be better focused thus making best use of limited development resources.
- It clarified certain need definitions (e.g. linkage between market force losses and supply and demand concept; when fragmentation in processed fish is a matter of physical or quality losses, etc.).
- And it promoted awareness and recognition among all stakeholders of loss assessment, capacity building and networking. The network created now requires sustaining, perhaps within a broader post-harvest fisheries regional network's activity or an appropriate forum at national, subregional and regional levels.

The assessment programme also led to a student dissertation paper on fish post-harvest losses and donor funds to provide equipment and training for the production of value-added products from low-value fish species.

In conclusion, governments and development agencies should ensure that changes in post-harvest fisheries-related policy and practices take stock of the loss assessment tools, information generated and experience of the programme. Fish loss assessments should be incorporated into national data collection systems and used to regularly inform policy.

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# Introduction

Small-scale fisheries in developing countries play a vital role in contributing directly to food and livelihood security, poverty reduction, wealth creation, foreign exchange earnings and rural development. The latest estimates indicate that small-scale fisheries contribute over half of the world's marine and inland fish catch of about 140 million tonnes, nearly all of which is used for direct human consumption (FAO, 2008). In Africa, over 60 percent of the fish supply to domestic and regional markets, as well as export-oriented processing units, is of artisanal origin. The New Partnership for Africa's Development (NEPAD) recognizes the vital contributions by African inland and marine fisheries to food security and income of many millions of Africans and to poverty reduction and economic development on the continent. Fisheries are an important part of food security, particularly for many poor people in developing countries. Small-scale fisheries employ over 90 percent of the world's estimated 28 million fishermen and support another approximate 84 million people employed in jobs associated with fish processing, distribution and marketing. At least half of these are women. In many cases these fisheries are responsible for between 50 and 70 percent of a nation's total catch, and nearly half of fishery exports derive from developing countries (FAO, 2008).

In spite of these economic, social and nutritional benefits, concerns are raised about the sustainability of small-scale fisheries in maintaining their role of filling the gap between an ever-increasing demand for fish and dwindling supplies from wild capture fisheries. Though there are numerous threatening factors, as acknowledged in the recently organized FAO Global Conference on Small-scale Fisheries,<sup>1</sup> securing post-harvest benefits through post-harvest fish loss control has long been a concern of development practitioners committed to improving the livelihoods of fishermen, processors and traders and the contribution fish makes to food security. In a region where aquaculture is still developing and against a backdrop of dwindling or static supplies of wild capture, African fisheries are at a turning point, which makes the problem of fish loss particularly acute (Ward, unpublished, Report of the Accra 2006 workshop).

Recognition of the important problem fish loss poses is reflected in the FAO CCRF under Article 11.1 – Responsible fish utilization (FAO, 1998a), which places an emphasis on loss reduction. The most obvious means of increasing supply of fish, even without increased landings, is by reducing post-harvest losses of what is presently caught. Yet, a rational use of already scarce development

<sup>1</sup> Securing sustainable small-scale fisheries: Bringing together responsible fisheries and social development, Bangkok, Thailand, 13–17 October 2008.

resources, and planning and implementation of effective loss reduction strategies, require that losses are thoroughly assessed and attention is given to reducing those that are significant.

Fish is an extremely perishable food commodity. No other food provides so much observed evidence of serious loss from harvest to consumption and so little documentation of the overall proportion of losses from fish production (ECA, 1984). Accurate assessment of post-harvest loss of fish in developing countries is an important challenge, which is made difficult by the fact that much of the artisanal catch is unrecorded and that fishermen may or may not be licensed. Additionally, it passes through many hands on its way from harvest to consumption.

It has been estimated that 10 percent by weight of world fish catch is lost by poor handling, processing, storage and distribution. However, losses in small-scale fish processing are said to be particularly high and figures as high as 40 percent are sometimes reported (FAO, 1984; Mills, 1979; Moes, 1980). In sub-Saharan Africa, recent investigations suggest that losses may be only around 5 percent of the total artisanal productions (FAO, 1996) while other studies put the figure for the West African Region at between 10 and 20 percent (McConnery, 1994). The dispersed nature of many small-scale and less developed fishing operations makes it difficult to make definitive estimates of post-harvest losses, but it is thought that in some developing country situations it could be as much as 25 percent of fish caught (FAO, 1998a).

However, while post-harvest fish losses occur all over the world in all fisheries from point of production to final sale to the consumer, even in more structured fisheries (industrial sector) the type of loss can vary. Three types of losses have been defined in Ward and Jeffries (2000): physical, quality and market force. Whereas physical losses are defined as fish that is thrown away (accidentally, voluntarily or as authorized) or eaten by insects, birds or animals, quality losses are associated with changes due to spoilage or physical damage but the fish is still sold, often for a low price. Market force loss refers to a loss induced/led by market changes or developments, where fish operators have to sell their product (even of good quality) at a price below their expectations. All three types of losses have financial implications (loss in revenue of the fish operator, macroeconomic impact at country level), in addition to the aspect of resource/fish as food wastage. Different approaches are also necessary to address different losses which can have complex causes.

