

Full Length Research Paper

Practices of farmers in processing and marketing of crayfish in Akwa-Ibom State, Nigeria

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Received 13 June, 2017; Accepted 10 July, 2017

The study was undertaken to assess farmer's practices in processing and marketing of crayfish in Akwa-Ibom State, Nigeria. Ninety crayfish farmers systematically selected from two zones, four blocks and twelve circles formed sample for the study. An interview schedule was used to collect data while percentage, mean score and multiple regression were used in data analysis. Findings show that the majority (95.6%) of the respondents processed their crayfish by smoking, using fire wood (87.7%). On the average, they produced 12.52 bags (1bag=19 kg) of crayfish monthly and packaged/stored them in big cellophane (73.3%) and raffia (72.2%) bags. Greater proportion (81.1%) of the respondents sold their crayfish after processing to retailers (61.1%) at local markets (91.1%). They earned ₦169,000 (approximately 551 US Dollars) and made expenses worth ₦57,400 (approximately 187 US Dollars) monthly from crayfish business. Hence, their monthly profit was ₦111,600 (approximately 364 US Dollars). Eighty four percent of the respondents indicated dry season and specifically November (55.6%) as season and month of the highest sale of crayfish. Age ($t= 2.372$; $p= 0.021$) and quantity (bags) of crayfish processed in a month ($t= 3.032$; $p= 0.003$) were determinants of monthly income of the crayfish farmers. Inability to pay for labour during processing due to lack of cash ($M=1.79$) and having eye problem due to smoke from the open fire and backache due to prolonged bending down during smoking/processing of crayfish ($M=1.78$) were major challenges of the respondents in processing of crayfish. Unavailability of credit and competition from other crayfish marketers ($M=1.62$ each) were major challenges of the respondents in processing of crayfish. The study recommends that extension agents, researchers and business administrators should teach and boost the competencies of the farmers on modern ways of processing and marketing of agricultural products through government and non-government sponsored trainings and workshops. This will boost both quality of crayfish and agricultural products processed, marketed, consumed locally and possibly create opportunity for their exportation and more income.

Key words: Farmers, processing, marketing, crayfish, Akwa-Ibom State, Nigeria.

INTRODUCTION

Crayfish is one of the aquatic animals and a dominant decapods in many freshwater and even terrestrial habitats playing important community roles through their

mobility, behaviour and omnivory. Their main habitats are cool or warm high quality streams and lakes, warm lower quality wetlands, semi-terrestrial swamps and temporary

wetlands (burrowers), and cave ecosystems (Reynolds et al., 2013). According to the authors, crayfish may tolerate broad temperature, dissolved oxygen and salinity ranges. Being an important crustacean consumed all over the world, they are usually prepared for consumption by smoking, and occasionally preserved by sun-drying. It is also a common delicacy in the diet among the people of the Southern Western Nigeria (Joseph, 2011). Crayfish may also be available at all the seasons, relatively cheap, affordable and suitable to supply adequate nutrients to cater for infants estimated daily nutrient requirements to eradicate protein energy malnutrition (PEM), in the developing countries (Joseph, 2011). It is a clean and very low carbohydrate food (Grace, 2010) and has a super healthy combination of nutrients from its almost pure form of protein to its healthy amount of omega-3 fatty acids which we now know are among the most beneficial fats we can eat (FAO, 2009). Meals containing crayfish play a great role in the development of humans in the world especially in the lives of people in the developing countries where other protein sources are grossly inadequate and comparatively costly (Nkang, 2014a). Experimentally, protein derived from crayfish and fish based diet is as good as that obtained from meat (Nkang, 2014b). Consumption of crayfish together with products of plants origin which are poor in some amino acids such as lysine and thiamine enables not only a complete utilization of plant protein, but also improves the content of the diet (Ele, 2014).

Crayfish key roles and attributes in ecosystems include indicators or surrogates for water quality, bio-indicators for communities or habitats, keystone controllers of trophic webs and ecological engineers. Protected crayfish may also act as umbrella species for the conservation of communities (Reynolds et al., 2013). They play important role in food chain by feeding on living and dead plants and smaller creatures/invertebrates as well as serving as food for fish and mammals.

They are normally harvested and processed from ponds and natural waters. The harvesting of crayfish entails farmers harvesting crayfish using canoe, traps and baits (Center for Environment Human Rights and Development (CEHRD), 2007). Use of baits is the most reliable method for harvesting crayfish (CEHRD, 2007). These baits are used in harvesting crayfish after, the baits are fixed between the nets and the nets are placed in the water which attracts the crayfish. After harvest, crayfish can be consumed fresh but they are perishable in this form and need to be preserved through processing especially when they cannot be consumed or sold immediately.

