

AN ANALYSIS OF FISH PROCESSING METHODS AMONG FISHER FOLKS IN CROSS RIVER STATE

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Abstract

This study analyzes fish processing methods among fisher folks in Cross River State. The main objective of this study was to; assess the distribution of respondents based on socio-economic characteristics, highlight the methods used for fish processing ascertain the effect of processing methods on the productivity; and to determine the effect of fish processing methods on the health status of processors. The population of the study comprised of the fisherfolks in the coastal communities in Cross River State. The study adopted multi-stage sampling technique to realize a sample size of 165 respondents. Data for the study were collected using structured questionnaire, administered by the researcher. Data obtained were analyzed using descriptive statistics such as frequency counts, percentages, mean and standard deviation, and inferential statistics tool such as multinomial logistic regression. The results of analysis on the socio-economic characteristics revealed that majority of the of the processors (78.1%) were female. It was equally revealed that a large proportion of processors (64.1%) were within the age bracket of 30-39 years and many of them were married (37.5%). It was found that smoking using red clay oven (97%), smoking with cylindrical drum/wire mesh (92%) and boiling and frying (78%) were some of the widely used processing methods in the area. Similarly, eye problems (93.8%), attacks by predators (100%), burns (96%), internal heat (60.9%) and respiratory tract infection (98.4%) were some of the effect of processing methods on the health status of the respondents. The study concludes that smoking using charcoal oven improves the market value and quality of the fish, while the use of smoking kiln was associated with improved shelf-life of the fish. And recommended that government and agricultural organization should encourage the participation of higher degree holders in the fish processing value chain in other to improve the knowledge and practise in the enterprise, as well as improve the educational capacity of fish processors in the study area.

Keyword: *Fish Processing Methods, Fisher Folks in Cross River State, Effect of Processing Methods, Health Status of Processors*

Background of the Study

Fish remains one of the most important sources of animal protein globally, particularly in developing countries where it contributes significantly to food security, income, and livelihoods (Kingsley et al., 2022). In Nigeria, fish plays a vital role in household nutrition due to its affordability compared to other protein sources such as beef and poultry. The demand for fish has increased consistently with the country's rising population, yet post-harvest losses remain a persistent challenge, especially in rural fishing communities. Cross River State, with its extensive inland water bodies and coastline, is a major hub of artisanal fisheries in Nigeria. However, the perishable nature of fish necessitates effective processing methods to reduce losses and ensure continuous availability for both domestic consumption and market supply (FAO, 2022). Fish processing encompasses a range of methods aimed at extending shelf life, maintaining quality, and enhancing food safety. These methods vary by

geographical location, cultural practices, resource availability, and socioeconomic conditions of fishing communities (Nwuba et al., 2022). Understanding the various methods employed by fisher folks is essential for designing interventions that improve fish preservation and reduce post-harvest losses. The methods employed for fish processing directly influence the productivity of fisher folks by determining the quantity and quality of fish available for sale. Inefficient or unhygienic processing can result in spoilage, contamination, and reduced market value, thereby decreasing income for fishing households (Mulokozi et al., 2020). Conversely, improved methods can enhance product quality, expand market reach, and strengthen household economic resilience. In Cross River State, where artisanal fisheries support a significant proportion of rural livelihoods, examining the methods in use provides insights into productivity outcomes and economic implications for fisher folks. In addition to productivity, fish processing methods have implications for the health of processors. Traditional smoking methods, for instance, often expose women and children to prolonged periods of heat and smoke inhalation, which can lead to respiratory problems, eye irritation, and other health risks (Adeleke et al., 2020). Similarly, handling fresh fish without adequate protective equipment increases the risk of cuts, infections, and exposure to pathogens. The health effects of these practices are often overlooked in fisheries research, yet they represent an important dimension of rural livelihoods and sustainability. Assessing the health implications of processing methods provides a more holistic understanding of fisheries development challenges in the state.

