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# COMPARISON OF TECHNICAL AND ECONOMIC PERFORMANCE OF FRESH AND SALTED FISH PROCESSORS IN LAKE NASSER

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***Abstract***

However, fish processing in traditional business for long time, the performance of fresh and salted fish processors is not documented. The current study aims to compare the technical and economic performance of salted and fresh fish processing associated with Lake Nasser fisheries. Field interview approach adopted to collect data from twenty two fish processors in Aswan. The questionnaire collected data of socioeconomic of fish processing, inputs and output and allowed for estimation of operational costs and revenue for the processors.

The study revealed that fresh fish processing is attractive business for some university graduates than salted fish processing. Tilapia processing represents 97% and Nile perch represents 1.5% of fresh fish processing by volume. While for salted fish processors, tiger fish (*Hydrocynus* spp.) represent 58 % and *raya (Alestes* spp) represent 35.3% of processed fish. The growth return of fresh fish processing was higher than salted fish. The current study did not test for fish quality and hygiene issues. A breakeven price to cover variable costs is higher in fresh fish processing compared to salted fish. Salted fish generated higher return to investment compared to fresh fish processors.

The study concluded that investment cost in slated fish processing is lower than fresh fish processing. Salted fish processing generated higher return on investment compared to fresh fish processing. Further work in needed to improve return of fresh fish and minimize the impact of fish processing on the environment and ensure safety of product to consumer health.

**Keywords:** Fish processing, tilapia, Lake Nasser, fisheries, salted fish.

## INTRODUCTION

Fish is one of the important traditional components of Egyptian citizen's meal, for its comparative cheap fresh protein. Economic importance of fish include fish as food, fishing industry, aquaculture and fish farming while its recreational importance include fish keeping, recreational fishing and angling.

Lake Nasser is the most important fishery in Upper Egypt, providing an important source of income and livelihood for fishers, traders and processors in Aswan Governorate (Nasr-Allah *et al*., 2016). The lake has a diverse fishery with 52 fish species belonging to 15 families (Van Zwieten *et al*., 2011). Tilapias comprise as much as 75% of the total catch by weight and are sold as fresh fish, while tigerfish and raya are also important and are used as raw material to produce a traditional salted fish product. Other fish species in the catch are Nile perch, squeaker catfish, sharptooth catfish, Bagrus catfish and Nile carp (Nasr-Allah *et al*., 2016). Salted fish (*muluha*) is a product that is unique to Upper Egypt and comes mainly from Lake Nasser. *Muluha* is made from tigerfish (*Hydrocynus* spp.), (*Alestes* spp.), Nile carp (*Labeo* spp.) and other species that cannot be sold as fresh fish.

Official statistics of fish catches from Lake Nasser by species group for the past 12 years are presented in Figure 1. It shows that recorded fish catches declined in the last 5 years mainly due to reduced tilapia and Nile perch catches. Most of the fish caught from Lake Nasser is sold fresh on ice, including species such as tilapia, Nile perch and catfish, while other species, such as tiger fish and *raya* (*Alestes* spp.), are sold salted. There is good market demand for salted fish in Upper Egypt.