Fish processing refers to the processes associated with

fish and fish products between the time fish are caught or harvested, and the time the final product is delivered to the customer (Swahn, 2009). Although the term refers specifically to fish, in practice, it is extended to cover any aquatic organisms harvested for commercial purposes, whether caught in wild fisheries or harvested from aquaculture or fish farming (Swahn, 2009). Crayfish are processed differently in various countries that use them because of their various needs. For example in countries like USA, China and Australia harvested crayfish are generally packed into open-mesh vegetable sacks for refrigeration, storage and transportation (Vance, 2009). Crayfish may be kept for hours in water for evacuation of food from intestinal tract before storage. This procedure has a dual effect of increasing the attractiveness of the product to the consumer while also increasing quality for storage and transport (Jose, 2002). In African countries like Nigeria, Ghana and South Africa crayfish are normally smoked, sun dried or salted (Adeosun, 2007). Smoking is the removal of most of the water from the flesh. It is also employed by the harvesters to reduce wastage due to decomposition. Crayfish are sometimes sun-dried, especially during the dry season which corresponds to the peak period for this fishery. They are usually spread on top of a mat for drying in the sun, or over an oven in a smoke house (Moses, 2013).

This crustacean has been used as a major source of income because of its high demand in the markets. Its market shifted from local consumption in rural areas to higher volume markets in cities such as Baton Rouge, New Orleans and beyond (Taylor, 2009). In the study area (Akwa-ibom State, Nigeria) crayfish has provided business and economic activities for the fishermen, crayfish dealers as well as consumers of crayfish (Enang, 2014). Crayfish, both industrial and artisanal, are major sources of both direct and indirect employment. This include crayfish capture/production, processing for local and export markets and jobs associated with gear sales/repair and cold storage facilities (Essuman, 2009). These and other value chain activities help to reduce post-harvest losses and boost economic returns from crayfish enterprise.

Unfortunately, crayfish farmers in rural areas still adopt old ways of crayfish processing which are unhygienic and affect the quality of the crayfish through microbial contamination (Nieland, 2004). Also, some farmers lack experience in the modern and proper way/method of processing (Teitze, 2014). Those living in rural areas normally use the same facilities that were used before in processing because of lack of fund to afford a new one. Farmers most times lack the proper storage facilities to

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store their processed crayfish which may lead to spoilage of the product (Njie, 2002), deterioration of crayfish during processing, heavy loss and poor yield (Teitze, 2014).

Aquaculture has been described as the fastest growing animal food-producing sector and to outpace population growth in the world (FAO, 2012). Unfortunately, crayfish are neglected compared to other aquatic animals because it is believed to yield low profit in terms of sales and it is usually called a poor man's business (Flake, 2007). The fishery sector (crayfish inclusive) is still characterized by rising import bills, low output, high post-harvest losses and the marketing methods used by traditional/local farmers that involves spreading of crayfish on the floor using raffia bags is un-hygienic and leads to spoilage of crayfish (Bassey et al., 2013).

Lack of availability of credit for crayfish marketers lowers efficient marketing and does not facilitate proper utilization of crayfish marketing resources and the adoption of crayfish marketing innovations (Oladapo et al., 2007). Poor market structure (instability), poor road network, and poor access to credit/finance are also factors that affect marketing efficiency. Government policies on the fish sector seem to be directed towards increasing production with little emphasis laid on marketing (Ukoha, 2003). Whereas the activities (harvesting, processing and marketing) are interlinked and driven by their forces in such a manner that a harvester/processor is motivated when there is ready market for his/her goods and vice versa.

One of the ways of improving the quality of agricultural products will be to carry out periodic investigation on the existing value chain activities (harvesting, processing, preservation, storage, marketing, etc.) in agriculture. This study will therefore provide relevant information on the activities of the farmers in processing and marketing of crayfish as well as determinants of income from the enterprise and challenges in processing and marketing of crayfish with a view to expose lapses/abnormalities that need to be tackled in order to bring/ improve efficiency in the sector and agriculture at large.

METHODOLOGY

The study area

The study was carried out in Akwa-Ibom State, Nigeria. The state has a population of 3,920,208 and a total land mass of 6,900 km² (National population commission (NPC), 2006). It is located in the coastal southern part of the country, lying between latitudes 4°32'N and 5°33'N, and longitudes 7°25'E and 8°25'E. The state is bordered on the east by Cross River State, on the west by Rivers State and Abia State, and on the south by the Atlantic Ocean and the southernmost tip of Cross River State (Ikono, 2016). This area is favourable for live-stock and fish production. Thus, most of the inhabitants are either full time or part time livestock/fish farmers. They produce different livestock like poultry, pigs, snails, rabbits, fish (crayfish, catfish, etc) and other aquatic animals. The state consists of thirty-one (31) local government areas and six

agricultural zones namely Oron, Abak, Ikot-ekpen, Etinan, Eket and Uyo agricultural zones (Ikono, 2016).

