Evaluating the different procedures for preserving fish in Rivers State, Nigeria

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Abstract. A survey was carried out in all the twenty three (23) Local Government Areas of Rivers State to evaluate the different methods of fish preservation in the State. The required information was collected by the use of questionnaires and direct interviews with the fish farmers and traders. The study holds that gender difference influenced approach to fish business, and that respondents are faced with problems which include lack of record keeping and finance. Others are inability of the State Government to introduce modern methods of fish processing/preservation techniques and proper management of fish business. If these innovations are introduced to farmers, there will be improvement in production, curtail spoilage and boost fish preservation in Rivers State.

1. Introduction

Fish preservation is a the technique of elongating the storability of fish and such other products using the principles of science and technology so as to enhance products desirable attributes [1]. As the population of the World is growing, there is an increasing demand for production, storage and transportation of food from one location to another hence preserving of the quality of the food is important to enhance shelf life, flavour, nutritional value and texture [2]. It should therefore be noted that excellent food storage technique must eliminate microbial and fungal damage with no effects on food quality and the nutrients therein. It is necessary to note that the fish harvesting method affects the quality and utility of fish as it moves along the processing line [3]. Wrong fish harvesting method causes mechanical damage to the fish, create stress as well as predispose the fish to deterioration immediately after death [3]. Fish is prone to spoilage in a situation where there are no provision for preservation and storage facility [4 and 5]. As the fish is caught it dies, followed by a lot of microbial and physiological changes aimed at degrading the fish quality [6]. Physiological, microbial and chemical deterioration account for a loss of 25% of gross primary agricultural and fishery product every year [7]. Taking an overview of World’s fishery it has been estimated that about 30% of landed fish [8] and (25%) of the world’s fish supply [9] perished due to microbial deteriorative action alone. Also about 4 – 5 million tonnes of trawled fish and shrimp
perish on yearly basis as a result of microbial and enzymatic spoilage due to lack of onsite storage facility [10].

Optimal preservation and storage of fish enhances better use of the fish and their allied product which is a key way to profitability in fish value chain. The preservation of fresh water fish like other food raw materials must ensure health and safety, best market quality, durable product, use the most effective preservation method and completely eliminate waste. [3] (Davis and Davis, 2009). Reports of high incidences of fish losses has been a major constrain to government objective at increasing the contribution of this sector to the overall growth of the Nigerian economy [11]. Eyo [12] in his report said that there is sufficient fish harvest in the dry season, moreover during this period streams, lakes, ponds and rivers had reduced water level for comfortable harvest. It is well understood that period of scarcity of fish is often in the rainy season; therefore it is necessary to process and preserve the fish caught during periods of abundance to ensure availability throughout the year. This practice will help to reduce post-harvest losses, increase shelf life and ensure sustainable supply of fish at all season with increased profit to the fish farmers. There are different types of fish preservation method namely; sun-drying, smoke drying, freezing, chilling and brining [13]. The methods listed are useful in preserving the quality of fish thereby increasing shelf life. The methods have a specific function of inhibiting metabolic changes that can lead to spoilage as it controls specific parameters of the fish or its environment Such parameters are temperature, water activity, microbial activity, chemical and enzymatic activities.

It is obvious that some fishermen spend more time in the creeks making surplus catches. These huge catches are auctioned to retailers due to difficulty encountered, such as proximity and preservation. In spite of government’s effort at providing education to various segments of the society in the state, fish business is seriously affected by low literacy level. Also skill acquisition programs do not give credence in the area of fish processing. Moreover lack of record keeping is endangering the quest for improvement as a result of ignorance on the part of fish farmers.

