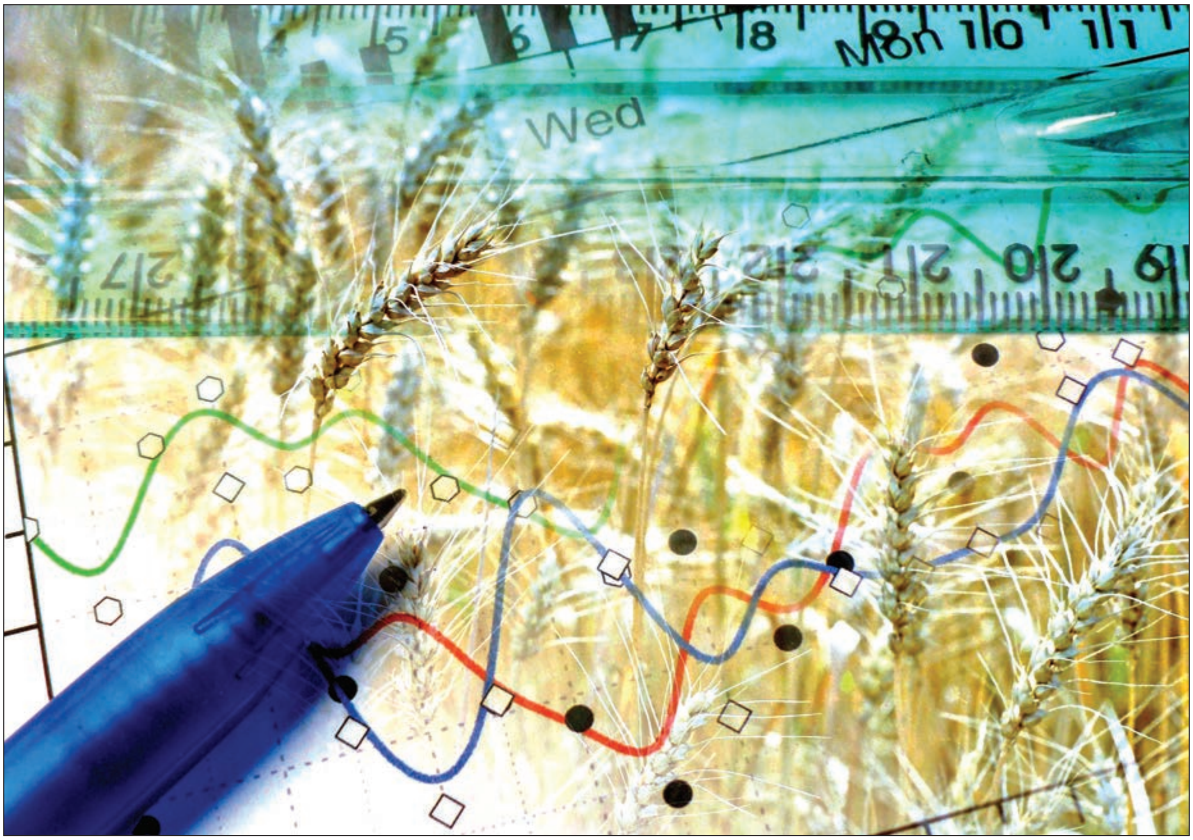

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Analysis of Wholesale Frozen Fish Markets in Calabar, Cross River State, Nigeria

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ABSTRACT
The study was carried out to evaluate the wholesale frozen fish market in Calabar, Cross River State for the period January 2000 to December 2010. Data for the study were obtained from records kept by five firms in the area. The data were analysed using descriptive statistics, Herfindahl index, analysis of variance and multiple regression analysis. The result showed that the wholesale frozen fish market structure is perfectly competitive with an Herfindahl index of 0.211. The mean marketing margin per carton (20 kg) of the different species of frozen fish in absolute and relative terms were N 251.21 and 21.42%; N 373.56 and 12.5%; N 283.74 and 17.99%; N 358.61 and 13.48%; N 167.39 and 11.8% for sardinella, croaker, herring, original mackerel and horse mackerel, respectively. However, the mean marketing margin among the species of frozen fish was significantly different (F-cal cal 6.03>critical 2.39). The results further revealed that the supply of frozen fish was positively and significantly influenced by the prices of the commodity overtime. The short run and long run elasticities with respect to own price were 0.48 and 0.56; 0.29 and 0.62 ; 0.17 and 0.25 ;0.44 and 0.82; 0.38 and 4.67 for sardinella, herring, original mackerel, horse mackerel and croaker, respectively. Trading more on sardinella would give the wholesalers more in terms of marketing margin while increase in the price of croaker would be an incentive to increase its supply overtime.

