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POST-HARVEST LOSSES IN THE FISH VALUE CHAIN: TYPES, CAUSES AND METHOD OF ASSESSMENT

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Fish is a highly perishable commodity among the food commodities. Fish has evidence of serious loss from harvest to consumption but there was little documentation on the overall proportion of losses from fish. Assessment of post-harvest losses (PHL) in fish is a crucial challenge in developing countries. The fish supply chain involves many functionaries through them the fish is passed on from one stage to another stage. According to FAO, 1984, it has been estimated that almost 10 per cent of world fish catch in terms of weight is lost by poor handling and processing. In general, one-third of all the food produced for human consumption in the world is lost or wasted (1.3 billion tons.) The objective of the post-harvest loss assessment in fish is mainly on determining the type of losses and measurement of the amount and extent of losses. PHL in fisheries is important as fish is considered the cheapest animal protein for the consumers which put restrictions in terms of food security and income loss on the actors of the fish supply chain. Post-harvest loss of fish is high than chicken and meat. Reduction of post-harvest losses is a vital development goal in the view of sustainable fisheries development. Under the Sustainable Development Goals (SDGs) it was recommended to 'by 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses (Target 12.3).

Post-harvest loss in fish

Loss is defined as a reduction in the weight of edible products available for consumption. It is a measurable reduction in foodstuffs and may affect either quantity or quality" (Tyler and Gilman, 1979). The major proportion of loss is due to quality and economic losses than quantitative losses. Post-harvest fish losses are often caused by biochemical and microbiological spoilage changes that occur in fish after death. PHL refers to measurable quantitative and qualitative food loss in the post-harvest system. It is defined as the loss from various stages of harvesting to the stage of consumption resulting from qualitative loss, quantitative loss and the food waste. FAO has estimated that post-harvest losses in developing countries vary up to 50% of domestic fish production. Globally, 35% of fish and

seafood losses occurred every year which includes 8% of fish harvested being thrown back into the sea.

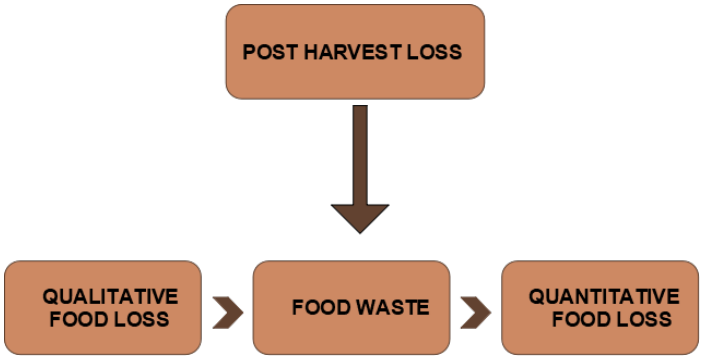


Fig. 1 Components of post-harvest loss

Types of post-harvest losses in fish

Post-harvest losses may occur in quantitative or qualitative terms, otherwise, it may be direct or indirect losses. Quality losses include those that affect the nutrient/caloric composition, the acceptability, and the edibility of a given product. These losses are generally more common in developed countries (Kader, 2002). Quantity losses refer to those that result in the loss of the amount of a product. Loss of quantity is more common in developing countries (Kitinoja and Gorny, 2010)Post-harvest losses are associated with loss of income, loss of quality, quantity of fish loss, loss of food, food insecurity and loss of nutritional value. According to Ward and Jefferies (2000), losses can be assessed by physical, quality and market force.

Physical losses: Physical loss is defined as fishes that are thrown away or eaten by insects, birds or animals. It is expressed in terms of losses in weight and/or monetary value.

Quality losses: Quality losses are associated with changes due to spoilage or physical damage but the fish is still sold, often for a low price. It is usually expressed in monetary terms.

Market force losses: Market force losses are the loss induced by market changes, in which fishermen are forced to sell their products at a price below their expectations.

At later times, apart from three losses, nutritional loss was also included under the post-harvest loss assessment.