Population and sampling procedure

All crayfish farmers in the zone constituted the population for the study. A multi-stage sampling technique was employed in selecting the respondents for the study. In stage one, two agricultural zones namely Oron and Eket were purposively selected from the six agricultural zones in the state.

In stage two, two blocks were purposively selected from each of these zones (Mbo and Okobo) from Oron (Ibeno and Onna) from Eket giving a total of 4 blocks.

In stage three, three circles were purposively selected from each of the blocks which are: Brahma clan, Uteffiong and Ibaka from Mbo block, Ube-okobo clan, Ebighi-edu clan and Atabong clan from Okobo block, Iwokpom, Inuayerikot and Nkpanak from Ibeno block and Awa clan, Oniong clan and Nung ndem from Onna block giving a total of 12 circles.

In stage four, 8 crayfish farmers were purposively selected from each circle giving a total of 96 respondents for the study. The purposive selection done at each stage aimed at capturing areas and people who were more involved in catching, processing and production of crayfish in the state.

Data collection

Data for the study were collected from respondents through the use of structured interview schedule that were administered by the researcher and other research assistants to the respondents. The interview schedule contained relevant questions based on the objectives of the study. In order to elicit information on their processing activities, the respondents were requested to indicate processing practices they engage in crayfish production. For example methods of processing, equipment used in processing, reasons for processing, methods of storage/packaging, etc. They were also requested to indicate marketing activities that they do such as when, where, whom and how they market their crayfish as well as estimated income and expenditure per month from crayfish production. Determinants of income of respondents on crayfish enterprise were captured using multiple regression through examination of variables like: estimated monthly income in naira, marital status, primary occupation, sex among others.

Data on challenges respondents face in processing and marketing of crayfish were collected using a modified Likert-type scale of three points with responses as: "serious (S)= (2), not serious (NS)= (1), not at all (NA)= (0)". The values on the Likert-type scale were added up to get 3, which was divided by 3 to get a mean of 1.0. Any variable with a mean score higher or equal to 1.0 was regarded as a major challenge while variable with mean score less than 1.0 was regarded as minor challenge. Some challenges that were measured under processing include: lack of processing facilities and inadequate knowledge on processing while price fluctuation, poor infrastructure, loss of capital due to debtors were some of the challenges that were measured under marketing.

Data were analysed with percentage, mean score and multiple regression. The regression model is stated in explicit form as follows:

$$Y = \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + U$$

where Y = income of crayfish farmers, α = constant term, $\beta_1 - \beta_{10}$ = regression coefficients, $X_1 - X_{10}$ = (independent variables), X_1 = age (years), X_2 = years spent in formal education (years), X_3 = sex (male = 1, female = 0) (Dummy), X_4 = marital status (Married=1, not

married=0), X_5 = primary occupation (farming=1, not farming=0), X_6 = years of experience in marketing crayfish (years), X_7 = household size (number), X_8 = access to agricultural related information (yes=1, no= 0), X_9 = extension agents visit in 2015 on agricultural matters, X_{10} = quantity (bags) of processed crayfish produced in a month (kg), and U = error term.

RESULTS AND DISCUSSION

Respondents' activities in processing of crayfish

Methods of processing crayfish

Entries in Table 1 show that the majority (95.6%) of the respondents processed crayfish by smoking; 35.6% processed by washing in salt water; while 20.0% processed by sun drying. These farmers may have relied mainly on smoking method probably because it gives crayfish a desirable taste and increases the consumer's desire or demand for it. According to Agwumba (2009), smoking of crayfish is the alternative method used when sun-drying is impossible because of the frequent rains during the rainy season.

Sources of heat energy for processing

Data in Table 1 also reveal that the majority (87.7%) of the respondents used fire wood while 38.9% used solar energy as sources of heat energy for processing of crayfish. Since majority of the respondents used fire wood as source of heat energy for processing, this practice may not be sustainable and ideal especially in this era of climate change and its negative impact that necessitates afforestation and deemphasizes indiscriminate felling of trees. Using modern and improved methods that saves time, reducing drudgery and use of energy efficient source like machines that can be operated with electricity or solar energy, may be better options. However, the finding agrees with Agwumba (2009) who stated that crayfish landings are smoked immediately when brought to shore; the process of smoking fish occurs by using fire wood in a smoke house.