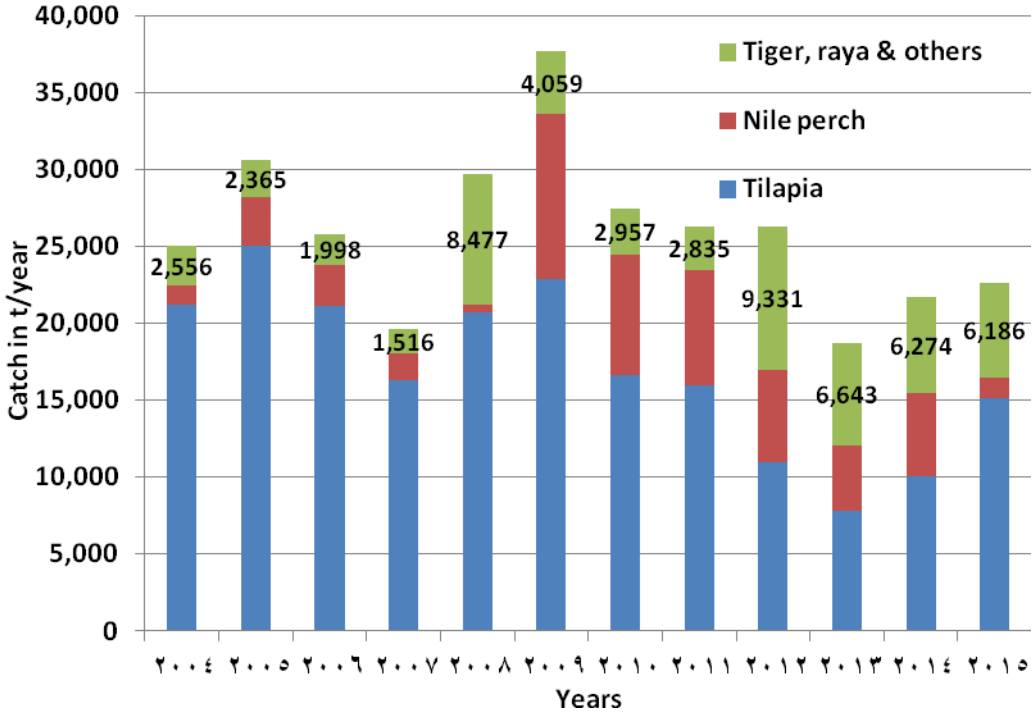



**Figure 1.** Annual trend of catch by fish group from Lake Nasser, 2004–2015. Source: GAFRD (2015).

Preservation starts on the reservoir by cooling with crushed ice in insulated boxes of 10–30 kg capacity. The boxes are stored in refrigerating stores belonging to two companies: Misr-Aswan Company for Fishing and Fish Processing and the Egyptian Company for Fish Marketing (Van Zwieten *et al.*, 2011). Large tilapia and Nile perch are filleted, while small ones are cooled and transported to markets in Egypt (Nasr-Allah *et al*., 2016).

Salting is a fish-preservation method and it is used in many countries of the world (Elmossalami and Sedik, 1972; Barrania, 2000; Bene *et al*., 2009; Kolawole *et al*., 2010; Iliyasu *et al*., 2011; Anihouvi *et al*., 2012; Mostafa and Salem 2015). It is also used in the preprocessing of fish before processing technologies such as smoking, drying, and canning are employed (Kolawole *et al*., 2010 and Anihouvi *et al*., 2012). The main function of salting is the removal of some of the water from fish flesh and its partial replacement by salt. Salting reduces the water activity of fish; hence, microbial and enzymatic

activities are also reduced. The ripening of salted fish is the biochemical process that causes the change in chemical and physicochemical characteristics of the fish tissues. The end of the salting process is the moment when all the fish has reached the required salinity, and acquired the appropriate taste, consistency, and odor. Salted fish processing in Lake Nasser described in detail by Bene *et al*. (2009). *Faseikh* and *Muluha* are a traditional Egyptian salted fish has been considered as a popular part of the Egyptian diet especially in certain celebration times as spring day (Mostafa and Salem 2015 and Nasr-Allah *et al*., 2016). Aswan is famous for production of salted fish (*muluha*) made from particular fish species caught in Lake Nasser. There is good market demand for *muluha* in Aswan and other governorates of Upper Egypt, especially during Easter and Eid celebrations (Bene *et al*., 2009).

Tilapia processing is an important business in Aswan (Barrania, 2000 and Nasr-Allah *et al*., 2016). Also, tilapia fish has excellent nutritional properties: it is high in protein, lipids, vitamins and minerals, besides having a pleasant taste due to its lipid content (Hernández-Sánchez and Aguilera-Morales, 2012). Fish filleting is an important process for preparing a much better fish flesh than dealing directly with whole fish (Hussein, 1990). Tilapia fish fed with (natural food) show higher percentages of dressing (47.7%) and flesh (37.3%) and lower percentage of head (33.3%), viscera (7.7%) and by-products (56.8%). These components, was differences by different feeding treatments (Hafez *et al*., 2000). By-products of tilapia filet processing include fish skin, collagen from inside the skin and fishmeal and fish oil (Fitzsimmons, 2008).

Although the fishery in Lake Nasser has existed for more than 40 years, its economic performance of fish processing in Aswan is not well understood or documented. The aim of this paper is to compare the fresh and salted fish processing performance for Lake Nasser fisheries.

## METHODOLOGY

The work for this study consisted of three main stages: planning, data collection and data entry. The secondary data source for the study is Lake Nasser Development Authority (LINDA) publications, local leader and fishermen association data base. The secondary data sources indicated that fish processors are located in Aswan. The data base indicated that numbers of private salted fish processors establishments in Aswan are sixty and twelve fresh fish factories identified in the study area. Misr Aswan Company is specialized in fresh fish processing. It was excluded as it public company and do not work most of the time, in spite of having large scale facility.

### Preparatory work:

The study carried out the following activities during planning:

1. Design and drafted (in Arabic) questionnaire to be used in the study.
2. Test and revise the questionnaire—adding questions, rephrasing and simplifying wording for the interviewees as appropriate.
3. Translate the questionnaire into English for data entry.
4. Prepare detailed activity and travel schedule and finalized and printed multiple copies of the questionnaire for fieldwork.

Fish processors are based only in Aswan and were usually visited at their site of operation. Twenty three fish processors (fresh and salted processors) interviewed. One fish processor was excluded because he worked in processing of both fresh and salted fish.

### Data entry and analysis:

The responses to the questionnaires were entered into an Excel spreadsheet. Each completed questionnaire was reviewed and checked for validity by the corresponding interviewer. The data was then analyzed to generate the outputs presented in this report.

The main indicator for the economical evaluation was net farm income (NPI) expressed as: NPI = GR – TC

Where:

NPI = Net Processor Income; TC = (TVC + TFC) = $P_x$. X; TC = Total Cost (EGP)

TVC = Total Variable Cost (EGP); TFC = Total Fixed Cost (EGP).

