POST-HARVEST QUALITY LOSS OF SMALL INDIGENOUS FISH SPECIES IN SYLHET REGION: ENSURE QUALITY UP TO CONSUMER LEVEL

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Abstract

The present study was designed to investigate the post-harvest quality loss of locally captured Small Indigenous Species (SIS) based on existing marketing system in Sylhet region. A total of 20 fish harvesters, 30 fish handlers (involve in sorting, loading and unloading, transporting, receiving at market), 10 depot owners, 10 auctioneers, 5 aratders was interviewed and 10 markets were visited to collect data about post-harvest activities and marketing of SIS from some areas of Sylhet and Sunamgonj district from July 2015 to December 2015. At harvesting places (100%) fish were the best quality (defect point <2). Fish sold in early market (7am – 9 am) were also acceptable (defect point <2 to <3) in terms of quality. After harvesting rough handling (15%), compactness (3%), delay icing (10%), no icing (45%), marketing process (15%) and transportation (7%) lead to loss of a major proportion of total quality. On the basis of defect point average freshness quality of SIS were found <2 at harvesting places, <2 to <3 in landing center, during sorting, <2 to <3 during transportation and <2 to< 4 at market which were results from different activities associated with SIS handling and marketing.

Key words: Small indigenous species (SIS), Post-harvest quality loss, Quality, Ice, Defect point

Introduction

In Bangladesh, fisheries sector contributes an important role in socio-economic cultural setting, rural employment and food security. About 60% of the animal protein intake in Bangladesh comes from fish. The average per-capita consumption of fish in Bangladesh is between 20 and 25 kg, while the world average is 13 kg (DoF 2012). In terms of inland captured fishery, Sylhet region is one of the richest areas of fish production. In this region, fishes are captured from different resources, such as haors, beels, rivers and flood plains etc. Fishes play an important role to meet up the protein demand of this area and also contribute to the economy of the country. Among the captured fishes, small indigenous species (SIS), which grows to a size of 25 cm (Hossain and Afroze 1991) takes important part of the total catch. These small indigenous fish species are demandable fish item for their taste. In terms of economic and nutritional aspects these SIS are good resources of protein to low income group people. On the other hand, SIS

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has high nutritive value in terms of protein, vitamins, and minerals (Thilsted *et al*. 1997). After harvested in large quantity from the haor area SIS are sold in the local and other markets. Quality of the harvested SIS fishes landed for consumption is lost during harvesting and post-harvest handling (Hossain *et al*. 2012) due to ignorance and/or negligence of the people during harvest, distribution, processing and trade (Nowsad 2004), preservation methods, transportation methods, availability of ice during transportation and selling period etc. All the activities related to the loss of quality also result in serious economic loss of fishermen, middlemen, fish traders and finally consumers. The current study was designed to investigate the quantitative and qualitative changes of small indigenous fishes after harvesting, in different stages of marketing, as well as to evaluate the present status of SIS harvesting, handling, processing, preservation and marketing related to quality of fish and to recommend some appropriate means to maintain quality of SIS/fish.

Materials and Methods

The study was conducted in two districts namely Sylhet and Sunamgonj, where Sylhet Sadar and Sunamgonj Sadar, the main survey areas in respect of adjacent landing sites, local fish markets were taken under investigation. Data were mainly collected from the fishermen, fish harvester, fish handler and fish traders on the basis of questionnaired interview. Direct observation of landing center, marketing channel, distribution, icing facilities, distance from the landing center, and handling were taken under consideration. The middlemen, aratdars, wholesalers involved in supply, distribution and marketing of fish were selected from whole-sale market (Arot) and retail market for the study. The data were collected over six months from July to December, 2015. The entire situation of the distribution channel of fish including SIS (Hossain *et al*. 2012) from haor to retailer level was also studied.

Assessment of post- harvest quality loss of SIS in different stages of harvesting, marketing and distribution channel was done according to the modified method of (Nowsad 2010). The method was based on Fish Loss Assessment and Control Tool originally developed by Torry Research Institute, UK (Sakaguchi 1994). To assess the quality of harvested SIS at different stages of distribution channel, at first sensory defect point with numerical scores employed in a sensory analysis was done by using Table 1 (modified based on Howgate *et al*.1992). General grading of fish obtained through the analysis of defect points (DP) is presented in Table 2.