Reasons for processing

Result in Table 1 also shows that 37.8% of the respondents processed crayfish in order to store them for a long time, 25.6% processed crayfish to increase market value and income while 24.4% processed crayfish to improve taste. Processing of crayfish in order to avoid deterioration and spoilage becomes inevitable when the product cannot be sold fresh or immediately after harvest probably due to lack of buyers and transportation facilities to move the product to bigger/urban markets where they can be sold. Through processing, handling of crayfish is easier, the shelf life is increased and crayfish is put into a

form that is acceptable to the buyers/consumers.

Methods of storage/packaging of crayfish

Table 1 shows that majority (73.3%) of the respondents packaged/stored their crayfish in big cellophane bags, 72.2% stored in raffia bags, while 6.7% of the respondents stored in basins. This implies that some of the crayfish farmers still use old methods of storing/packaging of crayfish which may be detrimental to the product and human health. The use of plastic and laminated packaging bags to store crayfish is the most reliable method of packaging. This is because they are designed to prevent dehydration and oxygen penetration which invariably controls deterioration.

Quantity (bags) of crayfish produced in a month:

Result in Table 1 reveals that greater proportion (34.4%) of the respondents produced 11 to 15 bags, 27.8% produced between 6 and 10 bags, 24.4% produced 1 to 5 bags, 4.4% produced 16 to 20 bags, while 8.9% produced more than 20 bags of crayfish in a month. The mean number of bags of crayfish they produced in a month was 12.52 bags (1 bag = 19 kg).

Activities in marketing of crayfish

When crayfish is marketed

Data in Table 2 also reveal that the majority (81.1%) of the respondents sold their crayfish after processing, while 58.9% sold theirs' immediately after harvest. Most of the respondents may have sold crayfish after processing because processed crayfish appear to be durable, generally accepted by people and yield more returns.

Type of buyers/customers

Entries in Table 2 reveal that 61.1% of people that purchase the crayfish were retailers, 48.9% were wholesalers, 38.9% were consumers, while 4.4% were exporters. Retailers are in closer link with the consumers and sometimes with the farmers/producers. In a normal scenario, they play very crucial role in marketing of agricultural commodities by bringing agricultural products to the door step of immediate users, assessing and transferring their reactions about the product to the farmers for adjustment and taking feedback from farmers to consumers. Optimum/maximum utilization of this network/synergy will lead to efficiency in production, processing and marketing of agricultural products. In the case of crayfish, when this role is abused, purchasing of crayfish by retailers leads to uncoordinated market structure which is characterized by instability, exploitation

Table 1. Distribution of respondent based on their activities on processing of crayfish (Field Survey, 2016).

Variable	Percentage
*Method of processing crayfish	
Smoking	95.6
Sun drying	20.0
Salting	4.4
Washing	35.6
Cleaning	5.6
Sorting	2.2
*Source of heat energy for processing	
Sunshine	38.9
Oven	1.1
Firewood	87.7
Ebanda	17.8
*Reasons for processing crayfish	
Improve taste	24.4
Prolong storage	37.8
Increase income	25.6
Increase market value	25.6
*Methods of storage/packaging of crayfish	
Plastic containers	1.1
Polythene/cellophane bags	73.3
Sachets	1.1
Bags	72.2
basins	6.7
Quantity (bags) of crayfish produced in a month (a bag=19 kg)	
1-5	24.4
6-10	27.8
11-15	34.4
16-20	4.4
>20	8.9

of crayfish farmers and low economic return for the farmers unlike selling directly to the consumers which ensures profit and a stable market price (Igwe, 2009).

Marketing venue

Entries in Table 2 reveal that the majority (91.1%) of the respondents sold crayfish at local markets, while 46.7% of the respondents sold at urban markets. This finding tends to suggest that farmers in the area have access to local markets than urban markets. This may be due to ignorance, lack/poor access road and lack of money for transportation of products to urban marketing sites. Selling at local markets may lead to further exploitation of crayfish farmers and may not afford them opportunity

to interact with co-producers and buyers from different regions for exchange of information, technologies and innovations, especially those related to their enterprise.

Monthly income from crayfish enterprise

Data in Table 2 also indicate that 55.7% of the respondents earned below ₦ 100,000; 18.2% earned between ₦101,001 and ₦200,001; 12.5% earned ₦200,002 to ₦300,002; 9.1% earned between ₦300,003 and 400,003; while 4.5% earned between ₦400,004 and ₦500,004. The mean monthly income of the respondents was ₦169,000 (approximately 551 USD). Although, this amount may not be up to the globally approved minimum wage per month, it may be said to be relatively high

Table 2. Distribution of respondents based on their activities in crayfish production (harvesting, processing and marketing) n=96 (Field Survey, 2016).

