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POST-HARVEST LOSSES OF CULTURE, CAPTURE AND MARINE FISHERIES OF BANGLADESH

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Abstract: *Bangladesh is one of the top countries in the world in terms of fish production. Considering the sectoral importance, this study assesses the post-harvest losses of culture, capture and marine fisheries of Bangladesh. Data were collected from different value chain actors of fisheries sector by using semi-structured questionnaire. Post-harvest losses were estimated for each type of fish by summing up all losses. The result shows that culture fisheries accounted 3.14-6.36% post-harvest loss where Rui, Catla and small Shrimp have faced more than 5% loss after harvest. In case of capture fisheries, the highest and lowest loss (in terms of money) was estimated for big shrimp and taki respectively and the total monetary loss for the fish species ranges from BDT12186-68760. In case of marine fishes, highest weight loss per metric tonne was found for Bombay duck ad Faissha where Hilsa was faced highest monetary loss of BDT77675 and shrimp accounted loss over BDT33000 after harvest which was 11.84% per metric tonne. The average post-harvest loss for per metric tonne of marine fish was found 11.67% which is higher than the loss of capture fish (7.01%) and culture fish (4.47%). Therefore, this study suggests to government and fisheries related agencies to focus on promoting initiatives, practices and policies to minimize the post-harvest loss and maximize the contribution of fisheries sector in Bangladesh.*

Keywords: Post-harvest loss, culture fisheries, capture fisheries, marine fisheries, Bangladesh.

1. Introduction

Bangladesh is one of the fasted growing countries of the world and the country is experiencing about 6% growth of its GDP (gross domestic product) from last two decades. Agriculture sector is still dominating the country's economy in spite of rapid growing of industry and service sector. Among the agriculture sub-sectors, fisheries sector is the second highest contributing sub-sector to the country's GDP. It is mentioned that agriculture sector contributed 22.8% of the GDP of Bangladesh of which fisheries sector accounted 4.4% and it also contributed significantly of the country's total export earnings which was 2.5% (Hossain, 2014). Moreover, more than 60% of the animal protein intake for the people of Bangladesh are obtained from fisheries sector. Thus, fish production as well as post-harvest of fisheries are very crucial to meet the nutrition demand and economic contribution of this sector in Bangladesh. However, the post-harvest loss of fisheries can be a challenge of limiting the growth of this sector. There is need to address this challenge as fish is a highly perishable commodity and its quality cannot be kept unaffected for human consumption for a long time. Post-harvest loss is occurred in every stages of value chain in case of culture, capture and marine fisheries. A few numbers of studies have found relating to post harvest losses along with value chain and governance structure in case of fisheries sector. Olusegun and Mathew (2016) assessed Fish Post Harvest Losses (FPHL) in and around Tagwai Lake involving three types of fish losses in handling, marketing and processing from the six sites and they found FPHL in number and weight 5.63-20.15% and 5.14-22.28% respectively. FAO (2010) has also determined the 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. In case of Bangladesh, very few studies have found relating to post harvest loss of fisheries sector. Nowsad et al. (2015) estimated post-harvest losses of four fish species (rohu; Ilish, catfish and tilapia) in different steps of major distribution channels in Bangladesh. The result revealed that most of the quality losses were originated at the transporters and commission agents that was estimated from 4% in catfish to 11% in tilapia. In case of retailer, a 16% loss was recognized in rui and tilapia, but 7% in catfish and 9% in Ilish. Higher loss was observed in fish vendors, from 10% - 19%. Nowsad (2004) also found that about 20% of the marine fish was deteriorated up to 80% of its original quality before loaded and about 28% fish lost 60-70% of freshness quality before it reached the consumer. Moreover, Nowsad (2010) estimated that about 20- 30% in different fish and fishery products losses after harvesting, and 50% reduction of such loss can save BDT8,000-10,000 crore per annum. Thus, it is essential to address the issue for reducing post-harvest loss and increasing the nutritional and economic contribution of this sector. Therefore, this study attempts to assess the post-harvest losses of culture, capture and marine fishes in Bangladesh.

