Fish Post Harvest Losses and Intervention Measure to Reduce Losses in Lake Hashengie

Yared Tigabu[1]

ABSTRACT

The survey was conducted to determine the kinds and extent of losses and to propose the actions required to prevent post-harvest losses in Lake Hashengie. The assessment was carried out by adopting the methodology of Wood (1985) by measuring the flow of fish through the system. Direct weight measurement of the catch was performed quickly by using a simple balance at landing site. The total catch, as well as, total discarded due to spoilage, size, and lack of market were measured. The study was conducted between September 2009 and August 2010. From the total annual 5118 kg total tilapia catch, the post-harvest loss constitute 526.9 kg (8.3 %), of which, 100.6 kg of tilapia was discarded due to size discrimination and 426.2 kg was discarded due to spoilage. From the estimated 2012 kg of common carp catch, the overall post harvest losses were 367.8 kg (15.4%), of which, 144.3 kg was due to size discrimination and 230.2 kg discarded due to spoilage. Higher post harvest fish losses were measured between March and May for both species. The main reasons for post harvest losses include inadequate handling, poor processing and storing facilities, delay between catch, collection and distribution, lack of proper market channel and lack of appropriate fish handling and preserving techniques.

Key words/phrases: Carp, fish handling, tilapia,spoilage, size discard

---

[1] National Fisheries and Other Aquatic Resources Research Center, Sebeta,ETHIOPIA
Email:yaredtig@gmail.com

INTRODUCTION

Post-harvest losses in fisheries comprise material losses of fish due to spoilage, breakage, size, discarding by catch and operational losses. There are also losses of value, what the fish is worth in monetary terms, losses of quality-when fish becomes less attractive to consumers, losses in nutritional value, when the fish contribute less towards the diet of consumer than it did (Geoffrey, 1990).

The total post-harvest loss is estimated between 17.9 and 39.5 million tons (average 27 million tons) per year (Alverson *et.al.*, 1994), which is about 30% of the total world catches. Losses in African countries are as much as 40% of the annual catch (FAO, 1989). Losses occur as a result of flaws in the handling, storage, distribution and processing of fish and in marketing techniques. The study of losses should be done on a case by case basis, and is a key step for improvement (Alverson *et.al.*, 1994). The important issue is, therefore, to reduce losses and make more food available and also to raise the income of the fishing communities.

In Ethiopia, there are significant post-harvest losses due to different reasons. Comparing the current fish production level with the overall potential of the country, the rate of exploitation ranged from 30 to 40% (Brook Lemma, 2012). So, there seems to be a room for expansion, but in major rift valley lakes, like Ziway, Awassa and Chamo, there is already a sign of over exploitation. The only way to develop fishery in those areas is by proper utilization of the catch. There is no room for further expansion of fishery, but it is possible to lower post-harvest losses at all stages of fish handling so that we can increase the tonnage of fish reaching the consumers.

The need for assessment of post-harvest loss is a first step towards reducing losses and devising ways to the existing problem. In order to understand what processing system needs to be improved, we must know what kind of losses occur and at what stage these happened.

Lake specific studies are needed to provide more precise information on the losses during the various stages of fish production (capture to marketing). The information could help to reduce post-harvest losses while increasing fish consumption without increasing the catch.The main objective of the study was to identify and estimate the kinds and extent of losses and to propose the required actions to prevent it.

Materials and methods

The study area

Lake Hashengie is located in the northern part of the country in Tigray region, close to the town of Korem. It is situated between 12^0 31' 9'' N and 39^0 30' 50''E at an altitude of 2440 m. The lake is nearly circular in shape and covers an area of 25 km^2. It has a maximum depth of 30m and a mean depth of 14 m (Wood and Talling, 1988). However, the maximum depth measured in the present study was 20 m. The lake has no water outlet and fed by inflows from the surrounding highlands.

The climate of Lake Hashengie region is characterized by cool and humid conditions, consisting of one dry and one rainy season. Rainfall data obtained from the agro-meteorological station of the region indicated that the rainy season extends from March to September, peaking in July and August. The lake area receives an annual rainfall of 818 mm/yr (Abelneh Yimer *et al*., 2012).

