INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH & DEVELOPMENT

ISSN 2278 – 0211 (Online)

Assessment of Fish Post Harvest Losses in Tagwai Lake, Niger State, Nigeria

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Abstract:
The research focused on assessment of Fish Post Harvest Losses (FPHL) in and around Tagwai Lake involving three types of fish losses, along the chain handling, marketing and processing from the six sites (Kadna. TungaGoro, GidanMangoroKasabo, TungaWaya, and TungaBoka). Structured questionnaires were designed to target losses at every segment of the chain. The results showed that the percentage FPHL in number and weight at the six landing, processing and marketing sites ranged from 5.63-20.15 and 5.14-22.28 respectively. One-way Analysis of Variance and correlation analysis revealed that at Kadna, the percentage loss due to handling in weight of fish at the landing point was significantly higher than the other points of processing and marketing. The high average fish spoilage by number and weight at the landing sites can be attributed bad handling by the fishermen as there was no gutting, washing and clean storage either on board or at landing. It was recommended that management blueprint for Tagwai Lake fishery must include improvement in the existing conventional handling, preservation, /processing and marketing practices in the Lake in order to make the much desired impact on fish availability.

Keywords: *Post-harvest, handling, processing, marketing, Tagwai lake.*

1. Introduction

Post-harvest losses in fish products are a foremost nuisance of the Nigerian fish industry particularly at the artisanal level. Post-harvest losses occur at various points from capture to marketing. The demand for fish in Nigeria is projected at 1.18 million tonnes (12kg per Capita) and capacity for Nigerian fish resources is estimated at 1.83 million tonnes (Tobor, 1993). Fish supply from all sectors is approximately 500,000 tonnes per annum. According to Adesehinwa *et al*. (2005), although captured fisheries is in control of over 60% of total domestic production per annum, the enormity of losses in this sector has been estimated at 30-50% of total catches. Post-harvest losses caused by spoilage amount to about 10 to 12 million tonnes per year and in addition, it is estimated that 20 million tonnes of fish in a year are discarded at sea which is another form of post-harvest losses (FAO, 2010). Eyo and Mdaihili (1997) estimated a loss of 80 million Naira worth of fish through poor handling, processing, preservation and storage.

When fish undergoes bacteriological putrefaction, the loss in quality is attended by a decline in marketable value. This may bring the product within the scope of low-income groups who could not afford better quality fish. The people involved in fish marketing (and perhaps the fishermen) may have suffered a loss of potential income by not selling at the best possible price, but someone else may have gained by having access to a still nutritious food. Even when fish has deteriorated so much that it cannot be sold at all and it is thrown away, there are regrettably often people who are so impoverished that they would be glad to take the least spoiled fish. This can be regarded as a loss in value for the fisherman or trader, but a social gain for very low-income groups (Kumolu-Johnson and Ndimele, 2011).

The time space between catching and preparation for preservation further complicates the problem (Bolorunduro *et al*., 2005; Kumolu-Johnson and Ndimele, 2011). It is therefore, imperative to assess post-harvest losses in fisheries from a wider perspective. According to Eyo and Mdaihli (1997) When management strategies are proposed for a fishery, adequate consideration is often not given to the very salient aspect of post-harvest. If losses are quantified it should be possible to authenticate at what stages of post-harvest, serious losses occur and so pay attention to the reduction of losses at these stages. This would have a more direct impact on the fishery. Much can be achieved by simple improvements in handling and processing methods (Bolorunduro *et al.* 2005). The basic requirement is to take more care. Fish is easily damaged and easily spoiled. Careless procedures will accelerate spoilage and increase losses. Careful methods will retard spoilage, reduce losses and improve the quality of the marketed produce.