Much of the early data on post-harvest fish losses, especially loss levels, had been derived from limited and unsystematic observations and studies. In many cases the way the data were collected and interpreted is not clear, and neither is the type of loss being described. Poulter *et al.* (1988) noted that very few quantitative studies of actual losses had been undertaken and much of the available data, therefore, was based on qualitative estimates sometimes involving rather massive extrapolation from single landing sites to whole countries, even regions.

A reason for this situation was the lack of a practical method or tools for assessing fish losses. The development of a method was complicated because

many fisheries, particularly tropical fisheries, are multispecies and catches lack uniformity in terms of composition, weight and shape. Spoilage rates under different conditions for different fish occur and fish enters complex distribution systems involving many stakeholders. Furthermore, often non-standardized units of measurement are used in landing sites and markets for trading and pricing purposes.

In 1990, FAO organized a symposium on post-harvest fish technology in Cairo. A paper on “The kinds and levels of post-harvest losses in African inland fisheries”, commissioned by the former Fish Utilization and Marketing Service (FIU) and now the Products, Trade and Marketing Service (FIPM), was the first to identify different types of post-harvest losses: material losses, value losses and nutritional losses (Ames, 1992). Before then, most work as mentioned by Poulter *et al.* (1988) referred to losses without identifying what was meant by “losses” and, willingly or not, suggested that all losses were either physical or material. An overview of physical losses of cured fish in the tropics is presented in Annex 1.

The Strategy for International Fisheries Research meeting in Paris in 1991 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. As a result, the Natural Resources Institute of the United Kingdom of Great Britain and Northern Ireland embarked upon a project in 1992, funded by the Overseas Development Administration, in the United Republic of Tanzania to develop loss assessment methodologies. Ward (1996) reported that three fish loss assessment tools were developed between 1993 and 1996 in collaboration with the United Republic of Tanzania Fisheries Division and a draft manual for assessing post-harvest fisheries losses through the informal and questionnaire methodologies was prepared. The results of the work were presented at the Sixth FAO Expert Consultation on Fish Technology in Africa (FAO, 1998b), which recommended that the methodologies should be validated, documented and widely disseminated.

Following this, the Department for International Development (DFID), through its Post-harvest Fisheries Research Programme (PHFRP) and in conjunction with the European Union-funded West Africa Regional Programme (1994 to 1999) on “Improvement of post-harvest utilization of artisanal fish catches” implemented by the West African Association for the Development of Artisanal Fisheries, agreed to support validation of the methods and development of loss assessment tools in four countries in West Africa.

The field-based methods were used to assess losses in:

- Côte d’Ivoire: with fishermen and fish processors at the Chicago wholesale market in Abidjan;
- Ghana: with women fish smoker groups;
- Senegal: with the Collectif National des Pêcheurs du Sénégal in Mbour; and
- Nigeria: with economic operators in Dorobaga and Maiduguri fish markets, in collaboration with Tedak Fishermen’s Co-operative Society of Nigeria.



This work, evaluated by FAO (Teutscher, 1999), led to the development of “A manual for assessing post-harvest fisheries losses” (Ward and Jeffries, 2000), a fish-loss computer-based model, and a database of information on losses from secondary and primary sources.

The FAO/DFID Sustainable Fisheries Livelihoods Programme (SFLP) in West Africa has supported community initiatives and pilot projects across 25 West African countries. The SFLP Post-harvest Livelihoods Pilot Project (PP3) aimed to bring visible sustainable social and economic benefits to the most vulnerable communities of the artisanal post-harvest fisheries sector. In November 2004, the SFLP began capacity development of regional stakeholders from Cameroon, Chad, the Gambia and Senegal in loss assessment and loss reduction based on the PHFRP loss assessment manual (Ward, 2007).

In 2006, FAO’s FIU (now FIPM) designed a regional PHLA programme to:

- develop a core of regional expertise in fish loss assessment;
- generate fish loss data in fisheries of socio-economic importance;
- produce practical guides for fish loss assessment for extension officers and the fishery operators;
- update the Ward and Jeffries (2000) manual; and
- provide normative guidance to support the implementation of the CCRF.

The regional programme began in October 2006 and lasted 18 months. It aimed to build on the past initiatives and to develop tools for practical loss assessment in artisanal fisheries. The programme provided training in qualitative and quantitative fish loss assessments methods, planned support, and supervised the implementation of loss assessment studies. The list of participants throughout the duration of the programme is presented in Annex 2.

This document presents data generated by the loss assessments of the PHLA in five sub-Saharan African countries, the lessons learned and key achievements. It is intended to support technical, policy and loss reduction planning processes and promote further interest by development agencies in loss assessment and reduction work. It will also contribute to the implementation of the CCRF. It also brings into focus the contribution of African fisheries to food security, the role of post-harvest in the livelihoods of many millions of stakeholders, poverty reduction and economic development of the continent.

This technical paper is directed towards people who are interested in the development of post-harvest fisheries and the food security of people in developing nations. For example, it is important for extension officers to be able to identify where fish losses occur, and be able to advise fishery operators and help implement loss reduction initiatives. Policy-makers and planners would benefit from being better informed regarding post-harvest loss reduction and contribution of fisheries to the alleviation of malnutrition and to national food self-sufficiency in coastal communities. It will also enable them to evolve appropriate policies to support small-scale fisheries’ loss assessment initiatives and intervention programmes.