$P_x$ = Unit Price of Input; X = Quantity of Input

GR = $P_y$. Y

GR = Gross Return / processors; $P_y$ = Unit Price of Output; Y = Quantity of Output

Degree of contribution %= (return above variable costs *100) / gross return

Breakeven Price to cover variable expenses = Total operating Cost / Yield

Safety margin % = (average sales price – breakeven price) / average sales price

Safety margin production % = ((yield - BEQ) /yield) *100

Calculation of depreciation costs of equipment was computed using the straight line method (Jolly and Clonts, 1993), where annual depreciation = (Cost – Salvage Value) / Useful life and the salvage value for all equipment was assumed to be zero (Asmah, 2008).

**Operating and fixed costs estimation:**

Operating costs are the costs that vary depending on the amount of fish bought, transportation, ice, fuel, electricity and wages. Fixed costs are the costs that do not vary depending on production volumes. These typically include equipment repair and maintenance and government license fees. Depreciation costs have been estimated by obtaining information on the replacement of fixed assets and depreciation over standardized life spans for each item; e.g. freezers and fridges over 7 years, and fish handling boxes over 3 years.

## RESULTS AND DISCUSSION

**Socioeconomic of fish processors:**

Socioeconomics information of fish processors in Aswan presented in detail in Table 1. The total number of fish processors interviewed was 22, of which 14 were salted fish processors and 8 were fresh fish processors. The overall level of education among fresh fish processors was higher than among

salted fish processors. The percentage of fresh fish processors attaining high and medium levels of education reached 75%, compared with 35% for salted fish processors. In addition, number of years in the business was higher for salted fish processors (21.7) than fresh fish processors (9.9). These observations reflect the traditional nature of salted fish processing, where sons are employed in the family business from a young age. By contrast, fresh fish processing is a newer business, offering more diverse opportunities, and may be attractive to well-educated individuals. Most fish processors did not have access to alternative sources of income other than their fish processing jobs. Almost all interviewed individuals were married and had families consisting of an average of 5.4 and 7.5 members (fresh and salted fish processors respectively). However, approximately one-third of the processors had other sources of income; for example, some owned fishing boats and collected salted fish from their boats or fishers for processing.

**Table 1.** Socio-economic characteristics of fish processors interviewed in this study.

| **General information** | **Salted fish** | **Fresh fish** |
|---|---|---|
| Number interviewed (sample size) | 14 | 8 |
| Average age of respondents | 46 | 44 |
| Maximum level of education attained | | |
| University | 7.1% | 37.5% |
| High school | 28.6% | 37.5% |
| Primary school | 28.6% | 12.5% |
| No education | 35.7% | 12.5% |
| Average years of experience in fish processing | 21.7 | 9.9 |
| % married | 92.9% | 100% |
| Average family size (individuals) | 7.5 | 5.4 |
| Existence of other income source | 35.7% | 25.0% |
| Labor source | | |
| Same governorates | 100% | 91% |
| Other governorates | 0% | 9% |

The average age of fishers in Lake Nasser is 41 years (Nasr-Allah *et al*., 2016). Similarly, in Sudan seventy four percentage of fishermen ranged in age between 35-55 years (Ahmed, 2009). More than 70% of fisheries in Lake Nasser are illiterate or attended primary school only (Nasr-Allah *et al*., 2016). Ahmed (2009) reported that 74 % of fishers in White Nile in Sudan attended primary school or less. Years of experience in fishing in Lake Nasser is higher than processing 24 years in fishing (Nasr-Allah *et al*., 2016) compared to 21 years in slated fish processing in this study. Similarly, Ahmed (2009) reported that 82% of fishers experience in business extends for more than 10 years in Sudan.

**Operational characteristics of fish processing:**

The average operational data for the fish processing in Lake Nasser are shown in Table 2. From the operational data for fish processors in Aswan, it was observed that average sales volume per processor was higher for fresh fish compared to salted fish (98.4 and 70.9 t/year respectively). Basket prices of all fish were also higher for fresh fish (EGP 20.9/kg) compared to salted fish (EGP 13.6/kg). Fresh fish processing focused mainly on tilapia, which represented 97% of species processed. By contrast, Nile perch represented only 1.5% of the total volume (either fillets or degutted) of fresh fish processed. Most tilapia (81.8%) was processed as degutted, while tilapia fillets represented only 15% of processing volume. None of fresh fish processing facility reported developed benefit of by-products. Fitzsimmons (2008) reported that tilapia skin by-product of filleting have become a side industry in Brazil producing wallets, belts, and briefcases.

Salted fish processing focused mainly on *raya* (35%) and different size grades of tigerfish (58%). The obtained result showed that degutted tilapia is the majority of fresh tilapia processed. This can be due to the high rate of catch small size tilapia from the Lake reported by Nasr-Allah *et al*. (2016). Macfadyen *et al*. (2012) in his market study found that hotel purchase only degutted tilapia for hygiene reasons.

