

## **Economic Benefits of Processed and Packaged African Catfish (*Clarias gariepinus*) in Edo State.**

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### **Abstract**

*Adding value to processed fish is of concern to farmers hence ascertaining economic benefits of processed and packaged African catfish (*Clarias gariepinus*) to fish farmers in Edo state was carried out. Data was collected using a well-structured questionnaire. Data collected with questionnaire included socio economic characteristics of processed and packaged *C. gariepinus* marketers, consumers acceptability, and profitability of processed and packaged *C. gariepinus*. A total of six (6) local governments areas were purposely selected from Edo State. The first stage involved stratifying Edo state into the three recognized agro ecological zones (North, Central and South) according to the state's Agricultural Development Programme (ADP) delineation. The second stage involved purposive selection of (2) two local government areas from each zone based on the prevalence of fish farming and marketing activities. This gave a total of six (6) local governments. The zones and the local government areas are; Edo south with a total of 7 LGA's Egor, and Oredo was selected. In Edo central with a total of 5 LGA's; Esan South East (ESE) and Esan North East (ENE) were selected, while in Edo North with a total of 6LGA's, Etsako central (ETC), Etsako west (ETW). were selected: The third stage involved random selection of at least 30 % of fish farmers from each of the selected local government area. Data were collected through administration of questionnaire to the fish farmers. Thus a total of 117 Questionnaires were administered with (36, 33, 18, 7,14 and 8 administered to Egor, Oredo, ESE, ENE, ETW and ETC LGAs respectively. Results of the study showed that majority of respondents (67.2%) were males. Majority of respondents made profits of ₦250/kg, 39.0%, 43.9%, and 17.1% sell at ₦3000, ₦3400 and ₦4000/kg respectively, 56.1% used nylon for packaging while 61.0% preferred well sealed polythene bag for packaging. it was recommended that since majority package with nylon, more enlightenment should be carried out on the proper use of nylon as a means of packaging and storing smoked fish. Also a shelf life of two weeks maximum to be attached to smoked and packaged smoke dried *C.gariepinus*. Processing and packaging of *C. gariepinus* is also recommended as a profitable means of increasing farm earnings.*

**Introduction:** Fish is one of the most perishable of all stable commodities especially in tropical climate regions of the world. If not consumed within one day of capture it becomes unfit for human consumption, unless subjected to some form of processing (Abolagba , O.J., Okonji, V.A. and Enobakhare, D.A., 1996)The advantages of processing fish are manifold. It prolongs shelf-life, enhances flavour and increases utilization in soups and sauces. It reduces wastages at time of bumper catches and permits storage for the lean season. It also increases protein availability to people throughout the year, and make fish easier to pack, transport and market.

However, a well dried fish product will go bad if it is not well packaged because of the hygroscopic nature and easy ability of fish to absorb oil when exposed to the atmosphere. In Nigeria, processed fish are not properly packaged and hence they are sold within a short period (Eyo, 2001); Nyong, *et al.*,2023)

Fish farming is now being adopted as a serious agribusiness in Nigeria. Even the Federal Government is sponsoring aquaculture based project to empower the youth and women as a way of reducing unemployment and consequently increasing productivity in the country at large. The recent increase in the

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number of catfish farms/marketers to meet the new demand warrants investigating how this category of farmers could increase their farm income. This study was carried out to ascertain the economic benefits of processed and packaged African catfish (*C.gariepinus*) to fish farmers in Edo state, describe the socio-economic of fish farming and marketing of processed and packaged *C.gariepinus* in Edo State, ascertain the profitability of processed and packaged *C.gariepinus* to fish farmers in Edo state.

**Materials and Methods:** The study was carried out in Edo State. It has diverse vegetation ranging from mangrove forest through the lowland rainforest and savannah zones in the north (Adeosun, F.I., Bemji, M.N., Adekunle, N.O. and Bolarinwa, K., 2009). The area is suitable for aquaculture due to the abundant natural resources. The target population for this study consisted of registered and non-registered fish farms (fish culturist, processors, and marketers) and consumers in selected agro-ecological zones of Edo state. The registered fish farms consisted of those farmers registered with the Department of Fisheries of the Edo State Ministry of Agriculture and Natural Resources. The first stage involved stratifying Edo state into the three recognized agro ecological zones (North, Central and South) according to the state’s Agricultural Development Programme (ADP) delineation.