Variable	Percentage	Mean
*when crayfish is marketed		
Immediately after harvest	58.9	
Immediately after processing	81.1	
After storage	1.1	
When cash is needed	2.2	
*Marketing venue		
Local markets	91.1	
At home	1.1	
Place of work	3.3	
Urban market	46.7	
*Type of buyers/customers		
Consumers	38.9	
Exporters	4.4	
Retailers	61.1	
Wholesalers	48.9	
Monthly income on crayfish enterprise		
<100,000	55.7	
100,001-200,001	18.2	
200,002-300,002	12.5	169,000
300,003-400,003	9.1	
400,004-500,004	4.5	
Monthly expenditure on crayfish enterprise		
<100,000	83.8	
100,001-200,000	13.8	57,400
200,001-300,000	1.2	
300,001-400,000	1.2	
Major expenses in marketing crayfish		
Rented shop	28.9	
Transportation	80.0	
Feeding	12.2	
Nylon bags	6.7	

*Multiple responses.

compared to what is obtainable among rural farmers especially in developing countries. For example average monthly income of melon farmers in Enugu Ezike Agricultural Zone Enugu State, Nigeria was ₦7,455.4 (approximately 45 USD) (Iwuchukwu et al., 2016).

Monthly expenditure on crayfish production

Data in Table 2 also reveal that majority (83.8%) of the respondents incurred below ₦100,000 expenses in crayfish production while respondents that spent ₦100,000 to ₦200,000 on crayfish production accounted

for 13.8%. The mean monthly expenses on crayfish production was ₦57,400 (approximately 187 USD) implying that the respondents made profit of ₦111,600 (approximately 364 USD) from crayfish enterprise.

Expenses on marketing of crayfish

Data in Table 2 show that the majority (80.0%) of the respondents stated that their major expenses in marketing of crayfish was incurred in transportation. 28.9% of the respondent indicated rented shop while feeding was the major expense made by 12.2% of the

respondents in marketing of crayfish. This is supported by Ajiboye and Afolayan (2009) who stated that transportation is the major factor in marketing of fish and it is one of the expensive means in marketing crayfish. The author further stated that availability of transport facilities is a critical investment factor that stimulates the marketing growth of crayfish through increased accessibility, its efficiency and effectiveness.

Other marketing activities of the respondents

Strategies for marketing crayfish

Entries in Table 3 show that majority (70.0%) of the respondents indicated packaging while 62.2% indicated displaying in the markets as their strategies of marketing crayfish. Thus, respondents relied mainly on packaging and displaying of crayfish in the market as their marketing strategies. Tobor (2005) opined that packaging contributes in marketing crayfish by making the product appealing to the consumer and extending its shelf life. Regrettably, the crayfish farmers made little or no effort towards advertising crayfish which would have boosted the positive effect of packaging as it will create awareness on the availability of the product and attract more customers and hence more income.

Seasons of highest and lowest sales

Table 3 also shows that the majority (84.0%) of the respondents indicated dry season, while 16.0% of the respondents indicated wet season as the season for highest sale of crayfish. Fish/crayfish are not easy to harvest during wet season probably due to increase in the volume of natural water where crayfish are caught/harvested. Consequently, there may be reduction in quantity of crayfish harvested and marketed during wet season. On the other hand, crayfish farmers are likely to sell their crayfish faster with more profit during wet season because demand of the commodity may outstrip supply during this season. However, Idiong (2009) asserted that fish farmers attain the highest sales during wet season because they (fish) are hard to harvest in wet seasons and therefore scarce in the markets.

Months of highest and lowest sales

Entries in Table 3 show that greater proportion (55.6%) of the respondents indicated that they obtain their highest sales in November, while 27.8% of the respondents indicated December as the month for highest sales. November and December are among the "Ember months" which are regarded as months for preparation

and celebration of Christmas respectively by Christians which dominated the study area. Also, these months mark end of the year and people all over the world shop during this time in preparation of the New Year celebration. Specifically in Nigeria, products like fish, crayfish and meat are sold easily and at a higher price during these months.

Data in Table 3 further show that greater percentage (41.1%) of the respondents indicated that August is the month of lowest sale, 21.1% indicated July, 18.9% indicated June, while 14.4% of the respondents indicated September as the month of lowest sales. These months mark period of rainy season in Nigeria where harvesting and even drying/processing of crayfish are difficult due to increase in size of water and shortage of heat energy either from sunshine or fire wood to dry or process the crayfish. So activities of crayfish catching/harvesting, processing and marketing are likely to be low during this time.