Methodology

The loss assessment was carried out adopting the methodology of Wood (1985) by measuring flow of fish through the system (assessment format was developed). Direct weight measurement of the catch was performed quickly with a simple balance at landing site. The total catch of the fish by species, the total amount of discard (due to spoilage, size, lack of market) of fish was measured. The appearance, texture and odor of the fish was also assessed following Howgate (1994) sensory evaluation of fish freshness.

Huss (1995) sensory assessment method was used to identify the cause of the spoilage by evaluating signs of spoilage. The study was conducted for twelve months, between September 2009 and August 2010. Data were analyzed using descriptive statistics:

Total monthly catch in kg was calculated using the formula:

$$\frac{\text{Sum of sampling day catch in kg x monthly fishing days}}{\text{Number of sampling days}}$$

Monthly discard was determined by:

$$\frac{\text{Sum of sample days discard x monthly fishing days}}{\text{Number of sampling days}}$$

Percent spoilage was calculated:

$$\frac{\text{Total weight of spoilage}}{\text{Total weight of catch}} \times 100$$

The operational yield was determined by:

Whole weight of fish in kg minus operational discard internal part of fish in kg

To identify the fishing power of the gear, the important parameter of the net, which are length, height, twine size, floater and sinker type, mesh width and

hanging ratio were measured. Other information on the overall fishery activity was obtained through observation and discussion with fishermen and development agents.

Results and Discussion

There are two (Nile Tilapia, *Oreochromis niloticus* and Common Carp, *Cyprinus carpio*) commercially important fish species are commonly available in the lake. Technical knowledge of the fishers in post-harvest fish handling, managing, processing and storing of fishes is very limited. No technical guidelines or manuals are available regarding harvesting gear and methods, time- temperature effects, methods for filleting and gutting, use of containers, shelf life of fish and preservation procedures.

Table 1. Total postharvest losses of *O. niloticus* due to size and spoilage in Lake Hashengie.

Month	Year	Total catch (kg)	Discard fish due to Size (kg)	Spoilage (kg)	Total loss (kg)	Total loss (%)
September	2009	613	15.33	67.43	82.76	13.5
October	2009	488	7.32	26.35	33.67	6.5
November	2009	299	3	11.96	14.96	5
December	2009	543	8.15	32.58	40.73	7.5
January	2010	376	6.02	24.06	30.08	8
February	2010	680	17	61.2	78.2	1.5
March	2010	869	21.73	95.59	117.32	13.5
April	2010	384	7.68	38.4	46.08	12
May	2010	434	8.68	45.57	54.25	12.5
June	2010	-	-	-	-	-
July	2010	145	2.9	11.6	14.5	10
August	2010	287	2.87	11.48	14.35	5
Total		**5118**	**100.68**	**426.22**	**526.9**	**8.34**

Table 2.Total postharvest losses of *C. carpio*due to size and spoilage in Lake Hashengie.

Month	Year	Total catch (kg)	Discard fish due to		Total loss (kg)	Total loss (%)
			Size (kg)	Spoilage (kg)		
September	2009	467	42.03	67.43	102.76	22
October	2009	30	1.50	2.10	3.60	12.4
November	2009	33	1.32	1.82	3.14	9.5
December	2009	45	1.80	2.70	4.50	9
January	2010	23	1.27	0.92	2.19	9.5
February	2010	185	14.8	22.2	37	20
March	2010	234	21.06	30.42	51.48	21
April	2010	318	25.44	41.34	66.78	22
May	2010	284	18.46	34.08	52.54	18.5
June	2010	-	-	-	-	-
July	2010	121	8.47	10.89	19.36	16
August	2010	272	8.16	16.32	24.48	9
Total		**2012**	**144.31**	**230.22**	**367.83**	**15.36**

Table 3. Estimated total postharvest losses of O. niloticus and C. carpio in Lake Hashengie

Month	Year	Total catch (kg)	Discard fish due to		Total loss (kg)	Total loss (%)
			Size (kg)	Spoilage (kg)		
September	2009	1080	57.36	128.14	185.5	35.5
October	2009	518	8.82	28.45	37.27	18.9
November	2009	332	4.32	13.78	18.1	14.53
December	2009	588	9.95	35.28	45.23	17.5
January	2010	399	7.29	24.98	32.27	17.52
February	2010	865	31.8	83.4	115.2	31.5
March	2010	1103	42.79	126.01	168.8	35.5
April	2010	702	33.12	79.74	112.86	33
May	2010	718	27.14	79.65	106.79	31
June	2010	-	-	-	-	-
July	2010	266	11.37	22.49	33.86	26
August	2010	559	11.03	27.8	38.83	14
Total		**7130**	**244.99**	**656.44**	**894.73**	**23.70**