The combined surface area of all the freshwater bodies; located in Niger state is approximately 436,196 hectares and the potential annual fish yield from these water bodies has been estimated at about 41,485 metric tons (Sikoki *et al.* 1992). Despite its high potential, fish production in the state is estimated at only about 20 tonnes of fish in 1990 representing about 17.48% of the Gross

National Domestic Fish Production. Many factors could be responsible for the low production such as overfishing, improper fishing methods, habitat disruption, pollution and post-harvest losses.

Tagwai Lake located in Chanchaga Local Government Area, in South West Zone of Minna. Tagwai Lake is the major source of water supply in Minna metropolis. The Lake lies on Latitude $9^0$33.55 to $9^0$36.07N and longitude $6^0$39.20" to $6^0$39.58" E (Muhammed *et al*., 2014). Communities around the Lake include Tunga-Goro, Kadna, GidanMangoro, TungaBoka, TungaWaya and Kasabo. The activities of people within the Lake environment are mainly farming and fishing.

With the importance of this Lake to fish production in Niger State specifically and Nigeria in general, this study attempts to carry out qualitative and quantitative assessment of post-harvest fish losses of Tagwai Lake and also, to provide recommendations that would enhance formulation of policy guidelines for utilization and exploitation of the fishery resources of the Lake.

2. Materials and Methods

2.1. Data Collection

Questionnaires on fish handling losses (FHL) were administered to fisher folk during their active fishing time (7 am and 1 pm). Questionnaires on fish processing losses (FPL) were administered to the fish processors between 2pm and 6pm. Questionnaires on marketing losses (FML) were administered at the market centers where fish sellers and buyers converge to transact business.

2.2. Results

Table 1 shows post-harvest losses at fish landing sites at different Locations around Tagwai Lake. The average fish weight of fish caught in the different locations around Tagwai Lake ranged from 0.17 to 0.19 kg and the average total number of fish caught ranged from 22 to 27 with average total weight range of 2.51 to 10.07 kg. The percentage loss in the number of fish caught from the six locations ranged between 21.68 to26.04% while the percentage loss in the weight of fish caught ranged between 19.82 to 22.28%. There were no significant differences ($p > 0.05$) in the mean total number of fish caught and the mean average fish size weight caught between the six locations studied around Tagwai Lake but there were significant differences ($p < 0.05$) between the total weight of fish in kilograms caught between these locations. The mean total weight of fish caught at Kadna (10.07 kg) was significantly higher than those caught from other locations. The mean total weight of fish caught at TungaGoro, GidanMangoro, TungaBoka, TungaWaya and Kasabo were not significantly different from each other. There were no significant differences ($p > 0.05$) in the mean injured fish between the six locations but the total weight of the injured fish which ranged from 0.59 to 2.36 kg showed some level of significance. The mean total weight of injured fish at Kadna was significantly higher than those of the other five locations. The mean weight of injured fish from the other five locations (TungaGoro, Giganmangoro, TungaBoka, TungaWaya and Kosabo) were not significantly different from each other. The mean percentage loss in fish number and weight at the landing point between the six locations were not significantly different from each other ($p > 0.05$).

Parameter	Locations					
	TungaGoro	**Kadna**	**GidanMangoro**	**TungaBoka**	**TungaWaya**	**Kasabo**
Average fish weight (kg)	0.17	0.36	0.19	0.17	0.19	0.17
Total number of species caught	24	22	29	26	26	27
Total weight of fish caught (kg)	2.51^b	10.07^a	4.27^b	3.30^b	4.17^b	3.27^b
Weight of injured fish(kg)	0.59^b	2.36^a	0.86^b	0.71^b	0.78^b	0.68^b
% FPH Loss in number	26.04	28.55	24.22	23.15	22.91	21.68
% FPH Loss in weight	20.48	22.28	21.21	21.27	19.82	21.84

Table 1: Mean post-harvest losses at fish landing sites at different Locations around Tagwai Lake

Means on the same row with different superscript are significantly different ($p < 0.05$)