**Table 2.** Average operational data for the fish processing in Lake Nasser.

| Operational data | Salted fish | Fresh fish |
|---|---|---|
| Number interviewed (sample size) | 14 | 8 |
| Average annual sales volume (t) | 70.94 | 98.25 |
| Average processing time (day) | 28.4 | 0.6 |
| Processing facility size (m2) | 163 | 176 |
| Peak season | July-October | Jan-April |
| Average FTE/100 t | 5.5 | 5.7 |
| Average sales price (EGP/kg; all species) | 13.6 | 20.9 |
| Sales volume distribution by species and as % of total | | |
| Tilapia fillet (kg) | - | 14,953 (15.2) |
| Nile perch fillet (kg) | - | 513 (0.5) |
| Tilapia, large, degutted (kg) | - | 5,588 (5.8) |
| Tilapia, medium, degutted (kg) | - | 13,650 (13.9) |
| Tilapia, small, degutted (kg) | - | 61,125 (62.2) |
| Nile perch, large, degutted (kg) | - | 375 (0.4) |
| Nile perch, small, degutted (kg) | - | 600 (0.6) |
| Squeaker catfish, degutted (kg) | 1,071 (1.5) | 250 (0.3) |
| Sharptooth catfish, degutted (kg) | - | 375 (0.4) |
| Bayad, degutted (kg) | - | 825 (0.8) |
| Squeaker catfish, salted (kg) | 1,071 (1.5) | - |
| *Raya* or *Alestes* spp. (kg) | 25,071 (35.3) | - |
| Tigerfish, large (kg) | 8,411 (11.9) | - |
| Tigerfish, medium (kg) | 12,643 (17.8) | - |
| Tigerfish, small (kg) | 20,143 (28.4) | - |
| Salted fish, fillet (kg) | 2,529 (3.6) | - |
| Marketing area | | |
| Aswan | 26% | 66.5% |
| Upper Egypt | 50% | 24% |
| Cairo and Delta Cities | 24% | 9% |

Immediate cooling or salting of the catch is more important in tropical conditions because the ambient temperature is high and it leads to rapid spoilage (Jeya Sakila *et al*., 2003). Fish filleting is an important process for preparing a much better fish flesh than dealing directly with whole fish. Fish filleting is easier to prepare, more convenient for the consumer to cook, easier for packing and transportation, especially when the refrigerated space in the transportation means is limited (Hussein, 1990). The current study demonstrate

that fish filleting in Lake Nasser represent only 15.7% from both tilapia and Nile perch in fresh fish processing business. As the catch size declined recently (Nasr-Allah *et al.*, 2016), processors produce degutted tilapia rather than tilapia fillet. Tilapia degut represent the main product in fish processing and represent by volume 82% of total fresh fish processing facility. Waste of fresh fish processing is not utilized by fish processors in Aswan. This can be attributed to the small fish volume of processing waste produced, because of that the processing of fishmeal is not economical. It was reported by processors that selling fish waste to other do not cover transportation cost. For this reason they dump processing waste to the surrounding environment. Fortunately, majority of processed tilapia is degutted and this reduces waste generated by the processing facility.

While most of the fish (all the tilapia and Nile perch) is handled and traded as fresh fish, salted fish (*muluha)* is a product that is unique to Upper Egypt and comes mainly from Lake Nasser. It is important because the fishers can begin processing the fish in their remote camps on the lake. In addition, it is a stable product, which unlike fresh fish does not need to be chilled or transported on ice. Nasr-Allah *et al*. (2016) found that most of processed fresh fish is sold as frozen in Aswan, 67% and 24% is sold to Upper Egypt governorate. While for the salted fish fifty percent of processed fish production is sold in Upper Egypt governorate and 26% is sold in Upper Egypt (Nasr-Allah *et al*, 2016). This can be attributed to the tolerance of salted fish to high temperature in the region. In Northern Sudan salted fish from the same fish species called *fessiekh* (Ahmed, 2009). The authors reported that seventy percentage of *fessiekh* is exported to Egypt.

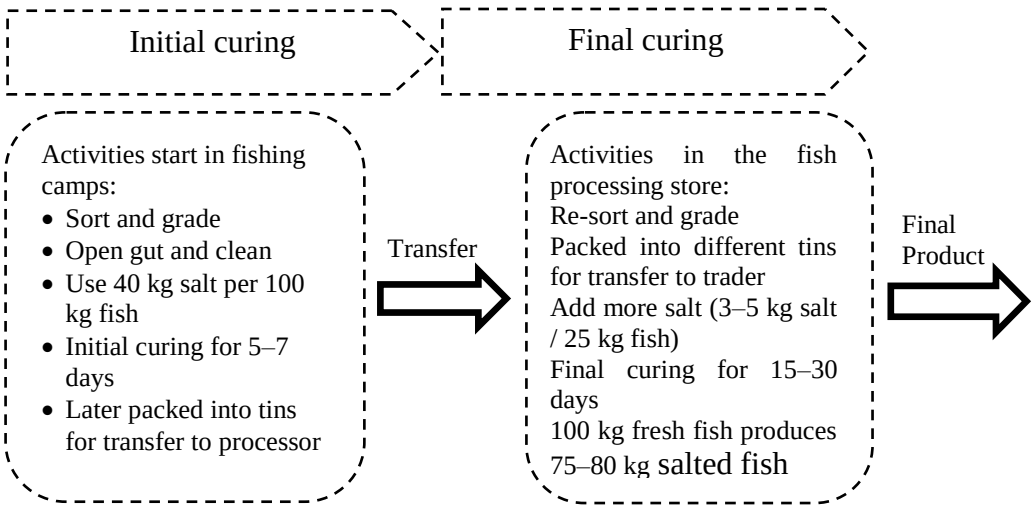
**Salted fish processing in Lake Nasser:**