Studies across Africa have highlighted the importance of fish processing in bridging the gap between production and consumption. In Egypt, Nigeria, and Uganda, for example, aquaculture and artisanal fisheries have grown significantly, yet post-harvest handling remains a bottleneck (Adeleke et al., 2020). Within Nigeria, the Federal Ministry of Agriculture and Rural Development has recognized this challenge and developed strategies such as the National Aquaculture Strategy to promote efficient fish processing and marketing systems. Despite such initiatives, fisher folks in rural areas like Cross River State continue to rely heavily on indigenous methods that may not align with modern health and food safety standards. Economically, fish processing provides an avenue for value addition, job creation, and poverty reduction in fishing communities. When properly managed, processing can contribute significantly to household income, particularly for women who are often more involved in post-harvest activities (Abdullahi et al., 2022). A study in Tanzania demonstrated that rural aquaculture and processing improved household livelihoods and food security by diversifying income sources (Mulokozi et al., 2020). This underscores the potential of improved fish processing practices to transform rural economies in Nigeria if given the necessary support in terms of training, infrastructure, and technology. The nutritional importance of fish further justifies the need for effective processing. Fish provides essential micronutrients such as calcium, iron, zinc, and omega-3 fatty acids, which are crucial for maternal and child health (Kingsley et al., 2022). However, nutrient loss can occur during poor processing, compromising the dietary contribution of fish to vulnerable groups. Traditional methods such as over-smoking can also alter taste and texture, affecting consumer acceptance. Therefore, the methods chosen by fisher folks not only impact household income but also the nutritional well-being of consumers in Cross River State and beyond. Recent reviews indicate that integrating modern fish processing technologies with traditional practices can enhance both quality and safety (Babatunde et al., 2021). Such innovations include improved kilns, solar dryers, and cold storage facilities. However, adoption of these methods is often limited by factors such as cost, lack of awareness, and inadequate extension services (FAO, 2022). Bridging these gaps requires targeted interventions that account for local realities while introducing scalable and sustainable technologies.

Given the socioeconomic and health implications of fish processing in Cross River State, an analysis of the methods used by fisher folks becomes timely and relevant. This study is designed to address three specific objectives: first, to identify the methods currently used for fish processing; second, to examine the effect of these methods on fisher folks' productivity; and third, to assess the health effects of fish processing practices on the processors themselves. By addressing these objectives, the research provides empirical evidence that can guide policy interventions, promote sustainable livelihoods, and safeguard the well-being of fisher folks in Cross River State.

Fish is one of the most important sources of animal protein in Nigeria, contributing significantly to household nutrition and livelihoods. In Cross River State, fishing remains a major occupation for many riverine communities, where processed fish provides both food security and income. However, fish is highly perishable, and without proper processing and preservation, post-harvest losses can reach up to 30–40% in some regions (FAO, 2022). Traditional methods such as smoking, drying, salting, and frying remain the dominant practices, but they are often associated with inefficiencies, poor quality products, and health risks to processors due to smoke exposure and unhygienic conditions (Nwuba et al., 2022; Kingsley et al., 2022). Despite the importance of fish to rural households, most studies on aquaculture and fisheries in Nigeria and Africa have concentrated on production, market access, and income generation (Adeleke et al., 2020; Mulokozi et al., 2020), with limited emphasis on post-harvest processing practices. While Babatunde et al. (2021) and Abdullahi et al. (2022) have highlighted economic opportunities in aquaculture and fish production systems, less attention has been given to the methods of processing fish and their direct implications for both productivity and the health status of fisher folks. This gap is critical, as improper processing reduces both the market value and nutritional quality of fish, undermining the food security benefits that aquaculture and capture fisheries are meant to provide. Therefore, this study seeks to address this gap by analyzing the fish processing methods used among fisher folks in Cross River State. Specifically, it will examine the socio-economic characteristics of fisher folks, the types of processing methods adopted, evaluate the effects of these methods on productivity, and assess the potential health risks associated with different processing practices. This analysis is essential for identifying safer, more efficient, and more sustainable fish processing practices that can improve income, reduce losses, and safeguard the health of rural fishing communities (Kingsley et al., 2022).

