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Assessment of harvest and post-harvest losses in Fisheries

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Introduction

Fisheries provides livelihood for millions of people and valuable foreign exchange earnings to many countries. In India, the gross revenue at the point of first sales was estimated as Rs.20000 crores (ICAR, 2011) whereas at the point of last sales it was more than Rs.28000 crores. The current volume of marine product exports from India (2012-13) stand at 9.28 lakh tonnes valued at 3512 US million dollars.

Fish, requires proper handling, processing and distribution if it is to be utilized in a cost effective and efficient way. Unlike agricultural commodities, fish reaches the end consumer through a chain of distributors and the highly perishable nature of the commodity leads to appreciable loss due to various reasons at each stage. Losses occur in marine fisheries due to discards in good condition and spoilage makes it unavailable and unacceptable for human consumption. Global demand for fish is growing and reduction in post-harvest losses can make a major contribution to satisfying this demand, improving quality and quantity for consumers and increasing income for producers.

Losses in Marine Fisheries

There can be many definitions of losses. In the present context of this lecture, quantity of fish not suitable for human consumption due to physical loss or spoilage or some other reason is taken as loss. There are mainly two kinds of losses -harvest and post harvest losses. Harvest losses occur onboard the fishing crafts mainly in the form of discards of juveniles and low value fish and post harvest losses occur due to improper handling and lack of infrastructure at different points starting from the landing centre to the consumer. Apart from these, there are latent losses such as realization of low value due to glut, multi-day fishing etc.

Discarding takes place because, in the course of fishing, many species other than the target species are often caught. This by-catch is usually discarded at sea unless it is worth keeping..Discarding by-catch consisting of a small proportion of mature specimens from healthy stocks causes relatively little damage, but when it consists of juveniles of commercial species it will disturb the balance of the sytem. Catching large numbers of juveniles is likely to reduce the future number of mature fish. This will have a direct impact on the fishery taking the by-catch, or on other fisheries if the juveniles belong to their target species.

Apart from the loss of a massive amount of potentially valuable food, the incidental capture of dolphins in tuna purse seine nets, turtles in shrimp trawls and marine mammals, birds, turtles and fish in high-seas squid driftnets has led to widespread public concern. Unfortunately, by-catches are an inevitable consequence of an industry that depends upon the capture of species that live alongside other creatures in an opaque medium and as a result can seldom be directly observed and targeted.

By-catch arises primarily because of fishing gears and adopting practices which do not selectively target the desired size and species. The reason for discarding part of the catch is generally economic. In such cases the cost of bringing fish to market is greater than its market value and it gets dumped at sea. Similarly, where a fishing vessel has limited holding capacity, low-value species are discarded in favour of the high-value ones.

Introduction of improved harvesting methods, starting from mechanisation, indiscriminte increase in fleet size and number, multi-day fishing, use of unregulated mesh sizes have all led to imbalance in several forms and threatening of food security. In tropical countries, high temperatures lead to fish spoilage while still in the boat, at landing, during storage or processing, on the way to market and while waiting to be sold. There is also considerable economic loss as value gets lost because of lower quality, including insect infestation and breakage.

An assessment of the quantity lost due to harvest and post-harvest activities will help devise ways for maximum utilization at each stage of the chain of distribution of fish. Also it is essential to have an estimate of the actual economic loss that has occurred. Seasonal employment of different gears for fishing, duration of the fishing trip and glut also plays an important role in determining the price of the catch. Therefore an economic evaluation of the latent losses occurring due to harvest activities will be of interest.

REVIEW OF LITERATURE

Several studies have been conducted in the recent past for the assessment of extent of harvest and post-harvest losses in fisheries. As early as 1981 FAO recommended action to reduce post harvest losses in marine fisheries- estimated at that time to be 10 percent of the global total, and up to 40 percent in some developing countries.

Studies were conducted at CIFT, Cochin on 'Assessment of harvest and post-harvest losses in fisheries' through a NATP funded project . The percentage loss due to harvest through traditional, motorized, mechanized and large trawlers has been put at 4.13, 3.61, 14.48 and 21.41 respectively within the craft/gear (Anon., 2005). The study has also assessed post-

harvest losses in fisheries in different channels viz., market, pre-processing and processing and reported the percentage loss through each of these channels.

Raju (2010) has reported landing and discards at sea from ten coastal states of India including illegal and unreported landings. Kumolu-Johnson and Ndimela (2011) argue that losses can be physical, economical and nutritional and advocates suitable post-harvest technology for minimization of losses.

Ahmed (2008) has assessed post-harvest losses of fish in Sudan with special emphasis on cultural and socioeconomic aspects including traditional food conservation; economic factors for food conservation and cost-benefit; assessment of the effect of globalization and liberalization of food markets and the fish trade in artisanal fisheries.

Cawthorn, *et. al.* (2000) estimated post-harvest losses In North America at 10-15%, representing an economic impact of US $50-75 million annually. Ward, A. (1996) developed methods to quantitatively assess post harvest fish losses and to understand and identify the causes in qualitative sense. Adams, (1995) advocates Individual Fishing Quota (IFQ) system where fishermen can be selective about factors as fishing depth, bottom substrate, or time of day, month or year. These factors are directly related to incidental halibut by catch mortality.

Clucas, *et. al.* (1989) reported 20% post harvest losses of annual fish production of about 13.5 lakh tonnes by 16 ECOWAS countries of West Africa. Similar figures were observed in the artisanal fisheries sector that contributes about 90% of the total catch.