Table 1. Attributes and defect points for quality assessment of wet fish.

Attributes	Defect	Defect points	Grade
1. Odour of neck when broken	a) Natural odour b) Faint or sour odour	1 5	Acceptable Reject
2. Odour of gills	a) Natural odour b) Faint sour odour c) Slight moderate sour odour d) Moderate to strong sour odour	1 2 3 5	Excellent Good Acceptable Reject
3. Colour of gills	a) Slight pinkish red b) Pinkish red to brownish c) Brown or grey d) Bleached colour, thick yellow slime	1 2 3 5	Excellent Good Acceptable Reject
4. General appearance	a) Full bloom, bright, shining, iridescent b) Slight dullness and loss of bloom c) Definite dullness and loss of bloom d) Reddish lateral line, dull, no bloom	1 2 3 5	Excellent Good Acceptable Reject
5. Slime	a) Usually clear, transparent and uniformly spread b) Becoming turbid, opaque and milky c) Thick sticky, yellowish or green colour	1 2 5	Excellent Good Reject
6. Eye	a) Bulging with protruding lens, transparent eye cap b) Slight cloudy of lens and sunken c) Dull, sunken, cloudy d) Sunken eyes covered with yellow slime	1 2 3 5	Excellent Good Acceptable Reject
7. Consistency of flesh	a) Firm and elastic b) Moderately soft and some loss of elasticity c) Some softening d) Limp and flabby	1 2 3 5	Excellent Good Acceptable Reject

Table 2. Grading of fish on the basis of the defect points.

Grade	Average DP	Comments
a	< 2	Excellent/highly acceptable
b	2 to < 3	Good/acceptable
c	3 to < 4	Poor/can be accepted with care
d	4 to 5	Bad/should be rejected

Results and Discussion

Most of the harvested fishes were excellent in quality during harvesting. Fresh SIS (Table 3) were available in all markets depending on proper handling, preservation, distance from harvesting areas and communication status of the harvested area. The small freshwater fishes are more susceptible to spoilage due to their comparative small size and vulnerability of constituent proteins and lipids (Nowsad 2004). Since the quality loss of

fish was not understood at least up to 50% of deterioration by common organoleptic means (Sakaguchi 1990), consumers generally took it without any complain on quality. Different activities related to quality loss of SIS are presented in Table 4. Quality loss of SIS at different stages of marketing is shown in Fig. 1.

Table 3. Some SISs which are normally found in Sylhet region.

Scientific name	Bangla name	Fishbase name
Ailia coila	Kajuli,Baspata	Ganjeti cailia
Amblypharyngodon mola	Mola, Moa	Mola carplet
Anabas testudineus	Koi	Climbing perch
Botia dario	Bou, Rani	Bengal loach
Chanda nama	Namachanda	Elongate glass-perchlet
Chanda ranga	Chanda	Indian glassy fish
Channa punctatus	Taki	Spotted snakehead
Clarias batrachus	Magur	Walking catfish
Colisa fasciata	Khalisa	Banded gourami
Corica soborna	Kachki	Ganges river sprat
Esomus danricus	Darkina	Flying barb
Glossogobius giuris	Bele	Tank goby
Gudusia chapra	Chapila	Indian rivershad
Heteropneustes fossilis	Shingi	Stinging catfish
Lepidocephalus guntea	Gutum	Guntea loach
Macrognathus aculeatus	Tara Baim	Lesser spiny eel
Mastacembelus pancalus	Guchi	Barred spiny eel
Mystus tengara	Buzuri Tengra	Pyjama catfish
Mystus vittatus	Tengra	Striped dwarf catfish
Nandus nandus	Meni	Gangetic leaffish
Notopterus notopterus	Pholi	Bronze featherback
Ompok pabda	Pabda	Pabdah catfish
Puntius sophore	Jatpunti	Pool barb
Puntius ticto	Tit Punti	Ticto barb
Osteobrama cotio	Dhela	-
Salmostoma bacaila	Chela	Large razorbelly minnow
Xenentodon cancila	Kakila	Freshwater garfish