Key words: Frozen fish market, herfindahl index, marketing margin, market structure

INTRODUCTION
One of the greatest problems confronting millions of Nigerians today is lack of adequate protein both in quality and quantity in the diet of the nation's ever growing population (Atimo and Laolu, 1983). Serious deficiencies in the amount of protein intake hinder people's health particularly mental capability, productivity and can even affect the overall national economic growth itself (Olayide *et al*., 1975). There are various food items that are known to supply protein when consumed ranging from animal sources (livestock and fishes) to crop sources (legumes). Proteins of animal origin (livestock and fishes) are higher in protein quality than plant protein as they contain essential amino acids, vitamins and minerals. Preferences and consumption of these meat types can be influenced by a number of factors such as disposable income, availability, taste, personal idiosyncrasies of the individuals, among others. The prevalent level of poverty in Nigeria appears to have caused the preferences of fish to meat as a source of protein in many homes, since frozen fish appears to be relatively cheaper than cow or poultry meat.

Frozen fish, as a food item, has been recognized for many years to contribute greatly to the dietary needs of Nigerians. As sources of protein, the importance of fish in reducing protein deficiency in the country cannot be overemphasized (Ukoha, 1998).

In Cross River State, 80% of the available animal protein comes from fish and fish products (Moses, 1980). Frozen fish has been a source of human food, livestock feed, sources of income and employment in the state.

The main objective of this study is to analyze wholesale frozen fish marketing in Calabar, cross River State. The following are the specific objective:

- To examine the structure of the frozen fish market at the wholesale level in Calabar
- To determine the mean quantity traded and the marketing margins received by the wholesale frozen fish marketers for the different species and to make comparisons among them
- To estimate a sales response function for the different species of frozen fish

MATERIALS AND METHODS

Study area: This study was carried out in Calabar Municipality and Calabar South Local Government Areas of Cross River State. Calabar Metropolis is a coastal town lying between latitude 04°.15 and 5°.15 North and Longitude 8°.15 East of the Equator. Calabar has an area of 7, 245, 935 sqkm and a population of about 2.4 million. It is the capital of Cross River State with various businesses enterprises including frozen fish enterprises.

Sampling procedure: A pre-field survey carried out showed that there are eight cold stores in Calabar Metropolis. This study purposively made use of five frozen fish cold stores using the volume of operation and availability of records as yardsticks for selection. The stores include Udosen and Son Limited with a storage capacity of 300 tonnes; Uweco Cold Stores with a storage capacity of 240 tonnes; Isong and Son Limited with a storage capacity of 160 tonnes, Afcon investment and Emmacon (Nig) Enterprise in Calabar with storage capacities of 120 and 165 tonnes, respectively. These stores kept up to date records and were willing to make the records available for the study. The species traded by these firms include; sardinella (*Harengula jaguana*), horse mackerel (*Trachus trachus*), croaker (*Johnius dussumieri*), herring (*Clupeiforms*) and mackerel (*Scombar scombrus*).

The data obtained include: wholesale buying price and quantity bought as well as wholesale selling price and quantity sold. The study covered the period between January 2000 to December 2010.The total quantities are expressed in Kilogrammes (20 kg) per carton of fish.

Methods of analysis: Data obtained were analyzed using descriptive statistics and regression analysis. The structure of the frozen fish marketing at the wholesale level in Calabar was analysed using the Herfindahl index. This index is used to measure the concentration of the market which is one of the variables of the market structure and is given thus:

$$S_i \frac{q_i}{q} \text{ (Market Share of the Stores)} \quad (1)$$

$$\begin{gathered} HI = S_1^2 + S_2^2 + \ldots\ldots + S_n^2 \\ \sum S_i^2 = \frac{1}{q_n} \sum q_i^2 \end{gathered} \quad (2)$$

where, q_i is quantity sold of store I, q_n is quantity sold of all stores:

$$S_i = \frac{\text{Quantity sold of all frozen fish stores}}{\text{Number of stores}}$$

$$S_n^2 = \frac{\text{Quantity n frozen fish stores}}{\text{n No. of stores}}$$

To estimate marketing margin at wholesale level (objective 3), the wholesale buying price of the different species of frozen fish was subtracted from the wholesale selling price of the frozen fish of the same species.