*Muluha* is fermented salted fish that constitute a part of popular diet in Egypt (Youssef *et al*., 2003). Species of fish used for salting have no market fresh and are consumed only as salted products (Nasr-Allah *et al*., 2016). *Muluha* is made from tigerfish, *raya* (*Alestes* spp.), Nile carp (*Labeo niloticus*) and other species that cannot be sold as fresh fish. This means that fishers can

continue fishing and processing even when they are not being visited by carrier boats or cannot land their fresh fish to shore-based traders. The steps and actors involved in *muluha* processing are described in Figure 2.

The first step of salted fish processing is to open the belly cavity of large fish, remove the gut contents and wash. The fish are then sorted and graded before being spreading on mats in layers with salt spread on each layer at rate of (20 kg salt / 100 kg fish) and cover fish with a blanket or mat to protect them from direct sun. Two to three days after, the moisture level in the fish has dropped and they are ready to be placed in plastic barrels, during which a further 10 kg of salt is added to each 100 kg of fish. Then, after 5–7 days in barrels, the fish are repacked into tins (usually 20-liter cooking oil tins) and again 10 kg of salt is added to each 100 kg of fish. Every 100 kg of fresh fish results in around 80 kg of salted fish product. The salted fish remain in tins for 15–20 days at ambient temperatures. During this time, the fish is transferred to the premises of processing businesses outside the Lake. Upon transfer to processors facility, the fish is re-sorted and graded and replace the salt (around 3–5 kg salt for each 20 kg of fish). The final product from 100 kg of fresh fish is around 70 kg of salted fish (*muluha*), which the processors sell to traders in markets of Aswan, Upper Egypt, or in Cairo and the Nile delta cities.

**Figure 2.** Processing steps of salted fish in Lake Nasser.



Improved salting methods inside cabin were tested by Bene *et al*. (2009). The salting take place inside cabin under hygiene condition. The improved method decreases significantly the proportion of salted fish spoiled during the processing. The study concluded that cost recovery of cabins is two years. Elmossalami and Sedik (1972) reported that there are two methods for fish salting (sand-salted and tin-salted). The authors reported similar processing steps for tin salted fish.

Fermented fish is traditional processing methods in Benin, Ghana and Senegal. Fish processed in these countries are Lanhouin, Momone and Guedj (respectively) (Anihouvi *et al*., 2012). The authors reported that in most African countries, the traditional fish fermentation is carried out in artisanal way and the processing methods seem to be similar from one country to another with however a slight variants. Also, in Sudan the end product of fermenting *Alestes* spp. and *Hydrocynus* spp is called *Fessiekh*, the processing methods is similar to those adopted in Lake Nasser (Ahmed, 2009). While in Egypt, *Feseiekh* (prefermented salted Egyptian fish) produced from one of *Mugilidae* family (EOS, 2005 and Mohamed *et al.*, 2009).

**Comparison of production costs and revenue for processing:**

Budgeting technique can be used to test the profitability of an enterprise. An enterprise budget is a listing of all estimated income and expenses associated with the enterprise to provide estimates of its profitability and performance (Azzazy *et al*., 2012). To facilitate profitability analysis, the budget requires numerical estimates of production, direct costs, and indirect costs. The typical budget format contains three sections: gross returns, variable costs, and fixed costs.

Fish processing is Aswan adopting low technology system to minimize investment costs and due to the viability of low cost labor. The study revealed that, fish purchase represent 88.5% of variable costs in slated fish and 86% in fresh fish processing. Salaries and wages are the second ranked cost items in fish processing. Labor costs in fresh fish processing is higher than salted fish. Labor cost represented 4.7 to 5.0% of variable costs in salted and fresh fish, respectively. The current study result revealed that, variable costs are higher in

fresh fish than salted fish due to the high cost of fish purchase for processing. Similar, fixed costs are higher in fresh fish processing than salted processing due to the high depreciation costs of equipment. The study revealed that fresh fish generates higher net return compared to salted fish processing.