The second stage involved purposive selection of (2) two local government areas from each zone based on the prevalence of fish farming and marketing activities. This gave a total of six

(6) local governments. The zones and the local government areas are; Edo south with a total of 7 LGA’s Egor, and Oredo was selected. In Edo central with a total of 5 LGA’s; Esan South East (ESE) and Esan North East (ENE) were selected, while in Edo North with a total of 6LGA’s, Etsako central (ETC), Etsako west (ETW). were selected: The third stage involved random selection of at least 30 % of fish farmers from each of the selected local government area. Data were collected through administration of questionnaire to the fish farmers. The following data were collected with the aid of a questionnaire. Socio-economic characteristics of respondents, Processing, packaging and Marketing information, Packaging, consumer satisfaction and acceptance Data collected were subjected to statistical analysis using SPSS version 2014.

**Results: Socio-Economic Characteristics of Respondents: Gender and Age distribution of respondents in the study area:** The result in Table 1 showed gender and age distribution of respondents. The result indicated that most of the fish farmers in Edo state are males (with a mean of 67.2 % males and 32.8 % females). Most farmers in Esan north east, Etsako central and Oredo local government areas are males with percentages of 83.3 %, 71.4 %,and 70.3 % respectively while few are females with 16.7 %, 28.6 % and 29.7% respectively. The result also showed the age distribution of respondents. It indicated that the age of most farmers lie between the ranges of 36-45yrs (38.8 %), 26-35yrs (25.9 %), 46-55yrs (25.9 %) in Edo state.

**Table 1: Gender and Age distribution of respondents in the study area**

|        |        | EDO STATE |       |      |      |      |      |      |
|--------|--------|-----------|-------|------|------|------|------|------|
|        |        | Egor      | Oredo | ESE  | ENE  | ETC  | ETW  | X    |
|        |        | (%)       |       |      |      |      |      |      |
| Gender | Male   | 66.7      | 70.3  | 61.1 | 83.3 | 71.4 | 50.0 | 67.2 |
|        | Female | 33.3      | 29.7  | 38.9 | 16.7 | 28.6 | 50.0 | 32.8 |

| Ages | 18 – 25yrs | 9.1  | 10.8 | 0.0  | 0.0  | 0.0  | 0.0  | 6.0  |
|------|------------|------|------|------|------|------|------|------|
|      | 26 – 35yrs | 27.3 | 35.1 | 0.0  | 33.3 | 35.7 | 12.5 | 25.9 |
|      | 36 – 45yrs | 39.4 | 32.4 | 50.0 | 33.3 | 35.7 | 50.0 | 38.8 |
|      | 46 – 55yrs | 21.2 | 16.2 | 50.0 | 33.3 | 28.6 | 25.0 | 25.9 |
|      | > 55yrs    | 3.0  | 5.4  | 0.0  | 0.0  | 0.0  | 12.5 | 3.4  |

NOTE: ESE (Esan South East), ENE (Esan North East), ETC (Etsako Central), ETW (Etsako west)

**Educational status and level of involvement of Respondents:** The result in Table 2 showed the educational status and level of involvement in fish farming of respondents. The result indicated that in Edo state, 50 % of farmers had tertiary education, 27.6 % are secondary school holders, 19 % are primary school holders while

3.4 % had no formal education. Oredo, Egor and Esan north east LGAs had the highest percentage of farmers with tertiary education with 67.6 %, 66.7 % 66.7 % respectively. No farmer had tertiary education in Esan south east LGA.

Table 2: Educational status and level of involvement of Respondents

|                      |               | EDO STATE |       |      |      |      |      |      |  |
|----------------------|---------------|-----------|-------|------|------|------|------|------|--|
|                      |               | Egor      | Oredo | ESE  | ENE  | ETC  | ETW  | X    |  |
|                      |               | (%)       |       |      |      |      |      |      |  |
| Educational status   | No Formal Edu | 0.0       | 0.0   | 11.1 | 0.0  | 0.0  | 25.0 | 3.4  |  |
|                      | Pri Sch       | 9.1       | 5.4   | 72.2 | 16.7 | 7.1  | 25.0 | 19.0 |  |
|                      | Sec Sch       | 24.2      | 27.0  | 16.7 | 16.7 | 50.0 | 37.5 | 27.6 |  |
|                      | Tertiary      | 66.7      | 67.6  | 0.0  | 66.7 | 42.9 | 12.5 | 50.0 |  |
| Level of involvement | Full time     | 66.7      | 67.6  | 77.8 | 83.3 | 92.9 | 100  | 75.0 |  |
|                      | Part time     | 33.3      | 32.4  | 22.2 | 16.7 | 7.1  | 0.0  | 25.0 |  |