That is:

$$Mm_i = Wbp_i\text{-}Wsp_i \tag{3}$$

where, Mm is marketing margin, wbp is wholesale buying price, wsp is wholesale selling price, p_i is species of frozen fish.

Analysis of variance was also used to compare difference among means for the different species of fishes. Anova was further subjected to Least Significant Difference (LSD) and Duncan Multiple Range Test (DMRT) to separate the means (Snedecor and Cochran, 1980). Sales response function was also estimated using the ordinary Least Square technique to determine the effect of own price, season and lagged quantities of the different species of frozen fish marketed objective (3). The model is stated as follows:

$$Q_{(s)} = f\ (x_1,\ x_2,\ x_3,\ldots,\ u) \tag{4}$$

where, $Q_{(s)}$ is quantity of frozen fish species sold in (20 kg) cartons, X_1 is season (a dummy variable) festive period = 1, Non-festive period = 0, X_2 is lagged quantity sold of frozen fish in 20 kg per carton, X_3 is own price of the frozen fish species.

The general forms of the equations used are:

- Linear function:

$$Q(s)=b0+b1x1+b2x2+b3x3-1+U \tag{5}$$

- Semi logarithmic function:

$$Q=b0+b1Inx1+b2Inx2+b3Inx3\text{-}1+U \tag{6}$$

- Double logarithmic function:

$$InQ=b0+b1Inx1+b2Inx2+b3Inx3\text{-}1+U \tag{7}$$

- Exponential function:

$$\text{InQ} = b0 + b1x1 + b2x2 + b3x3\text{-}1 + U \tag{8}$$

Q, X_1, X_2 and x_3 as defined in Eq. 1. b_0 = constant term (intercept), b_1-b_3 are coefficients to be estimated, U = the error term.

RESULTS AND DISCUSSION

Frozen fish market structure in Calabar metropolis of Cross River State: The Herfindahl index is 0.211 (i.e., 21%).The low index number signified low concentration of market shares amongst the firms. The frozen fish market structure is perfectly competitive. The results showed that the marketers traded a total quantity of 112,640.60 cartons of croaker between January 2000 and December 2010. The mean monthly quantity supplied was 838.671 cartons with a standard deviation of 292.966. The maximum number of cartons supplied during the period was 1614.00 cartons while the minimum was 44.00 cartons.

The total quantity of herring supplied by all the firms between January 2000 and December 2010 was 158,856.80 cartons. The mean monthly quantity supplied was 1,323.8067 cartons (SD = 285.7449). The maximum and minimum numbers of cartons supplied were 2015.00 cartons and 680.00 cartons. For original mackerel, total quantity supplied by all the firms between January 2000 and December 2010 was 141,542.00 cartons. The mean monthly quantity supplied was 1,179.5167 cartons (SD = 249.6296). The maximum and minimum numbers of cartons supplied were 1850.00 cartons and 63.00 cartons, respectively.

For horse mackerel, total quantity supplied by all the firms within the periods under study was 169,232 cartons. The mean monthly quantity supplied was 1410.2667 cartons (SD = 291.3312). The maximum and minimum numbers of cartons supplied were 2100.00 and 656.00 cartons respectively. Lastly, the total quantity of Sardinella supplied by all the firms between January 2000 and December 2010 was 354,435.4 cartons. The mean monthly quantity was 2,953.6283 cartons (SD = 1489.6641). The maximum and minimum numbers of cartons supplied were 162,504.00 and 908.00 cartons, respectively. The Duncan Multiple Range Test result indicates that the mean quantity sold of Sardinella was significantly different ($p<0.05$) from the means of other species while there was no significant difference among the mean quantities of herring, horse mackerel and original mackerel. However, the quantities of these species were significantly different from that of croaker. A comparison of the mean quantities of the different species of frozen fish traded by the firms from January 20005 and December 2010 showed that sardinella was supplied much more than the rest of the species of frozen fish and that the least supplied was croaker followed by original mackerel, herring and horse mackerel (Table 1).