2. Methodology

This study covers all sector of fisheries such as culture, capture and marine fisheries of Bangladesh. It is mentioned that there are two types of fisheries such as inland fisheries and marine fisheries. Inland fisheries are classified into culture and capture fisheries where inland culture fisheries are divided into pond, seasonal cultured water body, Baor, shrimp/prawn farm, pen culture and cage culture while inland capture fisheries are divided into River, Sundarban, Beel, Kaptai Lake and Flood plain. On the other hand, marine fisheries or open water fisheries of Bangladesh are also blessed with rich marine resources from the Bay of Bengal. Bangladeshi marine fish catch mainly extracted in two tiers such as industrial and artisanal fishery which are largely captured by the fishermen in coastal region of Bangladesh. As the inland and marine fisheries covers all districts of Bangladesh, therefore, this study selected the districts of different divisions on the basis of concentration of major production according to the data of Department of Fisheries, Bangladesh (DoF, 2017). Diei-Ouadi and Mgawe (2011) tested and validated the regional post-harvest loss assessment in fisheries by using three methods such as the Informal Fish Loss Assessment Method (IFLAM), Load Tracking (LT) and the Questionnaire Loss Assessment Method (QLAM). This study uses QLAM where a set of survey questionnaires was used to collect necessary information from all relevant actors of value chain including on fish farmers, fisher and traders (Arotdar, Paikar and Retailer and exporter) to assess the postharvest losses in fisher sector of Bangladesh based on the. Alam et al. (2012). Data were collected from 32 districts of Dhaka, Barisal, Khulna and Chattogram divisions using convenient and purposive sampling technique. Data were obtained from 2508 sample from different actors of fisheries sector which are shown in Table 1.

Table 1: Data collection from different value chain actors in the selected district

Name of Districts	**Fisher (Capture)**	**Fish farmer (Culture)**	Trader			Total
			Arotdar	**Paiker**	**Retailer**	
Barisal	20	56	14	12	58	160
Bhola	140	16	30	14	90	290
Pirojpur	26	32	10	14	34	116
Faridpur	10	12	24	0	38	84
Gopalgong	2	38	12	34	20	106
Madaripur	42	4	26	0	68	140
Rajbari	12	28	12	12	34	98
Shariatpur	28	30	24	2	76	160
Khulna	26	90	70	6	82	274
Jessore	200	96	56	18	76	646
Bagerhat	44	76	56	32	60	268
Satkhira	2	136	64	20	72	294
Kustia	6	14	22	2	36	80
Meherpur	12	32	16	0	24	84
Jhenaidah	10	38	6	0	80	134
Chuadanga	4	26	14	4	26	74
Total	**584**	**724**	**456**	**170**	**574**	**2508**

After collecting data, data is being scrutinized and carefully edited to eliminate possible errors and inconsistencies contain in the schedules while recording them. After completing the pre-tabulation task, it transfers to an Excel sheet from the interview schedules. In this study, tabular technique will be followed to illustrate the whole scenarios of postharvest of losses of fisheries sector in Bangladesh. The following formula were used to calculate the post-harvest losses in case of each fish type of fish.

Post-harvest loss = Weight loss + Price loss

Where,
Weight loss = Quantity (kg) X price (BDT/kg)
Price loss = [quantity of degraded fish (kg) X {price of fresh fish (BDT) – Price of degraded fish (BDT)}]

Post-harvest loss = Quantity (kg) X price (BDT/kg) + [quantity of degraded fish (kg) X {price of fresh fish (BDT) – Price of degraded fish (BDT)}]

3. Results and Discussions

Bangladesh is now recognized as one of the leading countries in case of fish production. The country was ranked third in producing fish from inland water-bodies after China and India (FAO, 2018). The country is now also the fifth biggest aquaculture producer in the world based on the FAO (2018) report entitled the State of World Fisheries and Aquaculture 2018. It is mentioned that Bangladesh produced a total of 41,34,000 metric tonnes of fish in the 2016-2017 fiscal year where 84,000 tonnes surplus production occurred after fulfilment of national demand. The production of Hilsa stood at around 0.5 million metric tonnes in that fiscal year which was twice of the amount in 2008-09. The performance of fisheries sector of Bangladesh is presented in Table 2.