NOTE: ESE (Esan South East), ENE (Esan North East), ETC (Etsako Central), ETW (Etsako west)

**Processing and Marketing Information**  
**Type of smoking materials used for fish processing:** The result in Table 3 showed the type of materials used for fish processing in

the study areas. The result in Edo state indicated that most respondents (58.5 %) used drums for processing, 22 % used smoking kiln while 19.5 % use the oven.

**Table 3: Type of material used for processing**

| EDO STATE           |      |       |      |     |      |      |             |
|---------------------|------|-------|------|-----|------|------|-------------|
| Smoking materials   | Egor | Oredo | ESE  | ENE | ETC  | ETW  | $\bar{X}$   |
| (%)                 |      |       |      |     |      |      |             |
| <b>Drum</b>         | 46.2 | 58.3  | 80.0 | 0.0 | 57.1 | 75.0 | <b>58.5</b> |
| <b>Oven</b>         | 30.8 | 16.7  | 20.0 | 0.0 | 14.3 | 0.0  | <b>19.5</b> |
| <b>Smoking kiln</b> | 23.1 | 25.6  | 0.0  | 0.0 | 28.6 | 25.0 | <b>22.0</b> |

**Economic benefits of processing catfish:** The result in table 4 showed the profit margin/kg of catfish processed by respondents in the study area in the last 12 months (1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> quarter) of the year. The result indicated that in the first quarter 36.6 % made profits between ₦150 and ₦250/kg, 41.5 % made profit between 251and350/kg, while 21.9 % made

profit between ₦ 351and 450/kg. The result was slightly different in the second quarter majority of respondents (53.7 %) made profit of ₦250 and below 34.2 % made profit between ₦251-350/kg, 12.2 % made ₦351-450/kg. In the third quarter the result showed that 100 % of respondents made profit of ₦250/kg and below.

**Table 4: Profit Margin/kg of catfish processed (1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> quarter) in the last 12 months**

| EDO STATE             |                      |      |       |      |     |      |      |             |
|-----------------------|----------------------|------|-------|------|-----|------|------|-------------|
| Qrter                 | Profit margin/kg (₦) | Egor | Oredo | ESE  | ENE | ETC  | ETW  | $\bar{X}$   |
| (%)                   |                      |      |       |      |     |      |      |             |
| <b>1<sup>ST</sup></b> | <b>150-250/kg</b>    | 46.2 | 41.7  | 0.0  | 0.0 | 28.6 | 50.0 | <b>36.6</b> |
|                       | <b>250-350/kg</b>    | 23.1 | 33.3  | 60.0 | 0.0 | 71.6 | 50.0 | <b>41.5</b> |
|                       | <b>351-450/kg</b>    | 30.8 | 25.0  | 40.0 | 0.0 | 0.0  | 0.0  | <b>21.9</b> |
| <b>2<sup>ND</sup></b> | <b>150-250/kg</b>    | 46.2 | 41.6  | 0.0  | 0.0 | 100  | 100  | <b>53.7</b> |
|                       | <b>250-350/kg</b>    | 30.8 | 39.6  | 100  | 0.0 | 0.0  | 0.0  | <b>34.2</b> |
|                       | <b>351-450/kg</b>    | 23.1 | 16.7  | 0.0  | 0.0 | 0.0  | 0.0  | <b>12.2</b> |

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|                 |            |     |     |     |     |     |     |     |
|-----------------|------------|-----|-----|-----|-----|-----|-----|-----|
| 3 <sup>RD</sup> | 150-250 kg | 100 | 100 | 0.0 | 0.0 | 100 | 100 | 100 |
|                 | 250-350/kg | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
|                 | 351-450/kg | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

NOTE: ESE (Esan South East), ENE (Esan North East), ETC (Etsako Central), ETW (Etsako west)

**Sales price per unit of processed fish:** The result on sales price per unit of processed fish showed that 39.0% of respondents sold 0.25 kg for ₦750, 43.9 % sold 0.25 kg for ₦850 while 17.1 % sold 0.25 kg for ₦1000. [i.e sales

prices were ₦3000/kg (39.0 %), ₦3400/kg (43.9 %), ₦4000/kg (17.1 %)]. Thus the sales price varied between ₦3000 to ₦4000/kg dry weight of smoke dried *C. gariepinus*.