Mode of selling of crayfish

Entries in Table 3 further show that greater percentage (68.9%) of the respondents sold their crayfish by bargaining with purchasers, 47.8% sold crayfish on a fixed price, while 6.7% sold on an auction price. Most times, selling of agricultural products in developing countries like Nigeria does not involve fixing of price because prices of these products vary, depending on season and availability of the product in the market. Therefore, farmers bargain with buyers in order to market their goods. Bargaining in fish marketing is a type of negotiation in which the buyer and seller of a good or service debate the price and exact nature of a fish product. If the bargaining produces agreement on terms, the transaction takes place (Enang, 2014).

Determinants of revenue from crayfish enterprise

The regression result in Table 4 shows that there was a significant relationship ($F= 3.397$; $p<0.05$) between the socio-economic characteristics of the crayfish farmers and their monthly income from crayfish enterprise. Specifically, age ($t= 2.372$; $p= 0.021$) and quantity (bags) of crayfish processed in a month ($t= 3.032$; $p= 0.003$) were positively significant and influenced the monthly income of the respondents from crayfish enterprise. This means that change in age of farmers and quantity (bags) of crayfish processed/produced in a month will change monthly income of farmers from crayfish enterprise.

Age of the respondents positively influence their monthly income from crayfish enterprise agrees with findings of Anyawale and Oluwasola (2008) that state that age of farmers, all things being equal has a positive impact on crayfish enterprise size, earnings, ability to

Table 3. Distribution of respondents based on other marketing activities (n=96) (Field Survey, 2016).

Variable	Percentages	Mean
*Strategies for marketing crayfish		
Advertising	3.3	
Packaging	70.0	
Displaying in the market	62.2	
Marketing in stalls	4.4	
Season of highest sales		
Dry	84.0	
Rainy	16.0	
*Month of highest sales		
January	23.3	
February	8.9	
March	5.6	
April	2.2	
May	1.1	
June	4.4	
July	1.1	
August	14.4	
September	1.1	
October	3.3	
November	55.6	
December	27.8	
Month of lowest sales		
January	1.1	
April	1.1	
May	2.2	
June	18.9	
July	21.1	
August	41.1	
September	14.4	
October	5.6	
November	8.9	
December	4.4	
*Mode of selling crayfish		
Bargaining	68.9	
Fixed	47.8	
Auction	6.7	

*Multiple responses.

take risks and adoption of modern innovation which they perceive to be capable of yielding higher income. The positive significant relationship between quantity (bags) of crayfish processed in a month and the monthly income from crayfish enterprise is expected because income of the respondents depend mostly on quantity of crayfish processed such that when more crayfish are processed, more bags of crayfish will be expected and hence more income. In corroboration, Nkang (2014a) stated that the

number of bags of fish/crayfish sold in a month determines if the fish farmer is making a profit or loss for that month.

Number of years spent in acquiring formal education, sex, marital status, primary occupation, years of experience in marketing crayfish, household size, access to agricultural related information and number of times extension agents visited in 2015 on agricultural matters did not influence income from crayfish enterprise. This

Table 4. Factors influencing monthly income/revenue of crayfish farmers (Field Survey, 2016).

Variable	Coefficient	T-statistics	Probability
Constant	-	633	0.529
Age	0.328	2.372	0.021
Number of years spent in acquiring formal education	-0.152	-1.287	0.202
Sex	0.146	1.267	0.209
Marital status	0.123	0.949	0.346
primary occupation	-0.006	-0.062	0.951
Years of experience in marketing of crayfish	-0.138	-1.076	0.286
Household size	0.093	0.770	0.444
Access to agricultural related information	-0.042	-0.408	0.684
Number of times extension agents visited in 2015 on agricultural matters	-0.003	-0.026	0.980
Quantity (bags) of crayfish processed/produced in a month	0.324	3.032	0.003

$R^2=0.333$, $\bar{R}^2=0.235$, F-value=3.397, ($P<0.05$ so it's significant). *Significant.

Table 5. Mean scores of perceived challenges in processing of crayfish (Field Survey, 2016).