Table 1: Mean quantities (20 kg per carton) traded by marketers for the different species of frozen fish

Species	Minimum	Maximum	Mean	Standard deviation
Croaker	244.00	1614.00	938.6717^{c}	292.9664
Herring	680.00	2015.00	1323.8067^{b}	285.7449
Original **Mackerel**	630.00	1850.00	1179.5167^{bc}	249.6296
Horse **Mackerel**	656.00	2100.00	1410.2667^{b}	291.3312
Sardinella	908.00	162504.00	2953.6283a	14689.664

Source: Computed from field survey data (2010). Means with different alphabets are significantly different ($p<0.05$)

Table 2: Mean marketing margins of the species of frozen fish marketed

Species	Absolute	Relative (%)
Sardinella	251.21	21.42
Croaker	373.56	12.58
Herring	283.74	17.99
Original mackerel	358.61	13.48
Horse mackerel	167.39	11.82

Source: Computed from field survey data (2010)

The larger number of cartons of sardinella traded is an indication that it is more preferred to other species due to its lowest price while croaker is bigger and more expensive not easily affordable by most Nigerians. On the whole quantity supplied increased over time. The mean marketing margin per carton (20 kg) of the different species of frozen fish is presented in Table 2. It shows the estimated absolute marketing margin and relative marketing margins over the period under study. The estimated mean absolute marketing margin for sardinella was N 251.21 (SD = 66.20). The estimated mean relative marketing margin was 21.42%. This implies that for every 100.00 spent, the firms had returns of 21.42. Also, the estimated mean absolute marketing margins were 373.56, 358.61, 167.39 and 283.74 for croaker, original mackerel, horse mackerel and herring respectively. Their estimated mean relative marketing margins were 12.58, 13.4, 11.82 and 17.99%, respectively.

However, there was a significant difference in mean marketing margin among the species of frozen fish for the period under study at 1% level (Fcal 6.03> Critical 2.39). The L S D estimated was 63.70. The highest mean relative marketing margin was recorded by sardinella (21.42%). This is similar to the finding. Also, herring relative marketing margin per carton was 17.99%. This is also similar to the result reporting by Idiong (1992 unpublished data). The lowest marketing margin in both relative (11.82%) and absolute terms (N167.4) was recorded by horse mackerel. On a general note, the result showed low marketing margins for all the species of frozen fish under study. This is due to less marketing functions performed as well as fewer numbers of middlemen. Another, reason for the low margin is that the frozen fish retains its identity from the producers to the consumers. This is agreement with the assertion of Kohl and Uhl (1972).

The results of the estimated sales response functions for sardinella are presented in Table 3. The double-logarithmic functional form was chosen as lead equation, as can be seen from the diagnostic test results in the table. Particularly, this function has the highest F-ratio of 414.159 which is significant at the 1% level and has the highest adjusted coefficient of multiple determination of 0.0933. The calculated Durbin Watson statistic of 1.918 was statistically significant at the 1% level and indicates absence of serial correlation among the error terms. Price coefficients have the expected positive sign and is significant at the 1% level implying that, price of sardinella positively influence supply. Elasticities of supply with respect to price of herring supplied are inelastic (0.48 and 0.56) in the short-run and long-run, respectively.

This means that 10% increase in price of herring will bring about 4.8% and 5.6% increase in quantity supplied in the short and long and respectively. Lagged quantity of sardinella was significantly at 5% level. This implies that the current supply of sardinella depends on last month quantity supplied by the firms. The season variable was not significant event at 10% level signifying that season does not significantly affect current supply of sardinella. The R^2 of 0.93 was quite high and implies that 93% of variability of the dependent variable (Y) was explained by the independent variable (X) or the regressors. Table 4 shows the result of herring sales response functions. Based on economic, econometric and statistical criteria, the semi-logarithmic function is chosen as the lead equation and used for the discussion. The adjusted R^2 was 0.67 which implies that 67% of the variability of the dependent variable is explained by the independent variable. This function has the highest F-ratio 77.51 which is significant at the 1% level and has the highest adjusted coefficient of multiple determination of 0.660. The calculated Durbin Watson statistics of 1.817 was statistically significant at the 1% level and indicated absence of serial correlation among the error terms.

The price variable carried the expected positive sign and is significant at the 1% level implying that the higher the price the higher the quantity of herring supplied. Elasticities of supply with respect to price of herring supplied are price inelastic (0.29 and 0.62) in the short-run and long-run respectively. This means that 10% increase in prices of herring will bring about 2.29 and 6.2% increase in quantity supplied in the short and long run respectively. Lagged quantity of herring is significant at the 1% level. This implies that the current supply of herring depends on last month quantity supplied by the firm. The season variable is significant at 1% signifying that season significantly affect current supply of herring.