Table 5: Sales price per unit of processed fish.

|                    |             | EDO STATE |       |      |     |      |      |           |  |
|--------------------|-------------|-----------|-------|------|-----|------|------|-----------|--|
|                    |             | Egor      | Oredo | ESE  | ENE | ETC  | ETW  | $\bar{X}$ |  |
| Price per unit (₦) | 1kg = ₦3000 | 38.5      | 50.0  | 20.0 | 0.0 | 42.9 | 25.0 | 39.0      |  |
|                    | 1kg = ₦4000 | 7.7       | 8.3   | 40.0 | 0.0 | 28.6 | 25.0 | 17.1      |  |
|                    | 1kg = ₦3400 | 53.8      | 41.7  | 40.0 | 0.0 | 28.6 | 50.0 | 43.9      |  |

NOTE: ESE (Esan South East), ENE (Esan North East), ETC (Etsako Central), ETW (Etsako west)

**Packaging of processed catfish.: Packaging materials :** The result on packaging material used showed that the major packaging material used in the study area were nylon bags (56.1 %) followed by well sealed polythene bags (29.3 %) and paper carton (14.6 %).

**Preferred packaging material:** The result on preferred packaging material showed that 61.0 % of respondents in the study area preferred well sealed polythene bags, 31.7 % nylon bags while 7.3 % preferred paper carton.

Table 6: Packaging materials and preferred packaging material

|                    |                       | EDO STATE |       |      |      |      |      |           |  |
|--------------------|-----------------------|-----------|-------|------|------|------|------|-----------|--|
|                    |                       | Egor      | Oredo | ESE  | EN E | ETC  | ETW  | $\bar{X}$ |  |
|                    |                       | (%)       |       |      |      |      |      |           |  |
| Packaging Material | Paper carton          | 15.4      | 16.7  | 20.0 | 0.0  | 14.3 | 0.0  | 14.6      |  |
|                    | Well sealed polythene | 30.8      | 33.3  | 0.0  | 0.0  | 42.9 | 25.0 | 29.3      |  |
|                    | Nylon                 | 53.8      | 50.0  | 80.0 | 0.0  | 42.9 | 75.0 | 56.1      |  |
|                    | Paper carton          | 7.7       | 8.3   | 20.0 | 0.0  | 0.0  | 0.0  | 7.3       |  |

|                                     |                              |      |      |      |     |      |      |             |
|-------------------------------------|------------------------------|------|------|------|-----|------|------|-------------|
| <b>Preferred packaging material</b> | <b>Well sealed polythene</b> | 61.5 | 58.3 | 20.0 | 0.0 | 85.7 | 75.0 | <b>61.0</b> |
|                                     | <b>Nylon</b>                 | 30.8 | 33.3 | 60.0 | 0.0 | 14.3 | 25.0 | <b>31.7</b> |

NOTE: ESE (Esan South East), ENE (Esan North East), ETC (Etsako Central), ETW (Etsako west)

**Effect of Packaging on the cost of fish, shelf life and length of storage:** The result on effect of packaging on the cost, shelf life and length of storage showed that 100 % of respondents stated that packaging affects the shelf life of fish products. The result on the length of storage showed that majority (63.4 %) of the respondents indicated that the length of storage was for 2 weeks, 9.8 % between 2-3 weeks,

22.0 % stored for 1 month, 4.9 % stored for 2 months.

**The effect of packaging on the cost of the fish:** The result on the effect of packaging on the cost of the fish showed that 52.0 % of respondents in the study area indicated that there was no effect of packaging on the prize of the fish while 47.5 % indicated that packaging increased the cost.