Nutritional loss: Nutritional loss refers to specific changes in the nutritional content or properties of fish as a result of spoilage or processing.

Besides food wastage, all types of losses have certain financial implications in terms of resource sustainability and economic development.

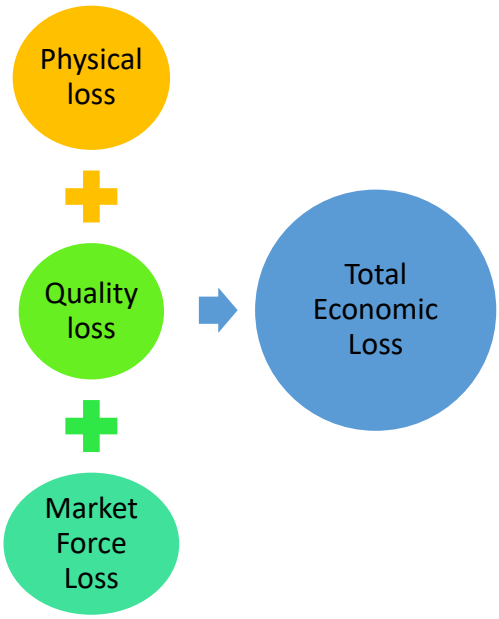


Fig. 2. Total Economic Loss

Total Economic Loss (TEL) is the summation of economic loss at landing centre, processing and marketing nodes (FAO, 2011; FAO 2018 & Torell et al., 2020). T

Causes of post-harvest losses in fish

The post-harvest losses may occur both in terms of quantity and quality due to discards at sea, improper handling, storage and icing, lack of cold chain facilities and delay in transportation. The post-harvest losses at various sta

ges of fish supply chain are presented in table1.

Table. 1. Causes of post-harvest fish losses

Stages	Causes	Type of loss
During fishing	Destructive/harmful methods of fishing resulted in inferior quality of fish	Physical, Quality
	Falling from the net and discarded as by-catch	Physical
	Setting fishing gear for long periods	Physical, quality
Handling fish onboard	Delay returning to landing centre after fishing and high temperature at sea	Physical, Quality
	Failure to wash and chill the fish onboard	Quality
During unloading	Poor hygiene practices causing contamination of fish	Quality
	Fish falling from basket/ crate to the floor	Physical

	Delayed bargaining at the first point of sale	Quality
	Theft at landing site during offloading of fish	Physical
Fresh fish marketing	Inadequate application of ice and no insulated container is used	Physical, Quality
	Limited preservation capacity during bumper catches	Physical, Quality
	Lack of marketing information	Physical, quality, market
	Delay in purchasing fish by traders	Quality
During processing and packaging	Processing of already spoiled / poor quality fish	Physical, quality
	Processing fish under unhygienic conditions	Physical, quality
	Inadequate control of heat intensity during smoking leads to over smoking of fish and possible burning	Physical, quality
	Drying fish under unsupervised places – on ground, rocks or herbs	Physical, quality
	Damage due to inadequate packaging method and materials	Physical, quality
	Oxidation of fatty acids leading to rancidity	Quality
During storage	Microbial growth causes spoilage	Quality
	Insect infestation	Physical, quality
	Discoloration due to chemical changes	Quality
	Inadequate storage facilities	Physical, quality
During Distribution	Delays due to problems with transport vehicles and inaccessible to production areas	Physical, quality
	Fish damage during transportation	Physical
During Marketing	Delay in selling	Quality
	Inadequate cold storage facilities and lack of ice	Physical, quality
	Delay in supplying to markets	Market
	Poor purchasing power of consumers	Market

Source: Torell et al. (2020)

Approaches to fish loss assessment

The estimate of post-harvest loss follows either a micro or macro approach depending on the objective and scope of the assessment (FAO, 2016).

Micro approach:

Micro approach estimates the fish loss for a particular single value chain usually located in limited geographical areas, based on direct physical measurements, observations or questionnaires to collect information directly from the actors of the fish value chain.

Macro approach:

Macro approach provides an estimate of the physical loss of the whole fishery sector at the national, regional, or global level using generally of secondary data from various sources.