Harvesting methods had an important role in quality assessment of fish. For selling the fish in the morning markets most of the harvesting operation started at about 4.30 am to 5 am. Fishes which were marketed within one or two hours after harvesting were found to be excellent and fishermen got more prices. Traditional system with mass catch made the small fishes much vulnerable to organoleptic changes shortly after death resulting reduction of price of the fishes. Fixed net were generally used to harvest SIS of fishes from shallow water. In the summer season especially in day time water became hot ultimately affecting the freshness and spoilage rate of the SIS. Hot water temperatures rapidly enhanced the spoilage rate of fish that were accumulated in the net. Nowsad *et al.* (2010) also reported that fishes were hardly washed with clean water immediately after

Causes of quality loss	Stages of quality loss	Rigor condition

Natural Water body (Haor, beel etc)

Fresh fish/ Starting of

- Larger catch
- Delay hauling
- Mixing of fresh and early harvested damaged fish
- No icing facilities

Harvesting

Early Pre-rigor state

- Organic waste
- Decomposed fish
- Exposed to sun light
- Mishandling

Landing center

- Long time sorting
- Poor icing facilities
- Inadequate washing
- Sorting on dirty soil
- Lack of icing

Sorting

Mid Pre-rigor

- Long distance
- Bamboo baskets
- Dirty plastic box
- Compactness of fishes
- Miss handling

Transport

Late Pre-rigor state

- Longer selling period
- Rough handling
- Poor icing
- Dirty equipment's
- Poor preservation
- Inadequate icing
- Delay of icing
- Delay auctioning