Table 2 Performance of fisheries sector of Bangladesh

Type of fish production	Total production in 2016-2017 (million metric tonne)	Total production in 2017-2018 (million metric tonne)	Growth of production (%)	Rank in the world
Inland fish production	1.16	1.22	11.01	03
Aquaculture production	2.33	2.41	5.89	05
Marine production	0.64	0.65	1.75	11
Total fish production	4.13	4.28	6.6	

Source: DoF, 2017; DoF, 2018

Bangladesh is one of the top fish producing countries in the world. In 2017-2018, the country's total fish production was 4.28 million MT (metric tonne) where inland open water (capture) contributes 28.45% and inland closed water (culture) contributes 56.24% to total production as shown in Table 3 (DoF, 2018). Thus, inland fisheries contributed 84.69% of total fish in the last fiscal year of the country. On the other hand, Marine fisheries production was 0.65 million MT which contributed 15.31% of the total fish production in the country. Bangladesh has achieved huge expansion of fisheries sector as the fish production has increased more than five times over the last three decades.

Inland open water capture fisheries comprise diverse sources such as river, Sundarban, beel, floodplain and Kaptai lake that has contributed 7.50, 0.43, 2.32, 0.24 and 17.97% respectively to the total fish production in 2017-2018. Moreover, pond, seasonal cultured waterbody, baor, shrimp farm, pen culture and cage culture are considered as aquaculture or inland culture fisheries which accounted 44.43, 5.06, 0.19, 5.95, 0.24 and 0.10% respectively of the total fish production in 2017-2018. Thus, it is found that pond and floodplain are the two most important sources of inland fisheries in Bangladesh. The aquaculture production became more than double during the last ten years. Thus, to maintain a satisfactory growth of this sector, post-harvest loss should be minimized.

Table 3 Sectoral production: An overview of fisheries sector in Bangladesh

Sector of Fisheries			Production (Metric Ton)	% of Production
Inland Fisheries	**Inland Open Water (Capture)**	• **River and Estuary**	320598	7.50
		• **Sundarbans**	18225	0.43
		• **Beel**	99197	2.32
		• **Kaptai Lake**	10152.	0.24
		• **Floodplain**	768367	17.97
	Total Culture fisheries		1216539	28.45
	Inland Open Water (Culture)	• **Pond**	1900298	44.43
		• **Seasonal cultured water body**	216353	5.06
		• **Baor**	8072	0.19
		• **Shrimp/prawn farm**	254367	5.95
		• **Crab**	11787	0.28
		• **Pen culture**	11015	0.24
		• **Cage culture**	3523	0.10
	Total Culture fisheries		2405415	56.24
	Total Inland Fisheries		3621954	84.69
Marine fisheries	**Industrial (Trawl)**		120087	2.81
	Artisanal		534600	12.50
	Total Marine Fisheries		**654687**	**15.31**
Total fisheries production in Bangladesh			**4276641**	**100**

Source: DoF, 2018

The growing trend of the fisheries sectors in Bangladesh demands priority of this sector for further growth. Post-harvest loss can be a thread to slow down this sectoral growth. Therefore, there is need to estimate this loss to limit such losses in fisheries sector. This study found a large variation of post-harvest losses in different type of fishes. In case of culture fisheries, post-harvest losses of culture fish species per metric tonne ranges from BDT3947-26169 where the highest and lowest loss (in terms of money) was estimated for Mirror carp and small Shrimp respectively which is presented in Table 4. The percentage of post-harvest loss for different fishes revealed significant as the estimated range was 3.14-6.36%. it is found that Rui, Catla and small Shrimp have faced more than 5% loss after harvest.

Table 4 Post harvest losses of culture fish species (Per metric tonne)