These have given rise to poor technological advancement in the use of modern facilities in fish preservation. Due to lack of mechanized system of fish preservation, there has been limited supply of fish in the market thus, making it unaffordable to the masses to meet their nutritional demand. Refrigeration, drying, and other modern ways of fish preservation are affected by lack of constant power supply. Lack of funding from government to increase the capital base of local fishermen is a contributing factor affecting fish preservation in riverine communities especially in Rivers State of Nigeria. Chilima [14] asserted that fish contributes very significantly to the survival and health wellbeing of an important part of the World’s population hence it is most essential in a developing world. Fish provides essential nourishment, especially quality proteins and fats, (macronutrient), vitamins and minerals (micronutrient) [3, 14]. Evidently some people take part in fish trade and aquaculture which provides a source of income and is used to gather for the needs of the family. As known for ages fish is soft, cooks easily and highly digestible when compared with meat as young children can be fed with it thereby contributing to better nutrient intake. [14]. Okeke and Ewelukwa [15], stated that, despite the fact that fish is rich in protein and minerals (iodine, calcium and potassium), it is used in preparing medicine, tonics, soap, polishing materials, fish manure, fish meal for livestock, fish ornament, bone meal, fish scales, fish oil which are by-products of fish. According to Barry [16], omega 3 fatty acids are derived from fish oil. Omega 3 fatty acids are another form of fish oil thus providing a pure form of fatty acid without side effect on health. Researchers also believe in omega 3 fatty acid to provide exceptional health advantage in treating chronic disease, enhancing athletic performance and improving emotional state of the mind. It is able to achieve this by reduction of inflammation and increase of blood flow to the whole body and brain. Also helps to treat a variety of health problems like heart disease, malnutrition in children and also for pregnant women.

Momoh [17] asserted that most agricultural products emanating from Nigeria including fish are lost due to absence of storage /preservation facilities though different techniques have been developed in Nigeria to preserve and store fish. According to [2], there is a method that is
improvise to restrain or minimize the metabolic changes which can predispose fish to spoilage by controlling specific activities of the fish and/or its environment. These methods are aimed at the control of water activity, microbial load, temperature, chemical and enzymatic activity, the control of o xo–reduction potential and combination of several preservation techniques. Van Pel [18] asserted that those involved in fish preservation but deficient in modern preservation equipment will show adequate interest in fish curing techniques. The four main techniques of fish curing are salting, drying, smoking and cooking. Leefrancesemery [1] stated that fish preservation is a method of extending the shelf life of fish and other fishery products and also applying the scientific and the principles of engineering in order to improve the quality of the products. He also stated that preservation methods help to maintain the quality of fish for a longer period of time, also described methods of fish processing which includes; curing, icing, freezing, canning, and the use of additives or chemicals and irradiation. Akinola et al., [13] in their work asserted that different preservation method exist including drying, smoking freezing, chilling and brining. They concluded by saying that the only prominent fish preservation method in Niger Delta region of Nigeria is smoke-drying which resulted from the fact that most fishing community do not have access to electricity not to mention other preservation facilities such as cold storage. Moreover it is on record that electricity in Nigeria is becoming an unreliable power source for fish preservation.

Davies and Davies [3] asserted that a study carried out in Bayelsa State of Nigeria, revealed that fish processing is still predominantly done manually in the country. Most of the fish processing centers studied, use drum oven and mud oven for smoke-drying. The improved modern technology, use of electricity for electric dryer, chorkor kiln and methane gas fired oven were not used at all in all the various processing centers. Igben [19] declared that the technical aspect of technology involved the harnessing and use of machines, tools and equipment to produce goods and services are not available in the area. The deployment of advance technology in terms of fishing machinery, techniques to enhance effective harvesting, storage and handling cannot be overemphasized especially now that aquaculture is fast spreading across the nation [20]. Following improvement in technology fresh fish can be stored for a long period of time without a reasonable loss of quality. In Nigeria, the level of mechanization of fish processing techniques is poor which gives rise to overall low production, periodical availability of fish, poor information outreach to fish farmers on the available improved technology and lack of inexpensive equipment for processing and storage of various fish [3]. Davies, [21] suggested adopting the correct processing technologies to enhance adequate use of raw material thus contribute to increase economic profitability in the fish value chain. From the standpoint of mechanizing fish processing techniques, much attention has been drawn to national agricultural research to give much interest and resources to improve this sector of the economy, thereby minimizing drudgery, reduce labour, curb unsanitary and unhygienic handling of operations normally done manually [3]. The role of the human factor in the process of economic growth is well recognized. For this reason, Schultz, [22] enunciated the concept of human capital development. For any country to acquire the necessary human capital, education becomes the tool for training of the labour force. The ultimate aim of such education is to ensure that a majority of the populace, both old and young enjoy the ability not only to read and write but also to analyze complex situations. Those apparently involved in fish business, are the rural people who may not have been opportune to gain access into the primary, secondary and tertiary institution. Igben [19] based on available evidence suggested that literacy can be achieved through formal or informal education. Davies and Davies, [3] reported that the educational attainment of the fish processors, affects capital outlay, investment and adoption of mechanization of fish industry.