Objectives of the Study

The objectives of the study include the following, to;

1. assess the distribution of respondents based on socio-economic characteristics
2. highlight the methods used for fish processing
3. ascertain the effect of processing methods on the productivity
4. determine the effect of fish processing methods on the health status of processors

Research Methodology

The study was conducted in Cross River State, a coastal state in the south-south region of Nigeria, located within the tropical rainforest belt. The state covers 20,156 square kilometers with a population of 2.89 million (NPC, 2006). It is bordered by Benue, Ebonyi, and Abia States, Cameroon, Akwa Ibom, and the Atlantic Ocean. The area has diverse ecological zones, ranging from mangrove swamps to tropical rainforest and savannah woodlands. Fishing is a major economic activity due to the extensive waterways, with fisher folks engaged in diverse harvesting and processing methods. Major towns include Calabar, Odukpani, Ikom, Ogoja, Obudu, and Akpabuyo, among others. The study population comprised artisanal fisher folks in coastal communities of Ogoja, Calabar, and Ikom zones. A

multi-stage sampling technique was adopted, starting with the purposive selection of six coastal extension blocks where fishing is predominant. From these, 16 cells were identified, and a proportional sampling factor of 15% was applied to registered fish harvesters and processors from ADP records. This yielded a total sample size of 165 respondents. Data were collected using a structured questionnaire and interviews, administered with the assistance of trained research assistants. This study was designed to analyze fish processing methods among fisher folks in Cross River State. Data analysis combined descriptive and inferential statistics. Descriptive tools such as frequency, percentages, mean scores, and ranking were used to analyze objectives one to three, while multinomial logistic regression was applied to objective four. Additionally, hypotheses were tested using Spearman rank-order correlation. Factors influencing utilization of methods were also assessed, with mean scores of two and above considered critical. This comprehensive approach provided insight into both the effectiveness and challenges of fish production practices in the state.

Table 1: Sampling procedure and sample size for the study

S/N	Extension blocks	Cells selected	Population of registered fish harvesters	Selected registered fish harvester at 15%
1.	Abi	Itigidi Adudama Anong	48 18 15	12
2.	Bakassi	Akpa-Ukwa Etabong Abona (Germany 1)	186 112 73	57
3.	Calabar south/ municipality	Adiabor Esuk-Atu Esuk-edibeedibe	64 45 31	21
4.	Odukpani	Okurigang Esuk-Ansa Ubombak	101 80 48	34
5.	Akpabuyo	Esuk-Mba Efiong Esuk-Idundu	87 63 48	30
6.	Obubra	OgrudeAhaha	34	8
Total			1,053	165

Source: Fisheries Department Field Survey, 2025

Results and Discussion

The findings in Table 2 describe the socio-economic profile of the fish harvesters. Most were male (70.9%), while females made up 29.1%, showing that fish harvesting is largely dominated by men. This trend reflects the physically demanding nature of fishing, particularly in deep or fast-moving waters. Similar observations were made by Oparinde (2021), who reported that men typically take on the strenuous aspects of fishing, whereas women are more involved in processing and marketing activities. In terms of age distribution, over half of the respondents (51.5%) were between 30 and 39 years old, followed by 43.6% who were between 40 and 50 years. Only 0.6% were above 50 years. This suggests that fishing is mainly practiced by individuals in their economically productive years. This pattern is consistent with Islamet et al. (2022), who found that fish harvesting in Nigeria is largely carried out by middle-aged adults capable of handling the occupational demands. Regarding marital status, 54.5% of the harvesters were married, 14.5% were single, and 31% were divorced, widowed, or widowers. The high proportion of married respondents implies that family obligations may drive engagement in fishing as a key livelihood activity. Household size data show that 66.1% of fishers lived in households of 1–3 members, 32.1% had 4–6 members, and only 1.2% had more than 7 members. Smaller household sizes suggest a lower dependency burden, potentially enabling greater savings and reinvestment in fishing operations. This contrasts with findings by Amare & Balana, (2023), who noted larger household sizes in fishing communities, often due to reliance on family labor. The majority (84.8%) had between 11 and 20 years of fishing experience, 9.7% had less than 10 years, and 5.5% had over 21 years of experience. This indicates that most respondents were highly experienced—a crucial factor for effective navigation, catch optimization, and adapting to changing environmental conditions. Nwuba et al. (2022) similarly emphasized the importance of experience in fishing success. Income distribution revealed that 58.2% earned between ₦60,000 and ₦100,000 monthly, 22.5% earned ₦20,000–₦60,000, while 17% earned ₦100,000–₦120,000. Only 2.4% earned as much as ₦120,000–₦160,000. The relatively moderate income levels highlight that fishing remains a major source of livelihood but is characterized by variable financial outcomes depending on the methods used. Mulokozi et al., (2020) had stressed that Fish processing contributes significantly to food security, income, and livelihoods.