**Table 3.** Budget estimation of fish processing expressed as EGP per ton product.

| Item | Salted fish | Fresh fish |
|---|---|---|
| Revenue | | |
| 1. Growth revenue (EGB/t) | 13,597 | 20,898 |
| Variable Costs | | |
| Fish | 10,702 (93.1) | 16,238 (80.6) |
| Fuel | 29 (0.2) | 108 (0.6) |
| Salaries/wages | 567 (4.7) | 948 (5.0) |
| Salt | 80 (0.7) | 0 |
| Packing material | 27 (0.2) | 117 (0.6) |
| Ice | 0 | 151 (0.8) |
| Water | 13 (0.1) | 24 (0.1) |
| Transportation costs | 52 (0.4) | 276 (1.5) |
| Sales commission | 1 (0.0) | 12 (0.1) |
| Others | 35 (0.3) | 14 (0.1) |
| 2. Sub-total variable costs | 11,506 (100) | 17,888 (100) |
| Fixed costs | | |
| License and Government charges | 21 (0.2) | 42 (0.2) |
| Repair & maintenance | 23 (0.2) | 46 (0.2) |
| Renting | 44 (0.4) | 103 (0.5) |
| Depreciation | | |
| Building | 41 (0.3) | 14 (0.1) |
| Freezing room | 0 | 32 (0.2) |
| Deep freezer | 0 | 16 (0.1) |
| Fridge car | 0 | 37 (0.2) |
| Tools (processing, packing, balances, ice crusher) | 22.1 (14.6) | 35.7 (11.0) |
| Interest | 431 (3.6) | 671 (3.6) |
| 3. Sub-total fixed costs (EGP/t) | 583 (4.8) | 997(5.3) |
| 4. Total costs (EGB/t) (2+3) | 12,089 | 18,885 |
| 5. Net return (EGP/t) (1-4) | 1,508 | 2,014 |

Note: Numbers in parentheses refer to % of total.

MacKenzie (1983) described fish processing as relatively labor intensive. These conclusions were supported by (Anihouvi *et al.*, 2012), who reported that salted fish is low cost methods of fish preservation. Fish purchase represents 75% of operation costs for fish monger in Sudan (Ahmed, 2009). Akinola *et al.* (2006) reported that fish preservation using smoking and drying is common in Niger Delta. The authors attributed that to the less access to electricity by fisheries communities. In Ghana fisheries artisanal value chain, processing adopting one of the five traditional processing methods such as salting, drying, smoking, frying and fermenting (Antwi-Asare and Abbey, 2011). On the other hand, farmed tilapia undertakes degutting and scaling only processing methods (Anane-Taabeah *et al*., 2016).

**Performance Indicators of fish processors:**

The financial performance of fish processors in this study is presented in Table 4. The average value of sales was higher for fresh fish processors than for salted due to higher sales volume and price per kilogram. This contributed to higher overall operating costs. The average net profit as a percentage of sales and the average profit per metric ton were also lower for fresh fish producers due to the higher level of investment associated with these businesses (e.g. freezers and cold storage facilities). But, average operating profit as a percentage of sales was lower than for salted fish producers.

Break even quantity (BEQ) is the output quantity required to cover total production costs so that there will be no profit or losses. The study found that average breakeven production to cover total costs was higher in fresh fish compared to salted fish processing. Similarly, breakeven price to cover variable costs and total costs were higher in fresh fish compared to salted fish. This can be attributed to the higher production costs in fresh fish processing compared to salted fish processing. Production safety margin (PSM) is the percentage by which production can be decreased before the business begins to run at a loss. The estimated coefficients of PSM were similar in both fresh and salted fish processing. However, return above variable costs and net return were higher in fresh fish, return on investment was noticeably higher in salted fish processing.

This is due to higher fixed cost (EGP/t) for fresh fish compared with salted fish. The current study find that average rate of return is 9% for fresh fish compared to 14% in salted fish.

**Table 4.** Comparing of economic performance of fish processors.

| Items | Salted fish | Fresh fish |
|---|---|---|
| Average annual sales value (EGP) | 975,046 | 1,766,025 |
| Average annual sales volume (t) | 70.94 | 98.25 |
| Gross Return (EGP/t) | 13,597 | 20,898 |
| VC (EGP/t) | 11,506 | 17,888 |
| Fixed cost (EGP/t) | **583** | **997** |
| TC (EGP/t) | **12,089** | **18,885** |
| Net Return (EGP/t) | **1,508** | **2,013** |
| Return above VC (EGP/t) | **2,091** | **3,010** |
| Degree of contribution% | 15.0 | 12.8 |
| Annual TR/Annual TC | 1.1 | 1.1 |
| Break-even price to cover VC (i.e. AVC/KG) | 11.5 | 17.9 |
| Break-even price to cover TC | 12.1 | 18.9 |
| Break -Even production to cover TC (t/yr) | 50 | 57 |
| Safety Margin (%) | 29 | 39 |
| Safety Margin Production (%) | 93 | 94 |
| Average Rate of Return | 14% | 9% |

**Job creation and value added in fish processing:**

The data in Table 5 was illustrated that the average annual sales value of sales was higher for fresh fish than salted fish due to higher sales volume and price per kilogram. Value-added processing activities within the Aswan fishery started some time ago with the salting of tigerfish and *raya*. Recently, fish processors started adding value to fresh fish such as tilapia and Nile perch by producing degutted fish and fillets to meet market demand for such products. A summary of benefits generated by the fish processing subsector are summarized in Table 5. Fresh fish processing generated slightly higher FTE/100 t compared with salted fish processing. Both labor costs and output value per metric ton were higher for fresh fish processing. Similarly, operational and net profits were higher in fresh fish processing. Value added calculated from discounting operational and fixed costs, excluding labor costs. Obtained data show that

fresh fish processing generates higher value added per ton (EGP 2962) compared with fish salting processing (EGP 2075/t) due to the high cost of labor in fresh fish processing. Higher value added (EGP 3172/t) was reported for fishers working in Lake Nasser (Nasr-Allah *et al.*, 2016). The authors also reported that fish traders working with the same fish generates lower value added (EGP 2455/t). While for the Egyptian farmed fish higher value added was reported by Nasr-Alla *et al*. (2012).