Table 3: Regression results for sardinella

Coefficient	Linear	Double	Exponential	Semi-log
b_0	234.575	2.553	5.772	-2937.145
	(1885,.252)	(1.439)	(2.046)	(1355.162)
b_1	0.137	0.0199	-0.00003	24.037
	(1.251)	(0.017)	(0.001)	(16.456)
b_2	0.307***	0.240***	0.00039***	122.997**
	(0.047)	(0.047)	(0.000)	(44.515)
b_3	1.599***	0.657***	0.00125***	808.356***
	(0.107)	(0,042)	(0.000)	(39.378)
R^2	0.885	0.918	0.848b	0.936
AdjR^2	0.881	0.916	0.842	0.933
F-ratio	219.034	320.864	158.392	414.159
Dw	1.837	1.912	1.880	1.918
h-	indeterminate			

Source: Computed from field survey data (2010). Values in parentheses are standard errors, ***Significant at 1% level, **Significant at 5%level, *Significant at 10% level

Table 4: Regression results for herrings

Coefficient	Linear	Double	Exponential	Semi-log
b_0	137.343	0.668	6.243	-7126.58
	(85.019)	(0.489)	(0.069)	(605.177)
b_1	78.26**	0.0525***	0.0572**	78.867***
	(32.509)	(0.026)	(0.026)	(32.032)
b_2	0.588**	0.601***	0.00051***	704.532***
	(0.077)	(0.074)	(0.000)	(93.780)
b_3	0.242**	0.296**	0.000147***	459.614***
	(0.068)	(0,089)	(0.000)	(111.152)
R^2	0.654	0.657	0.640	0.669
Adjr^2	0.45	0.648	0.630	0.660
F-ratio	72.584	73.963	68.106	77.511
DW	1.815	1.743	1.712	1.817
h-	indeterminate			

Source: Computed from field survey data (2010). Values in parentheses are standard errors, ***Significant at 1% level, **Significant at 5%level, *Significant at 10% level

Table 5: Regression result for original mackerel

Coefficient	Linear	Double	Exponential	Semi-log
b_0	207.531	0.871	6.190	-5911.382
b_1	(79.55)	(0.523)	(0.720)	(581.876)
b_2	0.150***	0.365***	0.00011***	89.525***
	(0.034)	(0.084)	(0.000)	(86.765)
b_3	0.459***	0.466***	0.00045***	452.647***
	(0.081)	(0.587)	(0.000)	(94.827)
R^2	0.581	0.587	0.574	0.599
AdjR^2	0.570	0.577	0.563	0.588
F-ratio	53.115	54.999	51.630	59.148
Dw	1.847	1.910	1.784	1.877
h -	Indeterminate			

Source: Computed from field survey data, (2005). Values in parentheses are standard errors, ***Significant at 1% level, **Significant at 5% level, *Significant at 10% level

The results of the estimate sales response of original mackerel are presented in Table 5. The semi-log functional form was chosen as lead equation, as can be seen from the diagnostic tests results in the table. The adjusted R^2 was 0.59 implying that 59% of the variability of the dependent variable is explained by the independent variables.

Particularly, this function has the highest F-ratio of 57.148 which is significant at the 1% level and has the highest adjusted coefficient of multiple determination of 0.588. The calculated Durbin-Watson statistics of 1.877 was statistically significant at the 1% level and indicated absence of serial correlation among the error terms. The Price variable carried the expected positive sign and is significant at the 1% level implying that increase in price of original mackerel will bring about corresponding increase in supply.

Lagged quantity of original mackerel was significant at the 1% level implying the last month's quantity of original mackerel positively influenced current quantity of original mackerel supplied by the firm. The season variable in this case is significant at the 1% level and is positive implying that season influence current quantity of original mackerel supplied. That is, during the festive season quantity supplied is much more than during the non-festive season.

The elasticities of supply with respect to price of original mackerel supplied are price inelastic (0.17 and 0.29) in the short-run and long-run, respectively. This implies that, a 10% increase in price of original mackerel will lead to 1.7 and 2.9% increase in quantity supplied in the short-run and long-run respectively. Table 6 shows the result of horse mackerel sale response function with the semi-log function chosen as the lead equation. The price variable carried the expected positive sign and is significant at the 1% level implying that there is a direct relationship between quantity and price of horse mackerel. Elasticities of supply with respect to price of horse mackerel are 0.44 and 0.82 in the short and long run. This implies that an increase in price by 10% will lead to 8.2% increase in quantity supply of horse mackerel. It also indicates that horse mackerel supply is price inelastic.