From the total annual tilapia (*O.niloticus*) catch (5118 kg), the total post harvest loss constitutes 526.9 kg (8.3 %), of which, 100.7 kg of tilapia was discarded due to size and 426.2 kg due to spoilage (Table 1). From estimated 2012 kg of common carp catch, the pos-tharvest losses were 367.8 kg (15.4%), of which, 144.3 kg was discarded due to size and 230.2 kg due to spoilage (Table 2). Monthly post harvest loss of tilapia ranged from 14.4 kg to 117.3 kg, whereas that of common carp (*C. carpio*) ranged from 2.19 to 102.7 kg. The loss varied significantly ($p < 0.0001$) between months both for tilapia and carp. Post-harvest fish losses were much higher between March and May for both species. During these months the fish catch was also high due to rise in water temperature. As the water temperature increases the fish movement also enhanced and the chance of fish being caught by the gill net is also high. Moreover, the air temperature during February to May is high and this rise in temperature obviously enhances rate of fish spoilage since the fish harvested are not iced immediately at -18°C after catch. The-Post harvest loss also increases as the catch increases due to low storing capacity of the only one freezer available there. The fishers had only one deep freezer with a capacity of holding only 150 kg. During these months' fishers over load the freezer and the cooling rate of the stored fish declines as there was no space for cold air movement and these leads to spoilage.

The post-harvest loss was also high in September, 2009, and this was due to constant power interruption which resulted in high rate of spoilage to the fish even inside the freezer. The fishers do not use blast freezer, chiller, ice or cold storage.The temperature in the freezer does not reach the recommended temperature of -30 °C required for long shelf life of fish. The

shelf life of fish products markedly extends when products are stored at low temperature (Huss, 1995). The main reason for discarding small fish is that there was no market for small size fish. Tilapia and carp, which weigh less than 150g and 250g, respectively, were thrown away in the landing site as there is no demand in the market for small sized fish.

In Lake Hashengie, the fishers use only gill nets with a length of 50 m and a depth of 3 m. They have a total of 8 nets and set only 4 nets at a time. The average mesh size in each net is around 11 cm. The nets were produced in Bahirdar net making center from imported white nylon twine with a standard twine size of 210d/6. The permitted mesh size of gill net is 10 cm.

Immediately after catch, a series of chemical and bacterial changes begin to take place within the fish. If these changes are not controlled, the fish quickly gets spoiled due to bacterial contamination and autolysis (Clucas, 1981). On landing sites the fish are gutted and processed on the ground without any shelter or protection. At no stage in this chain of processing the fish is protected from direct sun, dust and wind. There is no proper fish handling and preserving facilities both on boat and landing sites.

Long fishing hours, as well as, extended period between capture and arrival at landing sites causes spoilage of fish in Lake Hashengie. Fishers usually got to fishing grounds in the morning to set their gears and return the next day or the following morning to collect their catch (24 up to 48 hours fishing time). Research finding in Lake Kariba show that an average of 35% by weight of the total catch spoiled due to bacterial attack and autolysis if nets are set for more than 13 hours in tropical climate without cooling (Mulambozi, 1990). There are no regulations governing quality and standards of fish to be sold for human consumption in Ethiopia. This is evident at landing sites where the quality of fish is mixed. There is no

regular supervision from the government side and the extension service (awareness creation, training, follow up, etc.). The lack of serious demand for good quality fish tends to encourage carelessness of the fishers and processors. Quality assessment of the fish was practiced only organolepticaly and the consumer relies on his own judgment and on trust of the fishermen as there is no government inspection service body.

Table 4. Percentage yield of gutted and filleted fish in three Ethiopian lakes.