**Table 7: Effect of Packaging on cost of fish, shelf life and length of storage**

|   |                      | <b>EDO STATE</b> |       |      |     |      |      |             |
|---|----------------------|------------------|-------|------|-----|------|------|-------------|
|   |                      | Egor             | Oredo | ESE  | ENE | ETC  | ETW  | $\bar{x}$   |
|   |                      | <b>(%)</b>       |       |      |     |      |      |             |
| <b>Does packaging affect shelf life</b> | <b>YES</b>           | 100              | 100   | 100  | 0.0 | 100  | 100  | <b>100</b>  |
|   | <b>NO</b>            | 0.0              | 0.0   | 0.0  | 0.0 | 0.0  | 0.0  | <b>0.0</b>  |
| <b>How long</b>                         | <b>&lt;1 week</b>    | 0.0              | 0.0   | 0.0  | 0.0 | 0.0  | 0.0  | <b>0.0</b>  |
|   | <b>1-2 weeks</b>     | 69.2             | 75.0  | 80.0 | 0.0 | 28.6 | 50.0 | <b>63.4</b> |
|   | <b>2-3 weeks</b>     | 0.0              | 0.0   | 20.0 | 0.0 | 28.6 | 25.0 | <b>9.8</b>  |
|   | <b>1 month</b>       | 30.8             | 25.0  | 0.0  | 0.0 | 14.3 | 25.0 | <b>22.0</b> |
|   | <b>2 months</b>      | 0.0              | 0.0   | 0.0  | 0.0 | 28.6 | 0.0  | <b>4.9</b>  |
|   | <b>3 months</b>      | 0.0              | 0.0   | 0.0  | 0.0 | 0.0  | 0.0  | <b>0.0</b>  |
| <b>Effect</b>                           | <b>No effect</b>     | 61.5             | 72.7  | 100  | 0.0 | 0.0  | 0.0  | <b>52.0</b> |
|   | <b>Increase cost</b> | 38.5             | 27.3  | 0.0  | 0.0 | 100  | 100  | <b>47.5</b> |

NOTE: ESE (Esan South East), ENE (Esan North East), ETC (Etsako Central), ETW (Etsako west)

**Discussion: Socio Economic**

**Characteristics: Gender and Age:** The result on gender distribution showed that the males were more involved in fish farming activities than the females in Edo state (i.e. 67.2 % male and 32.8 % female). This may be attributed to the task involved in fish farming. This agrees with Ifejika, P.I., Uzokwe, U.N. and Oladosu, O.I., (2013) who reported that 81.8 % of fish farmers were males and 18.2 % were females. Also Adeogun, O.A., Ogunbadejo, H.K., Ayinla, O.A., Oresgun, A., Oguntade, O.R., Alhaji-Tanko; Nyong, and Nweze, (2012) and Williams, S.B., (2007) reported that 83.9 % of fish farmers were males and 16.1 % were females.

The result on age distribution showed that 70.7 % of fish farmers in the study area were 45 years and below (18-45years). While 29.3 % were above 46 years (46-55 years, 25.9 % and >55 years 3.4 %) This implied that fish farming is being practiced by the young people in their very active and youthful age when they still have the energy, zeal and ability to work. Egbufor, H.E., Onemolease, E.A. and Erie, A.P. (2012) also reported that the average age of 33 years were involved in fish farming which suggested that young able bodied men are actively involved in fish farming. The result of this study was also close to the findings of Akenbor and Ike (2015) Nyong, and Nweze, (2012); who reported that 87.8 % of fish farmers were 40 years old and above.

**Educational status and Level of involvement:** The result on the educational status of respondents in the study area showed that (50%) of the respondents had tertiary education, 27.6 % had secondary school education which implied that fishing activities is mainly practiced by educated people. This may be due to skills acquired at the tertiary institutions and secondary level. This result is similar to the findings of Ifejika *et al* (2013) who reported that 82.8 % of farmers were found to be graduates of various degrees.