2. Research Methodology
2.1 Area of study
Rivers State came to existence in 1967 after creating it from the then eastern region of Nigeria. Rivers State lies within the Niger Delta region of Nigeria on the West African coast border
of the Atlantic Ocean and has Port Harcourt as its State capital. Currently, Rivers State is made up of 23 local government areas (LGA) and constitutes the study area. Rivers State is endowed with a peculiar and favourable habitat for fish farming. This is supportive of the great extent in housing both fresh and salt water. Five communities were selected in each of these LGA. Rivers State has a favorable landscape suitable for fish farming. It becomes easy for any researcher to reach out with the necessary information for the desired result. The population of study is made up of those involved in fisheries aquaculture and fish trade in five communities each of the 23 LGA in Rivers State. The sample size is made up of 1,725 fishermen and 1,725 fish traders drawn in a randomized sample procedure, in Rivers State. The use of simple random sampling technique is to give each member of the target population equal chances of being selected.

3. Results and Discussion
All the third tiers of government in Rivers States were covered in this work; of the three thousand four hundred and fifty (3,450) questionnaires that was administered to fish farmers and fish traders in selected communities in Rivers State in the various LGA. One thousand two hundred and thirty eight (1,238) were accessible and rightly filled, representing 36% response rate. Hence our analysis would be centered on the one thousand two hundred and thirty (1,238) rightly filled questionnaires. The study revealed that 52% out of the 23 LGA of Rivers State has both fresh and salt water respectively for fishing.

3.1 Data analysis
To ascertain the number of male and female participants involved in fish business in selected communities of the 23 LGA of Rivers State, a total of 515 respondent representing 41.6% indicated male while 723 respondents representing 58.4% indicated female that are involved in fish business. To display the age brackets of fish farmers and fish traders in the selected local areas of Rivers State, a total of 215 respondents representing 17.4% indicated 15-29 to be their age bracket. 564 respondents representing 45.6% indicated 21-40 to be their age brackets while 459 respondents representing 37.1% showed their age to be above 40 years.

In order to determine the type of water body common in the area, a total of 271 respondents, representing 21.9% indicated salt water, 323 respondents representing 26.1% indicated fresh water while 644 respondents representing 52% indicated both in the type of water body common in the area of study.

To determine the traditional method of fish preservation most prevalent, a total of 110 respondents representing 8.8% were identified with smoke drying, 321 respondents representing 26% were identified with sun-drying while the 195 respondents representing 16% were identified with cooking whereas 612 did not respond to any of the options with a percentage of 49.4%

To determine the number of respondent on various preservation techniques, a total of 380 respondents representing 30.6% indicated mud oven, 103 respondent representing 8.3% indicated open dug pit, 38 respondents representing 3.1% indicated rafter 242 respondents representing 19.5% indicated sun-drying, 1 respondents representing 0.1% indicated gas oven while 474 respondents representing 38.5% did not indicate any preservation technique.

To determine the extent, in the use of energy source in preservation, a total of 305 respondent representing 24.6% indicated electricity, 617 respondents representing 49.8% indicated firewood, 92 respondent representing 7.4% indicated saw dust, 148 respondents representing 12% indicated wood shaving in the use of energy source of fish preservation whereas 76 respondents representing 6.13% did not indicate any option for energy source for fish preservation.