Main market/

Transport to local market

In Rigor state
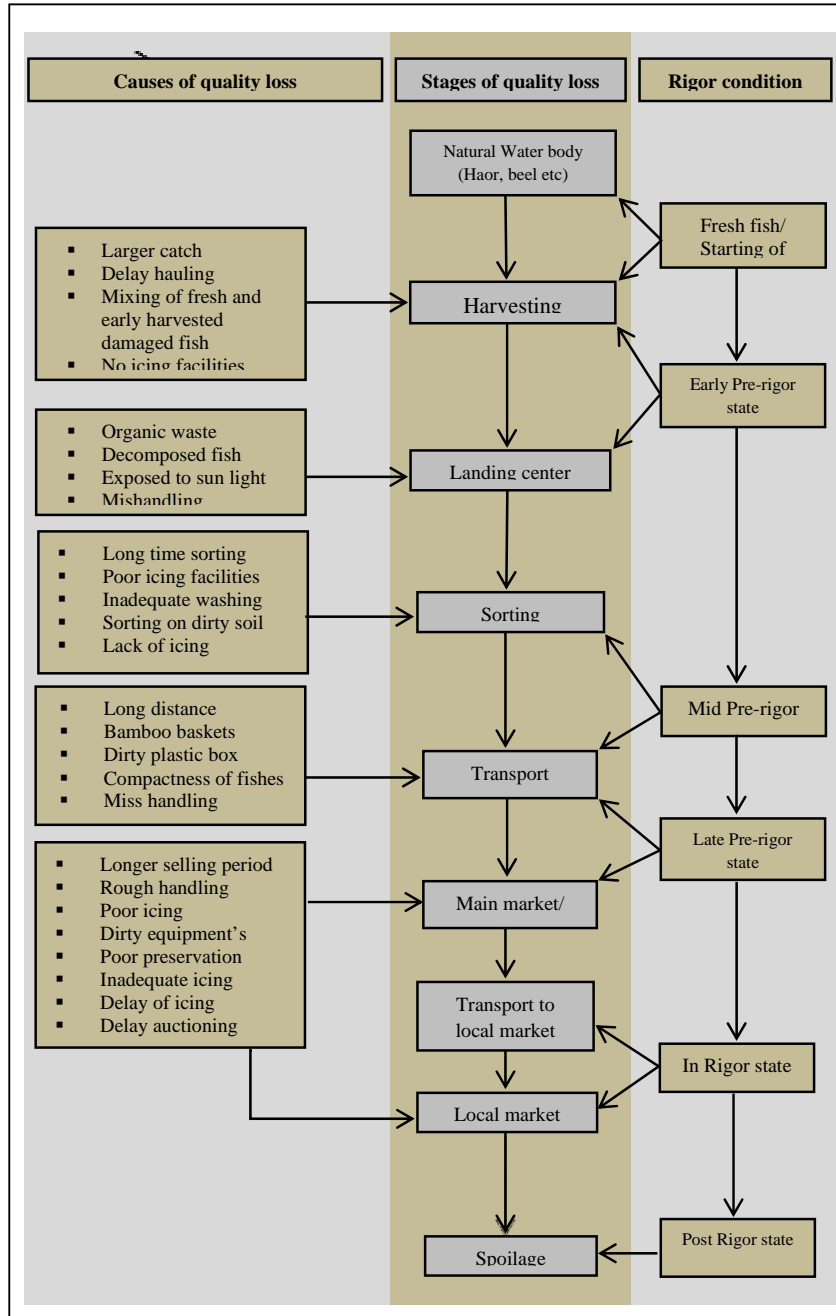
Local market

Spoilage

Post Rigor state

Fig.1. Flow chart of quality loss of SIS at different stages of marketing.

harvest. Sometimes engine oil of boat mixed with fish are preserved without ice. There was no icing facility for the harvested fish.

Boats were unloaded for first auctioning and also for sorting of mixed SIS catch even with large fishes. Sometimes bank near harvesting place was used as first landing and auctioning place. Generally local fishermen were associated with the unloading of the harvested fish. They hurried during unloading the boat. Smaller fishes especially SIS are more susceptible to physical damage if rough handling is done. Workers were found standing on the fish mass when unloaded. These bad practices created pressure on the top to lower part of the harvested fishes. Traditional bamboo made baskets and plastic boxes are used to unload fish from boat. In some cases human waste, duck waste, cow dung, dead animal body and other organic debris were observed where boats were unloaded. If organic debris was mixed with the catch accidentally or intentionally or unintentionally fish became more susceptible to bacterial decomposition. There was no facility of purchasing ice near temporary auctioning center (Hossain *et al.* 2012). Sorting after harvesting was done to separate fishes according to its value, price and size etc. Fish which are marketed immediately after landing remains better in quality. Lengthy sorting operations causing long time exposure to sunlight caused quality losses of fishes. Sometimes washing was done by dirty water, where as clean and contaminated free water was rarely used. Although, these activities did not affect the initial qualities but ultimately increased the load of spoilage bacterial population.

Distance was a factor for ensuring quality of small fishes. If communication was better it would require delivering the harvested fish within short time. However, not only the distance, proper transportation with necessary equipment is also required. It was observed that bamboos made baskets were mainly used. According to Hossain *et al*. (2012) mainly bamboo baskets wrapped in by polythene sheet and recently invented metallic box were used to transport the fish. Recently plastic made baskets are also used. Due to use of bamboo made baskets physical damage of fish as well as bacterial contamination also occurred. No ice was used during transportation of fish. Bamboos made baskets was mainly arranged in one by other vertically with full of fishes. Hossain *et al*. (2012) also reported that these were not properly washed after using and were kept in a contaminated place.

When harvested fishes were brought in a right way at early morning from water bodies were found fresh and excellent. Hossain *et al*. (2012) also reported that fish with extra respiratory organ like Baim (*Mastacembelaus armatus*), Taki (*Channa puntatus*), Gotchi (Macrognathus *aculeatus*), Gutum (*Lepidocephalichthys guntea*), Tengra (*Mystus bleekeri*) and Shing (Heteropneustes *fossilis*) were in quit fresh condition. In many cases during auctioning period icing was not done, but after completion of the auctioning the fish sellers use ice for high priced fish and avoid icing for the low priced fish. Nowsad (2004) observed the quality losses due to unavailability of suitable ice-box and ignorance of fishers on adequate handling, icing and freezing of fish.

In arat, washing, cleaning and icing of fish were hardly seen but sorting was regularly done. Again in the retail market washing, cleaning, sorting, grading and poor icing were done. Hossain *et al*. (2012) reported that to give fresh look to the fishes sprinkling water frequently over the fish was practiced.