The result on level of involvement in fish farming indicated that 75.0 % of respondents in Edo state engaged in fish farming activities on fulltime while 25.0 % engaged in farming on part time basis. This result indicated that the margin between fulltime fish farmers and part

time fish farmers is quite large. Both the employed and the unemployed are engaged in fish farming. Thus some proportion of fish farmers had other jobs. This result was similar to (Okonji and Osayi, 2016) who reported that more people engaged in fish farm on a full time (56.8 %) bases than the part time (43.2%) ones. This result differs from Ideba, E.E., Out, W.I., Essien, A.A., Iniobong, E.O. and Ekaette, S.U. (2013) who reported that 89 % were part time fish farmers and 11 % fulltime fish farmers. Adewuyi, S.A., Phillip, B.B., Ayinde, I.A; Nyong, *et al.*,2023) . and Akerele, D. (2010) reported that 71.9 % of fish farmers were part time fish farmers while 28.1 % were full time fish farmers. The difference in result suggested that more people particularly unemployed school leavers are taking up fish farming as full time job over time.

**Processing and Marketing Information:**

**Type of smoking materials used for fish processing:** The result in Table 3 showed the type of materials used for fish processing in the study areas. The result in Edo state indicated that most respondents (58.5 %) used drums for processing, 22 % used smoking kiln while 19.5 % use the oven. The dominance in the use of drums is an indication of the level of operation of processors in the study area as most processors may not be able to afford more sophisticated smoking/processing materials. This could also be as a result of the easy access to abundant fuel wood in the area being tropical. This result is similar to the findings of Omoruyi, K., Owolabi, K.E. and Oghoje, A.E. (2016) who stated that majority of processors (77.5 %) in Warri-South LGA used full metal oil drum to smoke their fish, 20.0 % used half metal oil drum and 2.5 % used wooden kiln.

**Economic benefits of processing catfish:** The result showed the profit margin/kg of catfish processed by respondents in the study area in the last 12 months (1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> quarter) of the year. The result indicated that in the first quarter 36.6 % made profits between ₦150 and ₦250/kg, 41.5 % made profit between 251and350/kg, while 21.9 % made profit between ₦ 351and 450/kg. The result was slightly different in the second quarter majority of respondents (53.7 %) made profit of ₦250 and below 34.2 % made profit between ₦251-350/kg, 12.2 % made ₦351-450/kg. In the third

quarter the result showed that 100 % of respondents made profit of ₦250/kg and below. This result is similar to the findings of Omowa (2016) who stated that profit generated from marketing processed fish was ₦160/kg. Adeyokunnu (1980), noted that factors which affect profit margins in fish /from fish include multiplicity of traders, which leads to duplication of functions and the small scale of operation, inefficient processing, transportation bottlenecks and losses due to storage.

**Sales price per unit of processed fish:** The result on sales price per unit of processed fish showed that 39.0% of respondents sold 0.25 kg for ₦750, 43.9 % sold 0.25 kg for ₦850 while 17.1 % sold 0.25 kg for ₦1000. [i.e sales prices were ₦3000/kg (39.0 %), ₦3400/kg (43.9 %), ₦4000/kg (17.1 %)]. Thus the sales price varied between ₦3000 to ₦4000/kg dry weight of smoke dried *C. gariepinus*. The variation in prices may be as a result of difference in input, standard of living of the area, level of demand and availability of product in the area. This was supported by Emokaro (2010) who reported that that fish prices were likely to be high in areas close to large and growing urban markets facilitated with good roads, together with demand and supply in combination with the transaction cost of marketing which influences the price the farmers can charge for their products.

**Packaging of processed catfish.: Packaging materials :** The result on packaging material used showed that the major packaging material used in the study area were nylon bags (56.1 %) followed by well sealed polythene bags (29.3 %) and paper carton (14.6 %). The prevalence of the use of nylon bags may be as a result of its cost as it is cheapest to afford. The result was different from the findings of Abolagba and Akise (2011) who observed that in Ekenwan 57.0 % of the fish processors preferred the use of basket as their packaging material, followed by 15.2 % who also used jute-bags as their commonly used packaging material, while only 12.7 % and 15.2 % go for paper carton and palm rope as their commonly used packaging material. The differences in findings may be as a result of the fact that Ekenwan is a fishing community which packages smoked fish in basket for transport.

However Folorunsho, O., Michael, O. and Olufemi, P. (2015); Nyong, *et al.*, 2023) observed that packaging of dried fish in a well-sealed polythene can keep the fish in good quality over a relatively long period.