To determine the extent of participation in method of preservation, a total of 632 respondents representing 51% identified various preservation methods to be a good, 284 respondents representing 23% identified various preservation methods to be at a moderate level while 322 respondents representing 26% identified the various preservation methods to be poor.
### Table 1. Fish Preservation in Rivers State

| LGA             | Method of preservation adopted | Traditional method most common: Smoking | Duration from time of catch to time of preservation (hours) | How much spoilage incurred | Cost estimate of spoilage Per month | Technology used (Drum oven) % | Source of energy most prevalent (Firewood) % |
|-----------------|--------------------------------|----------------------------------------|------------------------------------------------------------|-----------------------------|-------------------------------------|------------------------------|-----------------------------------------------|
| Ogba Egbema Ndoni | 30                             | 3.63                                   | 25 6.08 24 3.92 18 2.44 37 7.38 26 3.00 10,00 0 2.73 12 3.16 15 2.43 |
| Ahoada West     | -                              | -                                      | -                                                          | -                           | -                                   | -                           | -                              |
| Ahoada East     | -                              | -                                      | -                                                          | -                           | -                                   | -                           | -                              |
| Emohua          | 72                             | 8.71                                   | 45 10.95 40 6.54 30 4.07 87 17.36 68 7.79 38,00 0 10.35 28 7.37 39 6.32 |
| Ikwerre         | -                              | -                                      | -                                                          | -                           | -                                   | -                           | -                              |
| Okechi          | -                              | -                                      | -                                                          | -                           | -                                   | -                           | -                              |
| Omuma           | -                              | -                                      | -                                                          | -                           | -                                   | -                           | -                              |
| Asaru-Toru      | 40                             | 4.84                                   | 18 4.38 30 4.90 28 3.80 30 6.00 38 4.35 12,00 0 3.27 16 4.21 22 3.56 |
| Degema          | 34                             | 4.11                                   | 15 3.65 15 2.45 29 3.93 20 4.00 32 3.66 6,000 1.63 14 3.68 28 4.54 |
| Asaru-Toru      | 67                             | 8.10                                   | 32 7.78 47 7.68 62 8.41 37 7.38 80 9.16 21,00 0 5.72 31 8.16 43 6.97 |
| Okirika         | 67                             | 8.10                                   | 27 6.57 29 4.74 40 5.43 54 10.77 62 7.10 23,00 0 6.27 21 5.53 38 6.16 |
| Port         | Frequency | %    | Frequency | %    | Frequency | %    | Frequency | %    | Frequency | %    | Frequency | %    | Frequency | %    | Frequency | %    | Frequency | %    |
|--------------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|-----------|------|
| Port Harcourt| 66        | 7.98 | 46        | 11.19| 56        | 9.15 | 75        | 10.18| 37        | 7.38 | 82        | 9.39 | 16,000    | 16.00| 4.36      | 4.36 | 39        | 10.26 |
| Eleme        | -         | -    | -         | -    | -         | -    | -         | -    | -         | -    | -         | -    | -         | -    | -         | -    | -         | -    |
| Ogbololo     | 49        | 5.93 | 23        | 5.60 | 38        | 6.21 | 69        | 9.36 | 3         | 0.60 | 44        | 5.04 | 8,000     | 8.00 | 2.18      | 2.18 | 28        | 7.37 |
| Khana        | 49        | 5.93 | 19        | 4.62 | 32        | 5.23 | 53        | 7.20 | 15        | 3.00 | 62        | 7.10 | 11,000    | 11.00| 3.00      | 3.00 | 29        | 7.63 |
| Opobo-Nkoro  | 50        | 6.05 | 21        | 5.11 | 77        | 12.58| 62        | 8.41 | 9         | 1.80 | 66        | 7.56 | 20,000    | 20.00| 5.45      | 5.45 | 26        | 6.84 |
| Bonny        | 76        | 9.18 | 48        | 67   | 10.95     | 102  | 13.84     | 22   | 4.40      | 90   | 10.31     | 10.31| 48,000    | 48.00| 13.08     | 13.08| 34        | 8.95 |
| Obio Akpor   | -         | -    | -         | -    | -         | -    | -         | -    | -         | -    | -         | -    | -         | -    | -         | -    | -         | -    |
| Akuku-Toru   | 52        | 6.29 | 19        | 51   | 8.33      | 60   | 8.14      | 11   | 2.20      | 85   | 9.74      | 9.74 | 39,000    | 39.00| 10.63     | 10.63| 28        | 7.37 |
| Oyigbo       | -         | -    | -         | -    | -         | -    | -         | -    | -         | -    | -         | -    | -         | -    | -         | -    | -         | -    |
| Saakpenwa    | 62        | 7.49 | 23        | 28   | 4.58      | 47   | 6.38      | 38   | 7.58      | 72   | 8.25      | 8.25 | 8,000     | 8.00 | 2.18      | 2.18 | 27        | 7.10 |
| Andoni       | 71        | 8.59 | 30        | 57   | 9.31      | 32   | 4.34      | 69   | 13.77     | 35   | 4.00      | 4.00 | 90,000    | 90.00| 24.52     | 24.52| 31        | 8.16 |
| Gokana       | 42        | 5.07 | 20        | 21   | 3.43      | 30   | 4.07      | 32   | 6.38      | 31   | 3.55      | 3.55 | 17,000    | 17.00| 4.63      | 4.63 | 16        | 4.21 |
| Total        | 827       | 100  | 411       | 512  | 100       | 737  | 100       | 501  | 100       | 873  | 100       | 367,000 | 100       | 380  | 100       | 617  | 100       |