Fish species	Weight loss			Price loss				Total loss (BDT)	% of loss
	weight loss (kg)	Price of fish/kg (*BDT)	Monetary loss (BDT)	Quantity of degraded fish (kg)	Price of degraded fish (BDT/kg)	Price loss BDT/Kg	Monetary loss (BDT)		
Rui	18.66	212.5	3964.83	162.76	156.34	56.16	9140.60	13105.43	6.17
Catla	16.66	200.25	3335.16	148.56	151.65	48.6	7220.02	10555.18	5.27
Mrigal	13.24	160.75	2127.53	92.45	127.86	32.89	3040.68	5168.21	3.22
Kalibaus	14.35	364.95	5235.57	102.86	290.45	74.5	7662.77	12898.34	3.53
Bata	17.66	282.78	4992.48	103.75	210.49	72.29	7500.09	12492.57	4.42
Silver carp	21.66	110.34	2389.41	98.76	93.32	17.02	1680.90	4070.31	3.69
Grass carp	20.24	130.21	2634.80	92.67	112.76	17.45	1617.09	4251.89	3.27
Mirror/Common carp	17.12	111.23	1904.70	92.32	89.11	22.12	2042.12	3946.82	3.55
Pangas	5.35	113.65	607.57	167.86	90.54	23.11	3879.24	4486.82	3.95
Koi	9.24	182.43	1684.74	103.65	121.61	60.82	6303.99	7988.73	4.38
Big Shrimp/ Prawn	15.21	833.98	12685.67	47.57	550.54	283.44	13483.24	26168.91	3.14
Small Shrimp/ Prawn	10.24	456.54	4672.69	138.43	280.654	175.886	24347.90	29020.59	6.36
Tilapia/ Nilotica	10.89	120.44	1311.23	94.99	77.98	42.46	4033.28	5344.51	4.44
Sarpunti/Thai punti	21.32	241.91	5158.01	141.93	156.87	85.04	12069.73	17227.73	7.12
Average	15.13	251.57	3764.60	113.47	179.29	72.27	7430.12	11194.72	4.47

N.B. * BDT [Bangladeshi Taka], 1 US$ = 84.64 BDT

The capture fisheries are also important for Bangladesh as it contributes more than 28% to the total fish production. This study also estimated a large variation of post-harvest losses in different type of capture fishes. Huge weight was found in case of many fish species post-harvest losses of culture fish species where Rui, Catla Mrigal and Hilsa was lost 38.87, 32.66, 29.24 and 28.46 kg per metric tonne of harvest. Moreover, a large post-harvest loss was also occurred due to loss of degraded fish after harvest. The total monetary loss for each fish species ranges from BDT12186-68760. The highest and lowest loss (in terms of money) was estimated for big shrimp and taki respectively which is presented in Table 5. However, in case of percentage of post-harvest loss for different fishes, higher losses were estimated in case of capture fisheries than culture fisheries. The range of loss as percentage measured by 3.73-9.67%. Many fish species have experienced over 7% losses which includes Rui, Catla, mrigal, Shingi/Magur and small Shrimp. However, Olusegun and Mathew (2016) assessed Fish Post Harvest Losses (FPHL) in and around Tagwai Lake involving three types of fish losses and found FPHL in number and weight ranged from 5.63-20.15% and 5.14-22.28%.

Table 5 Post harvest losses of capture fish species (Per metric tonne)

Fish species	Weight loss			Price loss				Total loss (BDT)	% of loss
	weight loss (kg)	Price of fish/kg (BDT)	Monetary loss (BDT)	Quantity of degraded fish (kg)	Price of degraded fish (BDT/kg)	Price loss BDT/Kg	Monetary loss (BDT)		
Rui	38.87	360.86	14026.82	193.34	260.76	100.11	19354.30	33381.12	9.25
Catla	32.66	352.56	11512.85	199.87	241.763	110.80	22145.00	33657.84	9.55
Mrigal	29.24	260.54	7616.97	152.76	150.54	110.00	16804.06	24421.03	9.37
Kalibaus	19.35	411.43	7959.56	145.87	310.98	100.45	14652.93	22612.50	5.50
Bata	27.66	338.76	9368.55	134.87	240.85	97.92	13205.80	22574.34	6.66
Gonia	10.24	332.76	3405.84	142.87	222.34	110.42	15776.28	19182.12	5.76
Pangas	21.12	376.23	7947.50	178.76	310.76	65.47	11703.60	19651.10	5.22
Boal/Air	19.46	429.88	8364.10	96.98	276.96	152.92	14829.79	23193.89	5.40
hol/Gazar/ Taki	7.57	326.57	2471.46	77.9	201.86	124.71	9714.68	12186.13	3.73
Koi	18.46	482.88	8912.50	141.98	342.56	140.32	19922.49	28834.99	5.97
Shingi/Magur	14.68	567.65	8332.56	102.54	251.65	316.00	32402.85	40735.41	7.18
Hilsha	28.46	624.85	17781.47	165.87	423.74	201.11	33358.78	51140.25	8.18
Big Shrimp/ Prawn	10.24	1024.85	10489.38	158.64	657.54	367.31	58270.69	68760.07	6.71
Small Shrimp/ Prawn	26.46	425.87	11268.12	175.85	255.76	170.11	29914.02	41182.14	9.67
Average	21.75	451.12	9246.98	147.72	296.29	154.83	22289.97	31536.64	7.01