Product type	Koka (%)	Ziway (%)	Hashengie (%)	Reference
Tilapia fillet	29-32	25-28	32-36	(Yared *et. al.* 2006; Yared, 2010)
Tilapia gutted	78-80	72-76	74-78	
Carp gutted	80-84	78-82	78-82	

The difference in yield came due to size of the fish and fat accumulation in the stomach. Both fish species in Lake Hashengie contains more fat in their stomach as compared to the other lakes of the country. A study on fish yield by Montaner *et al.* (1994) also showed that the yield varies according to the quality of raw material, the training of the worker, size of the fish and working material and facilities. The price for fish were fixed the whole year. Tilapia and medium size carp sold 4 birr while big size carp sold 8 birr per fish.

To reduce the post-harvest-losses of the fish, the following intervention measures should be in place:

- After harvest, keep the fish in the shade out of direct sun contact and keep the fish in boxes and off the ground:
- Processing must be carried out on tables not on the ground;
- Maintain a hygienic environment and avoid careless handling;
- Construct appropriate processing shade and cooling facilities;

Conclusion

The main causes for post-harvest losses include inadequate handling, processing and storing facilities, delay between catch, collection and distribution, lack of proper fish market channel, absence of regulations governing quality and standards of fish to be sold for human consumption, poor extension services and lack of knowledge on proper fish preserving techniques. Although the extent of the problem varied from lake to lake, the country as a whole loses significant amount of fish annually through post harvest losses. This is a massive economic and nutritional waste, for a country like Ethiopia which suffers from dire protein malnutrition. Fish, being an extremely perishable foodstuff, requires careful handling and processing both from public health aspects and improvement of income of the fishing communities. Hence, concrete measures have to be taken to improve facilities from the point of production until it reaches the consumer.

REFERENCES

Abelneh Yimer, Adamneh Dagne and Esayas Alemayehu (2012). Observations on the limnological features of Lake Hashenge. (in press)

Alverson, D.L., Freeberg, M.H., Pope, J.G., and Muravaski, S.A. (1994).A global assessment of fisheries by-catch and discard FAO Fish. Tech. pp., (339):233.

Brook Lemma (2012). Report on the value chain assessment of the Fishery sector in Ethiopia.TCP / RAF/ 3308 FAO sub-regional office of East Africa, Addis Abeba. 2012

Clucas, I.J. (compiler). (1981). Fish handling, preservation and processing in the tropics: Part 1.*Report of the Tropical Products Institute*, G**144**, V iii+**144**

FAO (1989).Fish technology in Africa.FAO Regional Cooperative research in Africa. Rome.

Geoffrey, R. (1990). The kinds and levels of post harvest losses in African inland fisheries. **In:** proceeding of the symposium on post-harvest fish technology. CIFA Technical paper No 19. Rome, FAO. 1992 (1-9).

Howgate, P. (1994). Proposed draft Guide line for the Sensory Evaluation of Fish and Shell fish.*Cx/FF9 (ital.) 94/0.* Joint FAO/WHO food standards programme.

Huss, H.H. (1995). Assurance of sea food quality. *FAO fisheries technical paper* No. 334.

Montaner, M.I., Parin, M.A., Zugarramudi, A.Y Lupin,H.M.,(1994)Requerimiento insumos enindustria pesquera. Alim., (Espana), (253):19-24.

Mulambozi, (1990). Post harvest fish technology in Zambia. **In:** Proceedings of the symposiumonpost harvest fish technology. Cairo pp.103-106.

Wood, C.D. (1985). A methodology for the assessment of losses of cured fish and evaluation of countermeasures.**In:** Proceedings of the FAOexpert consultation on fish technology in Africa, Lusaka, P.360-368.

Wood, K.B. and Talling, J.F. (1988).Chemical and algal relationship in a salinity series of Ethiopian in land waters.*Hydrobiologia.***158**: 29-67

Yared Tigabu.(2010). Fish post harvest losses and intervention measures to reduce the losses in Koka Reservoir. In: Proceedings of the Second Annual Conference of Ethiopian Fisheries and Aquatic Sciences Association Bahir Dar, Ethiopia. Pp. 192-201.

Yared Tigabu, Abera Degebasa and Ahmed Mohammed. (2006). Kinds and levels of post- harvest losses and the possible ways to reduce the losses in Lake Ziway. ESAP proc. Ethiopian Society of Animal production. Addis Ababa Ethiopia.Pp. 141-148.