After auctioning certain amount of fishes were marketed to other fish market of Sylhet region. In this case, quality depends on the proper handling, icing and also on preservation period. Generally the fishes which were sold at the afternoon were observed poor in quality in relation to defect point (Fig. 2) except very recent harvested fishes. Ice was available in most large markets of the Sylhet region except some small local markets.
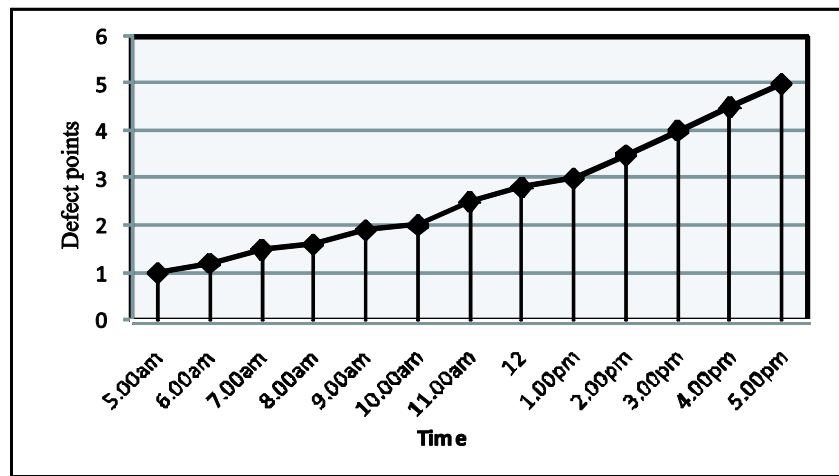

Fig. 2. Changes in defect point with relation to storage time.

In the present study it was found that quality of fishes was deteriorated due to delay in storage time (Fig.2). Major activities related to overall quality (Fig. 3) were lost due to no icing (45%), delay icing (10%), rough handling (15%) marketing process activities (15%), compactness (7 %) and transportation (3%). Range of defect point was between <2 to <4 (Table. 5). Some scientists also observed post-harvest fish losses at different stages of distribution chain from capture to consumption in the country. Huge loss of fish due to very poor or no preservation facilities in Mymensingh area was identified by Hossain *et al.* (2002). Hossain and Afroze (1991) and Hossain *et al.* (2002) observed that for inadequate handling and preservation (icing, chilling, and freezing) or storage facilities for farmed Indian major carps, the retail fish traders suffered huge economic loss in terms of low price offered for quality deterioration

Table 4. Different activities related to quality loss of SIS.

Quality assessment Activities	Frequency of activities (% of unit practice)						In Market		
	During harvesting	After harvesting	Landing after harvesting	First sorting after harvesting	Transportation on from landing center/ From market	Receiving	Sorting	Auctioning	Packaging
Washing of fish	Not done	Only 5%	0%	0%	-	35%	-	-	-
Compactness of fish	90%	-	-	-	100%	100%	-	90%	95%
Standing on fish	85%	90%	-	-	80%	-	-	-	-
Rough handling	90%	95%	95%	90%	80%	100%	100%	100%	100%
Mixing of fresh and spoilage fish	70%	80%	90%	100%	0%	40%	80%	20%	10%
Sorting according to quality	5%	3%	3%	45%	1%	20%	10%	10%	-
Mixing with dirty materials	90%	90%	90%	100%	10%	5%	10%	5%	20%
Icing facilities	0%	0%	0%	0%	2%	2%	1%	20%	85%
Use of ice box	0%	0%	0%	0%	1%	1%	0%	1%	10%
Use of bamboo made baskets	20%	95%	95%	100%	75%	90%	95%	90%	85%
Use of effective holding baskets, plastic baskets	5%	10%	10%	20%	35%	20%	20%	20%	40%
Flake ice used	0%	0%	0%	0%	0%	0%	0%	10%	55%
Facilities for live fish	0%	1%	1%	5%	10%	2%	5%	10%	-
Exposed to open environment/ sun light	-	29%	40%	80%	10%	-	55%	60%	70%
Physical damage due to handling activities	20%	30%	10%	20%	90%	70%	80%	70%	60%
Possibility of higher bacterial contamination	100%	100%	100%	100%	100%	100%	100%	100%	100%
Handler knowledge about quality maintenance	10%	10%	5%	0%	1%	5%	1%	1%	1%

Table 5. Freshness quality of fish at different points.