**Preferred packaging material:** The result on preferred packaging material showed that 61.0 % of respondents in the study area preferred well sealed polythene bags, 31.7 % nylon bags while 7.3 % preferred paper carton. Nautilus consultants (1997) stated that packaging can gain greater consumer acceptability, which will increase demand, providing producers with additional income. Abolagba and Akise (2011) reported that in Ekenwan 42.3 % and 38.5 % liked jute-bags and baskets packaging material respectively, 15.4 % and 3.8 % liked paper carton and palm rope packaging materials. David (2007) and Eyo (2001) recommended the packaging of dried fish in clean good-quality sacks lined with polythene or thick brown paper to slow the rates of immigration of dermestid beetle and prevent cross infestation in storage. The dominance of polythene and nylon bags is because smaller quantities are required by consumers.

Olurobode, G.B., Adelowo, E.O. and Unogwu, A., (2013) stated that the improvement of packaging (using low cost local effective packaging materials) and good storage conditions can protect fish products against spoilage and damage. Folorunsho *et al* (2015) stated that the use of well sealed polythene to package smoked catfish can improve its marketing on the shelves in super markets with proper labeling. This development will not only lead to improvement of the value chain of fish but provide additional business opportunity for investors. This will further enhance the export value of processed fish, reduce the risk of damage and guaranteed quality smoked fish to consumers.

**Effect of Packaging on the cost of fish, shelf life and length of storage:** The result on effect of packaging on the cost, shelf life and length of storage showed that 100 % of respondents stated that packaging affects the shelf life of fish products. This supports the findings of Akande, G.R., Ajayi, A.A., Ogunweno, C. and Ash, M.T. (2005), who reported that packaging was found to have an effect on the storage life



of the smoked products irrespective of the mode of storage. Also Soroka (2002) ; Nyong, *et al.*, 2023) stated that a well dried fish product will still go bad if it was not well packaged because of the hygroscopic nature and quick loss of oil when exposed to the atmosphere.

The result on the length of storage showed that majority (63.4 %) of the respondents indicated that the length of storage was for 2 weeks, 9.8 % between 2-3 weeks, 22.0 % stored for 1 month, 4.9 % stored for 2 months. The length of storage may be a function of the packaging materials and the level of dryness (length of smoking) of the packaged fish product. Arthur and Oseiu-Somuah (2004) stated that the longer the fish is smoked with the right temperature, the longer will be the shelf life. Folorunsho *et al* (2015) also stated that packaging of dried fish in Polythene bag can keep the fish in good quality over a relatively long period. The use of the packaging materials improved the storability of smoked dried fish by increasing the shelf life from about one month to between four and six months in good quality confirming the observation made by Masoomah, R., Alin, M. and Hashem, P. (2010).

**The effect of packaging on the cost of the fish:** The result on the effect of packaging on the cost of the fish showed that 52.0 % of respondents in the study area indicated that there was no effect of packaging on the prize of the fish while 47.5 % indicated that packaging increased the cost. This may be a function of the type of packaging material as some are cheaper than the others. Adebayor (2016) stated that packaging increased the cost of the fish. Bykowski and Dutkiesicz, (1996) and David, (2007) stated that sometimes packaging is so important that it cost more than the product itself (value addition) in order to lure the consumers to buy it. The use of nylon as dominant packaging material to the consumers affects the cost of the fish minimally hence most consumers did not notice the cost on the total cost of fish.

**Conclusion:** The economic benefits of processed and packaged african catfish (*C. gariepinus*) to fish farmers in Edo state was analysed. The result showed that fish processing in the study area is though popular, but still in a small scale, as major smoking material used is the drum. There is need for

research focus on packaging of smoked catfish for value addition in order to improve the marketability of the product, majority of respondents made profits of ₦ 250/kg of smoked fish which means an increased production and construction of good roads to ease transportation challenges can further increase income of farmers from the venture. It is therefore expected that smoked catfish will be a lucrative business in Edo state.

**Recommendations** Based on these findings: There is also need to encourage those in the business through micro-credit scheme to improve on packaging technology which could enhance the marketability of the product. Processors and marketers should be effectively linked to available financial institutions in the study areas for provision on-lending facilities to those stakeholders in terms of loans such as business plan development, project management, bank lending regulations and loan repayment, financial management and record keeping to these stakeholders to improve their scale of production and better their business performance. More enlightenment on the importance of proper fish packaging with good packaging materials should be done in schools and higher institutions in the state as this would increase productivity through value addition.

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