Lagged quantity of horse mackerel is significant at the 1% level implying that last month's quantity of horse mackerel supphed positively influenced current quantity of the product supplied in the market. The season variable was not significant even at the 10% level implying that season does not affect current supply of horse mackerel in the firms. For Croaker's sales response, the semi-log estimate gave the lead equation (Table 7). The price variable carried the expected positive sign and is significant at the 1% level implying that the higher the price, the higher the quantity of croaker supplied. Elasticities of supply with respect to quantity of croaker supplied is 0.38 and

Table 6: Regression result for horse mackerel

Coefficient	Linear	Double	Exponential	Semi-log
b_0	102.121	0.476	6.282	-7857.378
	(87.126)	(0.465)	(0.066)	(617.599)
b_1	5.732*	0.0215*	0.0226*	49.215*
	(30.193)	(0.022)	(0.023)	(29.911)
b_2	0.414***	0.456***	0.000271***	644.629***
	(0.090)	(0.093)	(0.000)	(125.872)
b_3	0.505***	0.477***	0.000398***	634.638***
	(0.79)	(0.073)	(0.000)	(100.476)
R^2	0.684	0.676	0.668	0.689
AdjR^2	0.676	0.668	0.659	0.681
F –ratio	82.925	80.748	76.991	85.032
Dw	2.040	1.9282	1.991	1.997
h-	Indeterminate			

Source: Computed from field survey data (2010). Values in parentheses are standard errors, ***Significant at 1% level, **Significant at 5% level, *Significant at 10% level

Table 7: Regression result for croaker

Coefficient	Linear	Double	Exponential	Semi-log
b_0	-383.999	-5.358	5.254	-9596.06
	(125.306)	(1.360)	(0.164)	(1072.42)
b_1	90.802**	0.106**	0.104***	97.970***
	(35.399)	(0.045)	(0.046)	(34.991)
b_2	0.314***	1.267***	0.000373***	143.745***
	(0.090)	(0.220)	(0.000)	(17.25)
b_3	0.335***	0.292***	0.00041***	200.963***
	(0.058)	(0.090)	(0.000)	(71.655)
R^2	0.581	0.587	0.574	0.599
AdjR^2	0.620	0.602	0.74	0.629
F-ratio	62.481	58.495	51.576	65.117
Dw	2.041	2.002	1.922	1.987
h-	indeterminate			

Source: Computed from field survey data (2010). Values in parentheses are standard errors, ***Significant at 1% level, **Significant at 5% level, *Significant at 10% level

4.67 in the short and long run, respectively. This implies that 10% increase in price of croaker will lead to 3.8% and 46.7% increase in quantity supplied. Hence, croaker is price inelastic in the short-run and price elastic in the long-run. The lagged variable is positive and significant at the 5% level implying that last month's quantity of croaker supply influence current supply of croaker. The season variable is also significant at the 1% level. This signifies that croaker is a seasonal fish and the implication is that during non-festive seasons, croakers might be off the market or scarce.

CONCLUSION

Frozen fish market is a perfect competitive market with volume traded depending on the price of the species. The marketing margin in relative terms were quite low, this is understandable when considering the major cost components of transportation and storage. The sales response estimates showed that relationship between the quantities supplied were positive and significant.

RECOMMENDATIONS

Based on the research findings, the following are recommended:

- For wholesalers who are interested in increased margin, the increased supply of sardinella is recommended
- Since croaker supply is price elastic, to encourage increased supply of this specie in the long run, price increases will be an incentive
- To further encourage investment in frozen fish marketing, financial institutions should provide soft loans to individuals or groups at reasonable interest rates

REFERENCES

Atimo, T. and A. Laolu, 1983. Nutrition and Food Policy in Nigeria. National Institute for Policy and Strategic Studies, Nigeria, pages: 447.

Kohl, R.L. and J.N. Uhl, 1972. Marketing of Agricultural Products. 5th Edn., Macmillan Publishing Co. Inc., New York.

Moses, B.S., 1980. Fisheries of the Cross River State of Nigeria: A preliminary report. Ministry of Agriculture and Natural Resources, Fisheries Division, Calabar.

Olayide, S.O., O. Ogunfowora, S.M. Essang and F.S. Idachaba, 1975. Element of Rural Economics. Ibadan University Press, Ibadan, Nigeria.

Snedecor, G.W. and W.G. Cochran, 1980. Statistical Methods. 7th Edn., Iowa State University Press, Iowa, USA., ISBN-10: 0-81381560-6, Pages: 507.

Ukoha, O.O., 1998. Fishery Sub Sector of Nigeria: Analysis of the Output Performance and the Way Forward. In: Agricultural Development in the 21st Century, Tweeten, L. and S.L. Thompson (Eds). Black well, New York, pp: 22-28.