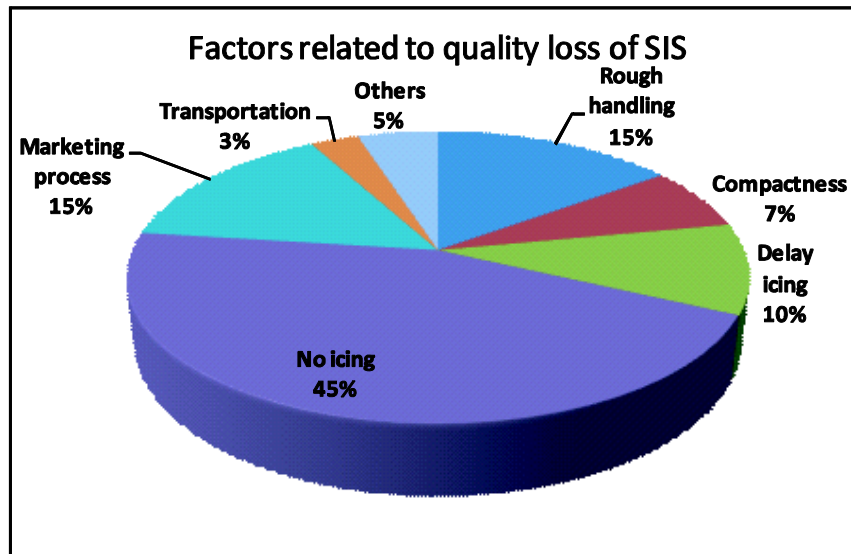| Defect point	Quality of fish at different point				
	Quality at harvest	Quality at landing	Quality at sorting	Quality at transportation	Quality at market
< 2	100%	100%	95%	95%	80%
2 to < 3	0%	0%	2%	2%	10%
3 to < 4	0%	0%	2%	3%	8%
4 to 5	0%	0%	1%	0%	2%
Range of defect points	< 2	< 2 to < 3	< 2 to < 3	< 2 to < 3	< 2 to <4

Fig. 3. Major activities related to overall quality loss (in percentages).

Some recommendations to ensure better quality of sis after harvesting: Small Indigenous Species of fishes are more popular in present market condition. Some recommendations are mentioned to ensure better quality of SIS depending on the existing situation and problems that are faced by the fishermen, sellers and customers.

1. Training of harvesters, fishermen about "Good Harvesting Practices" can be introduced. Fishermen should be trained up about some basic knowledge of harvesting technology so that it would be helpful to ensure the better quality of fish.

2. Some fixed landing centers should be established near harvesting areas with concrete made platform or temporary modified system (using of polythene on soil to perform the sorting), washing system and icing facilities.

3. In most of the areas where SIS is harvested have no icing facilities. To maintain the quality of fishes icing is indispensable. It is true that to ensure the icing facilities in every

place is very difficult but in some cases it is possible. In this case insulated van can be used for transportation.

4. Bamboos made baskets are commonly used for handling and transportation. Use of plastic boxes is not yet popular. In this case plastic boxes or insulated boxes can be used to carry the SIS as well as to maintain the better quality.

5. In the fish markets mishandling during harvesting, transportation, auctioning which is related to quality loss should be avoided.

6. Proper sanitation practices by the handlers in all cases through harvesting to marketing must be introduced to mitigate the above mentioned problems.

7. A time schedule can be maintained for selling of fish. Morning fish markets would be better for selling of fish to reduce the quality loss. Since most of the harvested fishes are brought at market before 9 am, so it is evident that fish which are sold before 10 am is better in quality. Beside this, a temporary based morning fish market (duration 2 to 3 hours) can also be established near the landing center and harvesting area which would ensure better quality of fish for the local consumers and reduce transportation cost, loss of quality during transportation.

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