**Table 5.** Summary of fish processing.

| Items | Salted fish | Fresh fish |
|---|---|---|
| FTE/100 t | 5.5 | 5.7 |
| Output value or basket price (EGP/t) | 13,597 | 20,898 |
| Labour cost (EGP/t) | 567 | 948 |
| Operational profit (EGP/t) | 2,091 | 3,010 |
| Net profit (EGP/t) | 1, 508 | 2, 013 |
| Value added (EGP/t) | 2, 075 | 2,962 |

## Conclusions and recommendations:

In conclusion, salted fish processing is traditional preservation methods used in Lake Nasser for long time. Fish processing technology associated with Lake Nasser fisheries for both fresh and salted fish are quite basic (traditional) technology. None of fresh fish processors reported utilizing by-product of processing and waste can have negative impact on the environment. Investment cost in slated fish processing is lower than fresh fish processing. Salted fish processing generates higher return on investment compared to fresh fish processing. Salted fish processing starts in fishing camp, while fresh fish processing starts in land based facility. Proper fish handle and fishing practices should be adopted to maintain fish quality when reach processing factories. Processors are in need for technical support to improve their processing technology to generate higher income and improve their economic performance.

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## REFERENCES

Ahmed, S. 2009. The economics of fish production and marketing in the White Nile state-Sudan (Doctoral dissertation, M. Sc. thesis, Faculty of Agriculture, University of Khartoum, 68.

Akinola, O.A.; A.A. Akinyemi and B.O. Bolaji, 2006. Evaluation of traditional and solar fish drying systems towards enhancing fish storage and preservation in Nigeria. J. Fish. Int., Pakistan, 1(3-4): 44-9.

Anane-Taabeah, G.; K. Quagrainie and S. Amisah, 2016. Assessment of farmed tilapia value chain in Ghana. Aquaculture international, 24(4), 903-919.

Anihouvi, V.B.; J.M. Kindossi and J.D. Hounhouigan, 2012. Processing and quality characteristics of some major fermented fish products from Africa: a critical review. Int Res J. Biol Sci., 1(7): 72-84.

Antwi-Asare, T.O. and E.N. Abbey, 2011. Fishery value chain analysis—Ghana. Food and Agriculture Organization, Fisheries.

Asmah, R., 2008. Development potential and financial viability of fish farming in Ghana, Ph.D. Thesis. University of Stirling, Stirling, U.K.

Barrania, A., 2000. Harvesting, transporting, processing and marketing of fish, p. 95-97. In J.F. Craig (ed.) Sustainable fish production in Lake Nasser: ecological basis and management policy. ICLARM Conf. Proc., 61: 184 p.

Bene, C.; E.K. Abban; S.H. Abdel-Rahman; S. Ayyappan; R. Brummett; H.R. Dankwa; A.K. Das; O.A. Habib; P.K. Katiha; J. Kolding; N. Obirih-Opareh; J.K. Ofori; M. Shehata; N.P. Shrivastava and K.K. Vass, 2009. Improved fisheries productivity and management in tropical reservoirs. CPWF Project Number 34: CGIAR Challenge Program on Water and Food Project Report series, www.waterandfood.org.

CAPMAS, 2015. Central Agency for Public Mobilization and Statistics Egypt. Egypt in figures. Retrieved from http://www.capmas.gov.eg/indicators.

EOS, 2005. Egyptian Organization for Standardization. Salted Fish, Part: 2 Salted Sardine, Egyptian Organization for Standardization and Quality, Arab Republic of Egypt. No. 1725-2.

Elmossalami, E. and M.E. Sedik, 1972. Studies on sand- and tin-salted fish 'Mugil cephalus'. Zbl. Veto Med. B., 19: 521-531.

Fitzsimmons, K., 2008. Tilapia product quality and new product forms for international markets. In 8th International Symposium on Tilapia in Aquaculture.

GAFRD, 2015. General Authority for Fishery Resources Development. Fish Statistics Yearbook for 2013. Ministry of Agriculture and Land Reclamation, Egypt.

Hafez, F.A.; M.A. Soltan and M.K. Ibrahim, 2000. Effect of organic fertilization, supplementary feeding and stocking rate on carcass and chemical composition of Nile tilapia and silver carp. Egypt. J. Agric. Res., 78(5): 2127-2142.

Hernández-Sánchez, F. and M.E. Aguilera-Morales, 2012. Nutritional Richness and Importance of the Consumption of Tilapia in the Papaloapan Region. REDVET - Revista electrónica de Veterinaria, 13: (6).

Hussein, A.A. 1990. Biochemical studies on fish by-products. M. Sc. Thesis,Faculty of Agriculture, Zagazig University, Egypt.

Jeya Shakila, J.R.; S.K. Vijayalakshmi and G. Jeyasekaran, 2003. Effect of delayed salting and drying on histamine and volatile amines formation in sardines (*Sardinella gibbosa*). SDMRI Research Publication, 3: 64-71.