Table 2 shows the mean post-harvest losses at fish processing sites at different Locations around Tagwai Lake. The average weight that ranged between 16.89 to 20.77 kg. There were no significant differences ($p > 0.05$) in the mean number and weight of fish bought from fishermen between the six studied locations. The number of fish that were spoilt or discarded before processing at the six locations range between 4 and 5 with the weight range of 1.08 to 1.43 kg while after processing, the number of fish spoilt ranged between 2 to10 with weight range of 0.94 to 2.70 kg. The total number of fish spoilt or discarded before and after processing ranged from 5 to 7 with average weight range of 1.43 to 4.59 kg. There were no significant differences in the mean number and weight of spoilt or discarded fish before and after processing between the six locations (i.e. the number and weight of fish lost before and after processing between the six locations were statistically comparable) but in percentage, a level of significant differences ($p < 0.05$) were obtained for loss in number and weight of fish before processing. The percentage FPH loss in the number of fish caught before processing at GidanMangoro (7.55%) was statistically comparable to those of Kadna and TungaGoro (7.26% and 6.07% respectively) but was significantly higher than those of Kasabo, TungaWaya, and TungaBoka. The percentage FPH loss in the number of fish before processing at Kadna was significantly higher than that of TungaBoka with the least loss in percentage (5.18%) but was statistically comparable to those of TungaGoro, Kasabo and TungaWaya, which were not significantly different from each other and also from that of TungaBoka. The percentage FPH loss in the weight of fish before processing at GidanMangoro was not significantly

different ($p > 0.05$) from those of Kadna, Kasabo and TungaGoro but was significantly higher ($p > 0.05$) than those of TungaWaya and TungaBoka. The percentage FPH loss in weight before processing fish caught at Kadna, Kasabo, TungaGoro, TungaWaya and TungaBoka were not significantly different ($p > 0.05$) from each other. The percentage FPH losses in number and weight of fish after processing between the six locations were not significantly different ($p > 0.05$) from each other.

Parameter	Locations					
	TungaGoro	**Kadna**	**GidanMangoro**	**TungaBoka**	**TungaWaya**	**Kasabo**
Quantity of fish bought from fishermen	65	72	62	69	79	68
Weight of fish bought from fishermen	16.89	20.54	18.31	20.32	20.77	17.80
Quantity of spoilt or discarded fish before processing	4	5	4	4	4	4
Weight of spoilt or discarded fish before processing	1.12	1.43	1.29	1.07	1.08	1.12
Quantity of spoilt or discarded fish after processing	5	6	6	6	7	6
Weight of spoilt or discarded fish after processing	1.53	1.85	1.64	1.79	1.67	1.70
% FPH Loss in number before processing	6.07^{abc}	7.26^{ab}	7.55^{a}	5.18^{c}	5.49^{bc}	5.63^{bc}
% FPH Loss in weight before processing	6.37^{ab}	7.16^{ab}	7.50^{a}	5.14^{b}	5.19^{b}	5.92^{ab}
% FPH Loss in number after processing	9.13	9.61	9.10	9.22	8.95	9.32
% FPH Loss in weight after processing	9.48	9.51	9.00	9.11	8.42	9.65

Table 2: Mean post-harvest losses at fish processing sites at different Locations around Tagwai Lake

Means on the same row with different superscript are significantly different ($p < 0.05$)