4.1.2 Methods used by fisher folks in fish processing

The results in Table 3 show that fish processing among respondents is dominated by traditional and widely accessible smoking methods. The most frequently used techniques include smoking with circular red clay ovens (97%), charcoal ovens (94%), and cylindrical drums or wire mesh (92%). These methods are preferred largely because they are cost-effective, require minimal technical skills, and are well suited to the local fish species and market demand. Bamboo-stick smoking (78%), boiling and frying (78%), and roasting (75%) are also commonly practiced, reflecting the flexibility of processors in choosing methods that enhance flavor, extend shelf life, and meet consumer preferences. The high reliance on smoking aligns with trends across artisanal fishing communities in West Africa, where smoked fish is valued for its long shelf life, reduced bulk during transportation, and commercial viability. The results confirms the findings of (Adeleke et al., 2020) that smoking is the main processing method used by the rural fish farmers and processors.

The results in Table 4 shows the percentage distribution of the respondents according to the effect of different processing methods on the output of fish. The results revealed that smoking using Charcoal oven improves the market value and quality of the fish (90%), while the use of smoking kiln was associated with improved shelf-life of the fish (92%), reduces the moisture content of fish (80%).



Table 2: Distribution of respondents based on socio-economic characteristics

Variables	Harvesters	
	Frequency	Percentage
Sex		
Male	117	70.9
Female	48	29.1
Total	165	100.0
Age		
<30	7	4.2
30-39	85	51.5
40-50	72	43.6
>50	1	0.6
Total	165	165
Marital status		
Married	90	54.5
Single	24	14.5
Divorced	14	8.5
Widow	15	9.1
Widower	22	13.3
Total	165	100.0
Household size		
1-3	109	66.1
4-6	54	32.1
7 & above	2	1.2
Total	165	100.0
Years of experience		
1-10	16	9.7
11-20	140	84.8
21 and above	9	5.5
Total	165	100.0
Monthly income (₦)		
20,000-60,000	37	22.5
60,000-100,000	96	58.2
100,000-120,000	28	17.0
120,000-160,000	4	2.4
Total	165	100.0
Source of fish Harvesting		
Big river	62	37.6
Pond	1	0.6
Shallow rivers	8	4.8
High sea	94	57.0
Total	165	100.0
Education		
Tertiary education	2	1.2
Secondary education	5	3.0
Primary education	50	30.3
No formal education	108	65.5
Total	165	100.0

Source: Field survey, 2025

Table 3: Methods Used for Fish Processing (N = 165)

Processing Methods	Used		Not Used	
	(n)	(%)	(n)	(%)
1. Smoking using charcoal oven	155	94	10	6
2. Smoking using cylindrical drum/wire mesh	152	92	13	8
3. Smoking using smoking kiln	51	31	114	69
4. Smoking using bamboo sticks	129	78	36	22
5. Smoking using circular red clay oven	160	97	5	3
6. Roasting	124	75	41	25
7. Salting	10	6	155	94
8. Frying with oil	77	47	88	53
9. Freezing in refrigerator	26	16	139	84
10. Sun drying	109	66	56	34
11. Boiling and frying	129	78	36	22

Source: Field survey, 2025

Similarly, it was observed that processing of fish using clay oven improves the shelf-life of the fish (97%), reduces the moisture content (86%) and makes the processing faster (76%) etc. Generally, the findings suggests that the various processing methods have overlapping effect on the output of fish, particularly with regards to the shelf-life, taste, quality/market value and the reduction in the moisture content of the fish. This result agrees with (Mulokozi et al., 2020), that the most common methods of fish processing, particularly among peasant processors are smoking (of various types) and roasting. Mulokozi et al., (2020) also found, enhance the shelf-life of fish, improve the quality and market value and importantly, promote faster processing and reduce the moisture content of the fish.