Source: Field Survey 2019
3.2 Discussion of findings

This study was undertaken to discuss the evaluation of fish preservation in the 23 LGA of Rivers State. Considering the first research question, more women were involved in fish business than men. It was also discovered that fishing in the creeks are dominated by men while the women do more of trading. Preservation becomes a major problem to these traders who at the end of the day will not want to incur losses due to spoilage. The study revealed that more female was involved in fish business due to their wide range of activity in marketing and purchase on wholesale before preservation. Other findings ascertained that the age range from 21-40 were more prominent than others in the fish business. The ages between 21-40 tend to be physically strong to indulge in the strenuous exercise in the course of preserving their catches. Others are constrained to assist their aged parents in the fish business.

Respondents declared smoke drying to be the most prevalent in the traditional method of fish preservation. The study equally revealed that the sex of the respondents male or female is significant in the approach to traditional method of fish preservation. Respondents’ interest on modern method of preservation was not encouraging due to the poor supply of electricity and unavailability of modern facilities.

Traditional method which is the primitive system becomes more accessible. Drum oven is taking the lead with 30.7% amongst others. The energy source, firewood is also taking the lead with 49.8% as indicated by respondents. From the study, it is obvious that the oven system is most preferred due to the availability of its energy source and reliability in preserving their catches against spoilage. The study also revealed that the rating of government support to fish preservation is insignificant. Government interest is not sufficiently high concerning fish business and thus; promoting the use of ancient system of fish preservation.

4. Conclusion and Recommendations

4.1 Conclusion

This study was an empirical investigation into the evaluation of fish preservation techniques in the twenty three LGA of Rivers State of Nigeria. In process of this investigation, it was found out that more females were involved in fish business than the men (58.4%) and 41.6% respectively. The ages of 21-40years were more prominent. Findings also showed that Rivers State has both fresh and salt water coastal areas suitable for fishing. The fish farmers practiced more of the traditional method of fish preservation than the modern method. The most preferred traditional method of preservation is the smoke drying and the level of sex influence on smoke drying is insignificant as compared to other traditional method type.

According to respondents, drum oven is dominating among the various preservation techniques and the energy source most common is firewood. Government support to fish business is low as preservation has not gained much impact in government assistance. The extent of participation in various traditional preservation methods is great, respondents averred that the traditional method is gaining much recognition than the modern method due to lack of electricity and funds.

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4.2 Recommendations

In course of the study, it was gathered that the fish farmers and traders practice more of traditional method of fish preservation due to poor state of technological advancement and lack of capital. There is need for government support by giving incentives and aggressive use of media to train and persuade those in fish business into practicing the modern method of fish preservation. Those in fish business should be introduced to proper record keeping for further improvement.

Also, to compliment the extent of involvement in these traditional methods of preservation and reduce fatigue, fish farmers and traders should modernize the oven method of preservation.
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