Table 3 shows the quantity of fish marketed at the six studied locations around Tagwai Lake ranged between 22 to 26 and an average total weight which ranged between 5.98 to 7.25 kg. There were no significant differences in the number and weight of fish marketed between the studied locations. The quantity of fish spoilt or discarded at the marketing point ranged between 4 and 5 and the weight ranged between 0.89 and 1.44 kg. There were no significant differences ($p > 0.05$) in the mean number of fish spoilt or discarded at this stage between the locations but some level of significant differences ($p < 0.05$) was obtained in the weight of fish spoilt or discarded. The weight of fish spoilt or discarded at GidanMangoro was statistically comparable to those of Kadna, TungaBoka and Kasabo but was significantly higher than those of TungaGoro and TungaWaya. The weight of fish spoilt or discarded at Kadna was statistically comparable to those of TungaBoka, Kasabo, and TungaGoro but was significantly higher than that of TungaWaya. Those of TungaBoka, Kasabo, TungaGoro and TungaWaya were not significantly different from each other ($p > 0.05$). The percentage FPH losses in number and weight of fish marketed at the studied areas ranged from 15.48 to 20.15 and 14.88 to 19.28% respectively. Statistically, there were no significant differences ($p > 0.05$) in the mean losses in number and weight of fish marketed between the six locations.

Parameter	Locations					
	TungaGoro	**Kadna**	**GidanMangoro**	**TungaBoka**	**TungaWaya**	**Kasabo**
Quantity of fish marketed	23	26	26	25	22	24
Weight of fish marketed(kg)	6.10	6.96	7.25	6.70	5.98	6.43
Quantity of spoilt / discarded fish	4	5	5	5	4	5
Weight of spoilt / discarded fish(kg)	1.00^{bc}	1.30^{ab}	1.44^{a}	1.24^{abc}	0.89^{c}	1.24^{abc}
% FPH Loss in number	16.52^{ab}	19.03^{ab}	20.15^{a}	18.95^{ab}	15.48^{b}	19.23^{a}
%FPH Loss in weight of fish	16.39^{ab}	18.67^{ab}	19.07^{a}	18.51^{ab}	14.88^{b}	19.28^{a}

Table 3: Mean post-harvest losses at fish marketing sites at different Locations around Tagwai Lake

Figure 1 shows percentage FPH loss in weight of fish at the landing point was significantly higher than the other points. On the average around Tagwai Lake, the percentage FPH loss in weight of fish was in the order landing > Marketing > after processing > before processing and they significantly higher than each other in that other.