Challenges in processing of crayfish	Mean	SD
Lack of processing facilities	1.18*	0.86
Inadequate knowledge on processing of crayfish	0.52	0.71
Climate change effect on t processing of crayfish	1.43*	0.80
Poor road for transportation of product from harvesting to processing site	1.42*	0.71
Inadequate equipment for processing of crayfish	1.07*	0.74
Microbial contamination caused by use of old processing facilities	0.90	0.69
Drudgery associated with the task	1.49*	0.87
Inhaling of carbon monoxide during processing	1.65*	0.60
Undesirable odour that comes with crayfish during processing	1.43*	0.70
Reduction of the size of harvested crayfish after processing	0.65	0.68
Loss of money and property due to incessant fire incidents caused by smoking in open fire	1.76*	0.49
Inability to pay for labour during processing due to lack of cash	1.79*	0.52
Need to use costly mangrove in smoking crayfish to give the desired taste to it	0.72	0.93
Having eye problems and backache due to smoke from the open fire and prolonged bending down during smoking/processing of crayfish	1.78*	0.45
Lack of efficient modern processing facilities provided privately or by government	1.53*	0.82

*Major challenges.

implies that these variables did not add to the ability to predict the monthly income earned from crayfish enterprise in the study area.

Challenges respondents encounter in processing of crayfish

Entries in Table 5 reveal that major challenges of the respondents in processing of crayfish were inability to pay for labour during processing due to lack of cash ($M=1.79$), having eye problems (due to smoke from the

open fire) and backache (due to prolonged bending down) during smoking/processing of crayfish ($M=1.78$), loss of money and property due to incessant fire incidents caused by smoking in open fire ($M=1.76$), inhaling of carbon monoxide during processing ($M=1.65$), lack of efficient modern processing facilities ($M=1.53$), drudgery associated with the task ($M=1.49$), undesirable odour that comes with crayfish during processing ($M=1.43$), climate change negative effect on the processing of crayfish ($M=1.43$), poor road for transportation of the product from harvesting to processing site ($M=1.42$), lack of processing facilities ($M=1.18$) and inadequate equipment for

Table 6. Mean scores of perceived Challenges in marketing of crayfish (Field Survey, 2016).

Challenges in marketing of crayfish	Mean	SD
Inadequate storage facilities of crayfish not sold after marketing	1.29*	0.83
Quality deterioration when not sold immediately and consequent reduction of price and income	1.15*	0.77
Poor infrastructure used for crayfish marketing	1.12*	0.88
Unfavourable government policies on crayfish marketing	1.44*	0.83
Lack of availability of credit for crayfish marketers	1.62*	0.78
High perishability of the product	1.21*	0.79
Huge competition from other crayfish marketers	1.62*	0.79
High bargaining and lack of purchasing power	1.49*	0.86
High price fluctuation	1.54*	0.84
Unsuitable position of market	0.92	0.93
Competition with other more valued aquaculture like fish	0.80	0.83
Undesirable odour of crayfish	1.33*	0.86
Dirtiness of business	1.44*	0.83
Attraction of flies and other undesirable creatures	1.61*	0.79
Lack of storage facilities	1.46*	0.87
Limited market outlets and poor marketing information	0.74	0.87
Loss of capital due to debtors	1.49*	0.86

processing of crayfish (M=1.07). The findings suggest that the respondents are still using old way of processing which involves use of fire wood to smoke or dry the crayfish for preservation. This method may be said to have aggravated other problems. For example, in using old method of processing crayfish, the farmer has to purchase firewood and employ people to help in processing crayfish because the task is stressful with other health implications/problems associated to it. When the farmer does not sell part of the harvested crayfish in fresh, he/she may lack cash to settle the wages of the labourers because the farmer is yet to market the crayfish after processing. Secondly, employment and payment of these labourers increase cost of production which can be handled/overcome by reducing the income of the farmers or increasing the price of the commodity in the market which may cause inflation. Also, when the fire used in smoking the crayfish is not properly monitored or managed it can lead to fire disaster where the crayfish and other valuable properties including cash can be lost. It is important to note also that the old method of processing crayfish using fire wood encourages deforestation and desertification that aggravate climate change and its negative impact on the universe and specifically on processing of crayfish as indicated by these respondents.

In support of the finding, Njie (2002) opined that rural farmers most times lack proper processing facilities which may be caused by lack of funds, while Silvia (2015) asserted that an open environment is an efficient way of smoking/drying fish to reduce fire outbreaks and reduce inhaling of carbon monoxide which is harmful to the processor.

Some factors that the respondents perceived as minor challenges to processing of crayfish include: inadequate knowledge on how to process crayfish (M=0.52), microbial contamination caused by the use of old processing facilities (M=0.90) and reduction of the size of harvested crayfish after processing (M=0.65).