Marine fisheries are also crucial for Bangladesh as it contributes more than 15% to the total fish production. Different marine fishes also face huge post-harvest loss. Hilsa (Ilish) is the national fish of Bangladesh which is the major fish among the marine fishes. Hilsa alone contributed about 12.09% of the country's total fish production. It can be mentioned that Hilsa has been declared as Geographical Indicator (GI) of Bangladesh. However, post-harvest losses of marine fish species (Per metric tonne) are presented in Table 6. Enormous loss was estimated in majority of the marine fishes. Highest weight loss per metric tonne was found for Bombay duck ad Faissha where Hilsa was faced highest loss of BDT77675. Shrimp is another major fishery of Bangladesh which have a major contribution of export earning for Bangladesh. This fish was accounted loss over BDT33000/metric tonne after harvest which was 11.84% per metric tonne. Some other major marine fishes are Pomfret, Jewfish, Vetky and Lokkha which are estimated 7.09, 14.20, 11.27 and 10.78% post-harvest loss per metric tonne. The average post-harvest loss for per metric tonne of marine fish was found 11.67% which is higher than the loss of capture fish.

Table 6 Post harvest losses of marine fish species (Per metric tonne)

Fish species	Weight loss			Price loss				Total loss (BDT)	% of loss
	weight loss (kg)	Price of fish/kg (BDT)	Monetary loss (BDT)	Quantity of degraded fish (kg)	Price of degraded fish (BDT/kg)	Price loss BDT/Kg	Monetary loss (BDT)		
Hilsa	41.13	585.35	24072.31	182.65	291.88	293.47	53603.29	77675.60	13.27
Pomfret	32.65	432.54	14120.27	102.66	271.346	161.19	16547.69	30667.96	7.09
Jewfish	45.12	210.54	9500.54	187.876	101.945	108.60	20402.96	29903.50	14.20
Bombay duck	57.01	121.54	6929.53	239.984	71.678	49.87	11966.80	18896.33	15.55
Vetky	40.33	240.65	9705.58	162.64	133.643	107.01	17404.27	27109.84	11.27
Lokkha	39.57	311.76	12334.98	177.31	191.876	119.89	21257.76	33592.74	10.78
Ribbonfish	43.11	111.46	4804.87	192.87	63.543	47.91	9241.22	14046.09	12.60
Faissha	57.22	160.65	9192.62	152.84	96.473	64.18	9809.10	19001.73	11.83
Surma	27.25	132.75	3616.77	193.65	82.654	50.09	9700.32	13317.09	10.03
Kawa	29.35	85.79	2517.56	175.90	51.624	34.17	6009.52	8527.08	9.94
Shrimp	40.24	280.46	11284.15	182.76	160.563	119.89	21912.12	33196.27	11.84
Average	41.18	243.04	8907.20	177.38	137.93	105.12	17986.82	27812.20	11.67

4. Conclusion

Considering the importance of fisheries sector in Bangladesh, this study measures the post-harvest losses of culture, capture and marine fisheries of Bangladesh. The study reveals that fisheries sector of Bangladesh faces huge post-harvest loss that need to be addressed. The post-harvest losses are considered as limiting factor of growth of fisheries sector. This loss combines weight loss and price loss due to improper handling, landing and processing in the value chain actors of fisheries sector. Specifically, bad handling by the fishermen during harvest as there was no gutting, washing and clean storage either on board or at landing. Various coping strategies and proper practices are crucial for all actors including fishermen, processors and traders for reducing or preventing losses. There is also need to improve the existing conventional handling, preservation, processing and marketing practices for limiting the losses. Therefore, governments and fisheries related agencies should focus on promoting initiatives, practices and policies including loss assessment tools, loss prevention mechanism and dissemination of information to minimize the post-harvest loss of fisheries sector.

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