Estimation of losses in fisheries

A recent study completed at CIFT, Cochin attempted to estimate harvest and post-harvest losses in marine fisheries. Ernakulam and Alleppey districts were covered for the study. The estimation was carried out at the two stages harvest and post-harvest stages using stratified random sampling design. The channels of fish production namely mechanised, motorised and traditional formed the various strata at the harvest stage, In the post havest stage, losses occurring at landing centre, processing, marketing and transportation sectors were observed. The study was conducted for a full fishing season to observe loss pattern during monsoon, pre-monsoon and post-monsoon seasons. Around 1 to 3% sampling was done in the harvest stage whereas for the post-harvest study, the samping done was from 10 to 30% for the various channels.

In the processing channel, the pre-processing centres and fish processing centres in Ernakulam and Alleppey district were covered by using of a sample. The losses occurring in marketing sector was studied in the wholesale markets, retail markets, roadside markets were covered for the study. The dryfish production and marketing channel was also studied by means of a sample for recording losses occurring in the dryfish sector. The estimates were computed using methodology derived by IASRI for loss estimation (Anon., 2005).

Harvest losses in marine fisheries was estimated from Ernakulam district by stratifying fishing crafts into mechanized, motorized and traditional. Primary data on fish catch and losses was collected for 12 months from fishing crafts operating in six selected fish landing centres at Ernakulam. Loss estimates were computed analyzing the season wise data and pooled data. The sector wise harvest loss estimates are as under :

Table 1: Harvest losses in marine fisheries

Sector	Pre-monsoon (%)	Post-monsoon (%)	Monsoon (%)	Overall (%)
Traditional	1.93 (0.43)	0.98 (0.37)	0.83 (0.28)	1.14 (0.28)
Motorised	3.45 (0.54)	2.76 (0.13)	4.38 (0.53)	3.65 (0.17)
Mechanised (upto 7 days fishing duration)	12.74 (1.23)	11.09 (0.11)	9.11 (0.05)	14.15 (2.10)
Mechanised (more than 7 days)	13.78 (1.24)	14.98 (1.35)	13.35 (1.32)	18.73 (2.22)

Multiday fishing by the mechanized trawlers reported maximum loss due to capture of juveniles and their discards. Around 1500 to 2750 kg of fish gets discarded at sea by trawlers during fishing trips for more than 7 days duration. The no. of hauls during fishing and loss was positively correlated (0.69) at 5% level of significance. The estimate of loss due to mechanized fishing was computed by utilizing information on no. of hauls which was more precise than the traditional estimator. The losses due to motorized fishing crafts was very less in comparison with trawlers. The traditional fisheries sector reported minimal or no loss during the period.

Post-harvest losses

Table 1: The post-harvest losses in marine fisheries (at the landing centre level) was estimated as below :

Sector	Loss % (SE)
Traditional	0.09 (0.0004)
Motorised	1.19 (0.07)
Mechanised	4.79 (1.09)

The loss estimates when compared with the estimates brought out by earlier studies indicate that the post-harvest losses have come down due to efficient handling of catch. The post-harvest losses in processing and marketing sector was also computed from Ernakulam-Alleppey during the period under report. For reporting loss in processing sector, 50 pre-processing units and 25 processing units were observed and data on raw material processed and loss were recorded fortnigh tly. Shortage of ice and spoilage were cited as the reasons for loss in pre-processing. At the processing stage, losses occurred due to discolouration, broken tentacles, black spot and at time loss during glazing. Few units reported rejections at export destination due to heavy metal detection.

Losses in the marketing sector was due to damage during transportation, spoilage when delay in transport and weather. Two wholesale markets for fresh fish and one wholesale market for dry fish were covered fortnightly for recording losses due to marketing. Similarly 4 retail markets were surveyed fortnightly of reporting loss in retailing fish. The estimates for post-harvest losses due in processing and marketing are given below :

Table 3 : Post-harvest losses in marine fisheries

Sector	Loss % (SE)
Pre-processing	0.38 (0.04)
Processing	1.19 (0.07)
Dry fish production	36.97 (12.88)
Wholesale market (fresh)	3.79 (1.09)
Wholesale market (Dry)	7.56 (2.12)
Retail market (fresh)	3.13 (0.02)
Retail market (Dry)	8.23 (0.13)
Roadside market (fresh)	2.54 (0.11)
Roadside market (dry)	5.43 (1.19)

The reasons for losses were also recorded along with the loss details. Harvest losses were mainly due to :

i) Fish fall from net
ii)Bruising due to handling
iii) Fish spends too long in the net and gets spoiled
iv) Lack of ice / Chilling causing spoilage

Post-harvest losses

At landing centre

i) While loading for transport
ii) Kept in the beach without sufficient ice

Processing level

i) Low capacity of the plant to process
ii) Adverse weather conditions (drying)
iii) Insect infestation

Transport

i) Mechanical damage
ii) Delay in transport

Storage

i) Poor storage
ii) Insect infestation

Market level

i) Insect infestation
ii) Packaging
iii) Mode of transport
iv) Handling

Conclusion

A look at the loss estimates reveal that the fish loss in the mechanised fishing sector is more compared to the other sectors. Multi-day fishing leads to larger volume of discards at sea which has inflated the estimates. Use of stipulated mesh sizes to avoid junenile fishing, use of by-catch reduction devices, utilisation of low value fishes for innovative product development and waste utilisation for production of fish based feed and manure will help reduction in havest and post-harvest losses in fisheries. Training and awareness programmes on the responsible fishing methods developed by CIFT among the mechaniused fishermen will check discards at sea. Under NAIP value chain project at CIFT, Cochin a number of innovative technologies for value addition from low value fishes were developed and demonstrated as viable business models for adoption by coastal fisherwomen. Popularisation of these technologies along the coastal belt will enhance the income and livelihood of the fiaherfolk.

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