Fish loss assessment methods (FLAMs)

In general, fish loss assessment methods are carried out by FAO methodology which includes the Informal Fish Loss Assessment Method (IFLAM), Load Tracking (LT) and the Questionnaire Loss Assessment Method (QLAM).

Informal Fish Loss Assessment Method (IFLAM)

IFLAM is also known as the exploratory loss assessment method. It is a rapid method used for loss assessment based on the Rapid and Participatory Rural Appraisal approach including checklists and group discussions to identify the hotspots. It provides qualitative and indicative quantitative data on various issues related to losses.

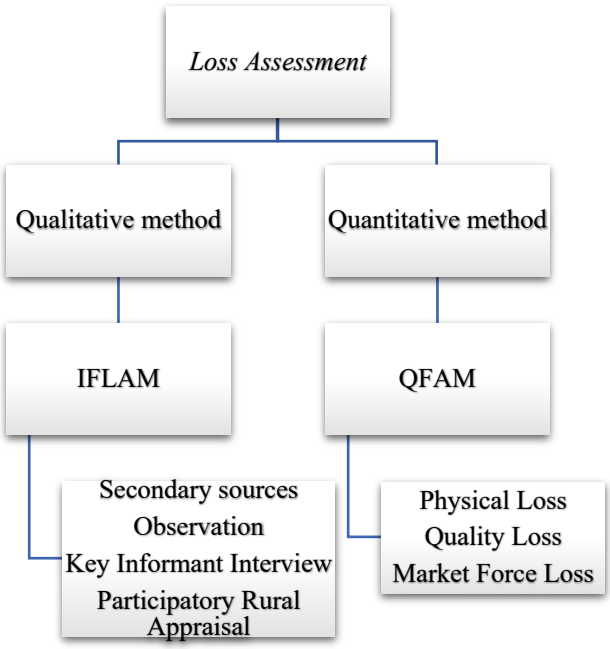


Fig. 2. Fish Loss Assessment Method (FLAM) - FAO

Load Tracking (LT)

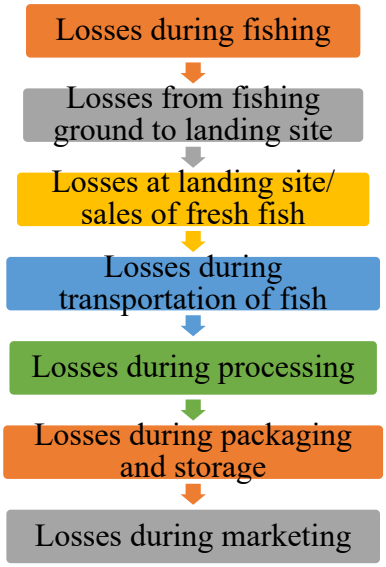
LT is an experimental method that produces statistically valid results for the calculation of loss between stages in a distribution chain involving the loads at different stages. This method is most robust because of the experimental and replicable nature of the procedure.

Questionnaire Loss Assessment Method (QLAM)

QLAM is a formal survey-based method that provides quantitative data on issues such as types of loss, reasons for the loss, frequency of loss, and variables that affect the loss. This analysis of survey data provides quantitative information, which can be used to validate the IFLAM and LT methods.

Under the QLAM method, the three losses in fish value chain will be assessed viz., physical loss, quality loss and market force loss.

The methodology uses both qualitative and quantitative survey methods which is the basis of the economic method/ approach. Loss assessment can be carried out at various stages and /or nodes of fish supply chain.



Source: FAO, 2011

Fig. 3 Stages in post-harvest loss in the fish supply chain

Strategies to reduce the post-harvest losses

Post-harvest losses can be effectively reduced by providing the proper infrastructure needed at various stages of fishing activities and regional-specific interventions are required to tackle the problem. The safety, quality assurance, and value addition need to be strengthened to reduce the PHFL. A sustainable loss reduction methodology incorporating capacity building of functionaries involved in the fish value chain is essential for an inclusive fisheries development.

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