Jolly, C.M. and H.A. Clonts, 1993. Economics of Aquaculture. Food Products Press, New York.

Kolawole, O.D.; S.B. Williams and A.F. Awujola, (2010). Indigenous fish processing and preservation practices amongst women in Southwestern Nigeria. Indian Journal of Traditional Knowledge. 9(4): 668-672.

Iliyasu, A.H.; J.I. Onu; A. Midau and J.S. Fintan, 2011. Economics of smoked and dried fish marketing in Yola North and South local Government areas of Adamawa State, Nigeria. J. Agric. Soc. Sci., 7: 13–16

Macfadyen, G.; A.M. Nasr Allah and M. Dickson, 2012. The market for Egyptian farmed fish. Study Report. WorldFish Center.

MacKenzie, W.C. 1983. An introduction to the economics of fisheries management. Food and Agriculture Organization of the United Nations.

Mohamed, R.; S.S. Livia; S. Hassan; E. Soher and E.A. Adel, 2009. Changes in free amino acids and biogenic amines of Egyptian salted-fermented fish (Feseekh) during ripening and storage. Food Chemistry, 115: 635– 638.

Mostafa, A.A. and R.H. Salem, 2015. Characterization of microbiological and nutritional variations in processed mullet (*Mugil cephalus*) Fish. International Journal of Microbiological Research, 6(2): 108-122.

Nasr-Alla, A.; G. Macfadyen; M. Dickson; D. Al–Kenawy; M. Fathi and G. El-Naggar, 2012. Value chain analysis of the Egyptian Aquaculture sector. Proceedings of IIFET Conference in Tanzania from 16 to 20 July 2012. Tanzania.

Nasr-Allah A. M.; O.A. Habib; M. Dickson and C. Dickson, 2016. Value chain analysis of Lake Nasser fisheries in Aswan, Upper Egypt. Penang, Malaysia: WorldFish. Program Report, 2016-11.

Van Zwieten, P.A.M.; C. Béné; J. Kolding; R. Brummett and J. Valbo-Jørgensen, 2011. Review of tropical reservoirs and their fisheries – The cases of Lake Nasser, Lake Volta and Indo-Gangetic Basin reservoirs. FAO Fisheries and Aquaculture Technical, Paper No. 557. Rome: FAO. 148 pp.

Youssef , M.S.; N.F. Abo-Dahab and R.M. Farghaly, 2003. Studies on Mycological Status of Salted Fish "Moloha" in Upper Egypt. Microbiology, 31(3): 166-172.

# مقارنة الأداء الفنى والاقتصادى لمصنعى الأسماك الطازجة والمملحة في بحيرة ناصر

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## الملخـص العربـى

على الرغم من ان تصنيع الاسماك يعتبر من الأعمال التقليدية المرتبطة بعمليات صيد الاسماك فى بحيرة ناصر منذ زمن بعيد ، الا انة لم يتم توثيق أداء المصنعين للأسماك الطازجة (الفيليه) والمملحة. ولذلك تهدف الدراسة الحالية إلى مقارنة الأداء الفني والاقتصادي لتصنيع الأسماك المملحة والطازجة المرتبطة بمصايد أسماك بحيرة ناصر. اجريت مقابلات ميدانية لجمع البيانات لاثنين وعشرين من مصنعى الأسماك في أسوان. تم تجميع البيانات من خلال الاستبيان عن عمليات التصنيع والجوانب الاقتصادية والاجتماعية لتصنبع الأسماك ومدخلاتها ومخرجاتها والتى أتاحت تقدير تكاليف التشغيل والإيرادات للمصنعين.

أوضحت الدراسة أن تصنيع الأسماك الطازجة هو عمل جاذب لخريجى الجامعات مقارنة بتصنيع الأسماك المملحة. يمثل تجهيز اسماك البلطي 97٪ واسماك قشر البياض 1.5٪ من حجم الاسماك التى تصنع طازجة، ينما يمثل كلب السمك 58 ٪ واسماك االراية 35.3 ٪ من حجم الاسماك المملحة. كما ان العائد من الاسماك الطازجة أعلى من الأسماك المملحة. الدراسة الحالية لم تختبر جودة الأسماك ونظافتها. وقد افدت الدراسة بان تغطية التكاليف المتغيرة أعلى في الأسماك المصنعة طازجة مقارنة بالأسماك المملحة. ولذا فان الأسماك المملحة تعطى عوائد استثمار أعلى مقارنة بالأسماك الطازجة. وخلصت الدراسة إلى أن تكلفة الاستثمار في تصنيع الأسماك المملحة أقل من تصنيع الأسماك الطازجة. وان إنتاج الأسماك المملحة يعطى عائد استثمارى اعلى مقارنة بتصنيع الأسماك الطازجة. وتوصى الدراسة بمزيد من الابحاث على جودة المنتج وتعظيم العائد من تصنيع الاسماك، وان تقليل تأثير تصنيع الأسماك على البيئة يحتاج مزيد من العمل لضمان سلامة المنتج والحفاظ على صحة المستهلك.