Table 5 presents the result on the effect of fish processing methods on the health status of processors. The result revealed that among all the processing methods, the ones that posed severe health challenges, as cited by many respondents were smoking, roasting and frying, with weighted means of 2.73, 2.58 and 2.23, respectively. This results revealed that processing fish via smoking poses the severest impact on the health status of processors. On the other hand, the processing methods that posed the least impact on the health status of fish processors was use of open air kiln and use of refrigerators, with both having means of 1.0, respectively. To collaborate this findings, Adeleke et al., (2020) indicated that traditional smoking methods, for instance, often expose women and children to prolonged periods of heat and smoke inhalation, which can lead to respiratory problems, eye irritation, and other health risks.

Table 4: Effect of processing methods on the productivity

Processing Methods	Effect (%)						
	Reduce damage of pest	Improve the taste of fish	Improve the market value and quality of fish	Increase the shelf life of fish	Reduce the moisture content of fish	Foster processing period	Process more quantity of fish
Smoking (Charcoal oven)	30	20	90	20	52	10	51
Smoking (cylindrical drum)	24	17	30	14	60	78	29
Smoking (smoking kiln)	70	79	80	92	97	41	57
Smoking (Bamboo sticks)	85	82	70	65	48	94	80
Smoking (clay oven)	70	60	58	97	86	76	74
Roasting	96	85	62	49	39	53	78
Salting	48	93	88	40	60	51	86
Frying with oil	60	82	71	50	94	63	79
Freezing in Refrigerator	90	44	55	67	33	48	62
Sun drying	50	70	90	80	60	65	98
Boiling and frying	60	80	70	91	58	73	56

Source: Field survey, 2025

Table 5: Effect of fish processing methods on the health status of processors

Processing methods	SD	$\bar{x}$	Rank
Smoking	0.479	2.73	Severe
Roasting	0.684	2.58	Severe
Frying	0.603	2.23	Severe
Salting	0.570	1.27	Not Severe
Freezing	0.666	1.53	Not Severe
Sun drying	0.906	1.56	Not Severe
Open air kiln	0.000	1.00	Not Severe
Refrigerator	0.000	1.00	Not Severe
Boiling and cooking	0.642	1.47	Not Severe

Source: Field survey, 2025 Cut off = 2.0

Conclusion

Fishing and all its associated activities, including processing and marketing, are integral mainstay in Cross River State's coastal settlements. The tools used in fishing are largely local gears and the processing also has relied extensively on methods such as smoking and roasting etc. The use of traditional processing techniques are creating severe health concerns to the people, in addition to significantly affecting the productivity. In rural Nigerian settings such as Cross River State, traditional methods like smoking, drying, and salting remain dominant due to limited access to modern preservation technologies. Despite their importance, traditional methods have limitations in terms of efficiency, hygiene, and long-term product quality. This study revealed that processing fish via smoking poses the severest impact on the health status of processors. The results also revealed that smoking using charcoal oven improves the market value and quality of the fish, while the use of smoking kiln was associated with improved shelf-life of the fish.

Recommendations

The following recommendations are made based on the findings of the study. That government and agricultural organization should

- encourage the participation of higher degree holders in the fish processing value chain in order to improve the knowledge and practise in the enterprise, as well as improve the educational capacity of fish processors in the study area.
- Encourage the development of local oven with high drying capacity to improve drying in large number and short duration.
- Traditional smoking should be improved in such a way that improves handling practices and reduces the hazard associated with smoke dust or soot
- Improve the health consciousness of farmers to fish processing methods and their effect on health. This will improve their awareness and enhance best or safety practices such as the use of nose mask to reduce smoke intake.

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