Challenges respondents encounter in marketing of crayfish

Entries in Table 6 reveal that the major challenges of respondents in marketing of crayfish include: unavailability of credit for crayfish marketers (M=1.62), competition from other crayfish marketers (M=1.62), attraction of flies and other undesirable creatures by crayfish during marketing (M=1.61), high price fluctuation (M=1.54), high bargaining and lack of purchasing power (M=1.49), loss of capital due to debtors (M=1.49), lack of storage facilities (M=1.46), dirtiness of the business (M=1.44), unfavourable government policies on crayfish marketing (M=1.44), undesirable odour of crayfish (M=1.33), inadequate storage facilities for crayfish not sold after marketing (M=1.29), perishability of the product (M=1.21), quality deterioration when not sold immediately and consequent reduction in price and income (M=1.15), and poor infrastructure used for crayfish marketing (M=1.12). Marketing of crayfish, fish and other fish products in a developing country like Nigeria is not easy especially during rainy season even when they have been processed into dry form. This is because of poor/lack of adequate storage facilities to maintain or improve the quality of the product when they

cannot be sold easily or immediately due to glut in the market or other reasons. Sometimes when the facility is there, other factors like unstable power supply, lack of personnel and mismanagement of the facility may constrain the use of the facility. Consequently, when farmers rely on local method of marketing by exposing the goods and keeping the ones they could not sell in the bag for the next market, the quality of crayfish deteriorates especially when storage is prolonged. At this point crayfish may produce undesirable odour that will scare people and attract other bad creatures. The farmer may find it difficult to market the good and where possible at reduced price probably lower than the cost price. Worst still, when the buyer cannot pay cash at the point of purchasing the good or decides to pay part of the money or in bits or unable to pay at all, the farmer loses capital and income and may lose interest in the business especially when he lacks credit that will help to resuscitate the business. In line with the findings, Gittenger (2004) stated that despite the profitability of crayfish marketing, it has been on the decline due to the problems of lack of storage facilities, quality deterioration which results to price reduction and unavailability of credit for crayfish marketers, etc. Basse et al. (2013) also noted that the fishery sector (crayfish inclusive) is still characterized by rising import bills, low output, high post-harvest losses and marketing methods used by traditional farmers that is the spreading of crayfish on raffia bags and on the floor is un-hygienic and leads to crayfish spoiling since it is highly perishable.

Some minor challenges in marketing of crayfish as enumerated by the respondents include: unsuitable position of market ($M=0.92$), competition with other more valued aquaculture like fish (tilapia) ($M=0.80$) as well as limited market outlets and poor marketing information ($M=0.74$).

CONCLUSION

Based on the findings of the study, the following conclusions were drawn: Majority of the respondents processed crayfish using old/ traditional method of smoking with logs of firewood. They stored processed crayfish in cellophane bag and sold them to retailers in the local markets. On monthly basis, the respondents realized ₦169,000 (about 551 US Dollars) and made expenses worth ₦57,400 (about 187 US Dollars) in crayfish business hence they made profit of ₦111,600 (364 US Dollars) from the enterprise. Age of farmers and quantity of crayfish processed/produced were the determinants of income from crayfish enterprise. The major challenges respondents encountered in processing were inability to pay for labour employed during processing and health issues (eye problems and backache). Unavailability of credit and competition from other crayfish marketers were constraints in marketing

of crayfish.

RECOMMENDATIONS

Extension agents should teach and encourage crayfish farmers to discard old method of processing crayfish using firewood and embrace new and improved processing technologies so as to reduce drudgery and consequent health challenges associated with old processing method, improve quality of processed crayfish and maintain stable ecosystem that will discourage desertification and climate change. Where crayfish farmers cannot afford new processing technologies, government and non-government agencies should subsidize the cost or supply them as incentives to these farmers.

Government and other stakeholders in fishing, ought to develop market information and marketing infrastructure to enhance more market accessibility of crayfish products. They should also sponsor trainings and workshops geared towards building capacities of farmers especially crayfish farmers on marketing. These trainings and workshop should be anchored by business administrators and extension agents. The emphasis will be on marketing strategies like packaging, advertising, sourcing of information on marketing, ideal market for selling of agricultural products etc. Knowledge and skills gained from these expositions will boost the competencies of the farmers on marketing of agricultural products for higher quality and income.

Favourable financial policy that will help farmers especially crayfish farmers to access credit in form of loan and overdraft at low interest rate should be made by policy makers, while Central Bank of Nigeria will ensure compliance by all the banks especially agriculture banks. In this way, these farmers can have money to settle expenses in crayfish business, purchase good processing equipment, store their products when there is poor market or glut in the market and transport their products to urban market for quicker sale and more income.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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