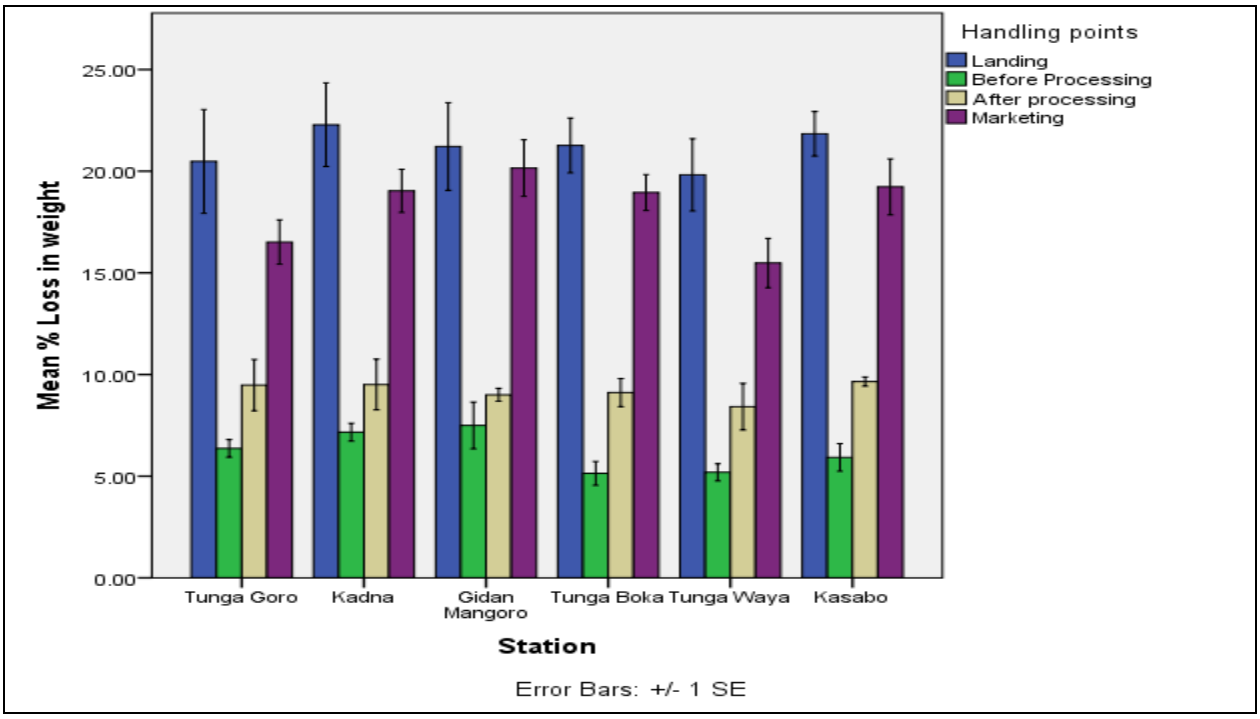

Figure 1

3. Discussion

The high average fish spoilage by number and weight at the landing sites can be attributed bad handling by the fishermen as there was no gutting, washing and clean storage either on board or at landing. This agrees with Eyo (1997, Bolorunduro et al., 2005, Kumolu-Johnson and Ndimele, 2011). Fish being taken out from fishing gears are sometimes badly handled and most of the times left in the open at the canoe bottoms under the dominant high temperatures. Quick spoilage especially through bacterial decomposition under the warm conditions sets in. Also, some of the fish having spent many hours in the net before hauling could be dead in the water and have begun to spoil. According to Diei-Ouadi and Mgawe (2011), by the time the fishing gear is hauled into the canoe, after a long stay in the water, fish would have become too spoiled to fetch a good price and market and are not worth landing, and, therefore, they are thrown away at sea.

The percentages of fish post-harvest processing losses in number and weight after processing were significantly higher than before processing. This suggests improper preprocessing handling of washing in clean water, provision of shade for the processed fish and ignorance by the processors believing that smoking would mask the spoilage. But since smoking does not improve the quality of spoilt fish such smoked products have off odour and break easily. This is in agreement with Akande and Diei-Ouadi (2010) that fish losses can occur through mishandling, bad/poor packaging, fragmentation of smoked fish and lack of adequate storage facilities. This is also in agreement with Diei-Ouadi and Mgawe (2011), that harvest fish losses are often caused by biochemical and microbiological spoilage changes that occur in fish after death and factors that are responsible for this include time between death and final use or consumption, temperature abuse and poor handling practices.

Fish displayed market sites were not gutted. Sporadically water was showered over the fresh fish to keep away flies and to make the fish moist. They are sold according to species amidst swarms of flies and unhygienic environment. This leads to both quality and economic losses to the fish mongers as the market value of the fish is reduced. lead to sustained and increased microbial contamination, hastening the spoilage rate of fish. Such practices include: using dirty canoes, equipment, fish boxes and baskets; not washing fish; washing fish in dirty water; placing fish on dirty surfaces; and physically damaging fish by throwing or standing on them.

The FPH losses along the chain of the landing, processing and marketing point at different locations around Tagwai Lake were very significant. Cumulatively on the average along the chain FPH was 53.34% in weight. This is huge and detrimental to domestic fish production in Nigeria. With the increasingly low domestic fish production in Nigeria, any management blueprint for Tagwai Lake fishery must include improvement in the existing conventional handling, preservation/processing and marketing practices in the Lake in order to make the much desired impact on fish availability.

Therefore, to significantly curtail losses in the Taqwai Lake fishery, fishing time with the obtainable fishing gears should be reduced to the barest minimum and should not exceed 12 hours prior to checking. This will enable most of the fish caught early to remain in excellent condition at checking. Fish should be effectively handled on board by gutting, washing and storing in clean boxes or containers.

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