

Fish Consumption Preference and Expenditure in Port Harcourt Metropolis, Rivers State, Nigeria

Mercy Ebere Ndubueze-Ogaraku, Ebisine Patience Feke & Oyoburuoma N. Ihunwo

Department of Agricultural Economics and Agribusiness Management, Faculty of Agriculture, University of Port Harcourt, East-West Road, Choba, Port Harcourt, Rivers State, Nigeria

Corresponding email: mercy.onu@uniport.edu.ng

Abstract

The study compared households' consumption expenditure on fresh fish and dried fish in Port Harcourt Metropolis, Rivers State, Nigeria. Socioeconomic characteristics of the fish consumers were described, differentials in expenditure of fresh fish and dried fish consumption was determined and effects of socio-economic variables on household's consumption expenditure of fish products were estimated. 80 respondents were randomly selected from 4 locations in the study area. Descriptive statistical tools such as percent, mean and multiple regression model were used in the data analysis. The results indicated that an average amount spent on fresh and dried per monthly were ₦992,250.00 and ₦1,166,400.00 respectively. Fish types consumed as fresh and dried among other fish products was mainly catfish with 57.5 % and 45.0% respectively. 87.5% of consumers purchased fresh fish product from open market while 53.8% purchased dried fish products from the open market. Regression results showed that monthly income, fish availability and age of the respondents were positive and statistically significant at 1% level while price of the commodity and occupation were also positive but statistically significant at 5% and 10% level respectively. The result indicated a z statistics value of 2.94 and -2.651 respectively with a p value of 0.000 for fresh and dried fish under a 2 tailed test respectively. Therefore, the null hypothesis that states that there is no significant difference in the quantity and expenditure of fresh fish and dried fish was rejected. The study recommends that consumers should reduce the amount on dried fish in the area.

KEYWORDS: Preference, fresh fish, dried fish, consumption expenditure, household.

Introduction: Demand for fish in Africa, Asia and the Pacific is growing. In order to meet these demands, many countries will have to at least double fish production by 2030 (World Fish, 2017a). Fish is as an important component of a modern healthy diet and also a critical food source for developing countries (High Level Panel of Experts, 2014). Fish provides key macro-and micro-nutrients, and are low in saturated fat (Lynch and Macmillan, 2017). Fish consumption has been linked to a wide array of health benefits for infants and adults including the developing foetus (Millen, et al., 2015). According to Nesheim and Taktine (2007), fish can supply up to 50 percent or more of high quality protein, mineral elements (zinc, magnesium, iron, copper and

potassium), vitamins (B₆, B₁₂, niacin, thiamine, riboflavin, vitamin E) and essential fatty acids such as oleic acid and omega-3 fatty acid. The United Nations Food and Agriculture Organization (FAO, 2018), noted that world population growth has outweighed fish production due to increased fish consumption. The report further stated that fish consumption per capita across the world increased from 9.0kg in the 1961 to 20.5kg in 2017. In terms of utilization, fish products used for food and non-food purposes varies across countries and regions. The utilization of fish for direct human consumption increased significantly over the years from 67 percent in 1960 to 88 percent in 2018 (Vannuccini et. al., 2018). Considering the upsurge in population growth, urbanisation and

demographic dynamics in Nigeria (Barange et. al., 2018; Falaye and Jenyo-Oni, 2009), fish consumption (demand) appear to be on increase. Consumption pattern of a household is the combination of qualities, quantities, acts and tendencies characterizing a community or a human group's use of resources for survival, comfort and enjoyment. The consumption pattern is skewed towards food i.e. food is higher than the non-food items in Nigeria. (FAO, 2018) analysis of food expenditure by households in 2019 showed that various foods consumed outside the home include; starchy roots, tubers and plantains, rice, vegetables, fish and seafood, grains and flours in that order were the top food items households spent on in 2019 accounting for a combined 59.19% of food expenditure

Fish appears to be more widely consumed in the dried, fresh and frozen forms. It is also commonly asserted in Nigeria that the dried fish product is more widely consumed than the fresh product. Also, there is an avalanche of conflicting reports as to which, between urban and rural households, consume more fish (Mafimisebi, 2010; Omotesho, and Muhammad-Lawal, 2010). According to USAID (2014), consumer demand for fish products in Nigeria was reported as 2.66 million metric tons which was met only in part by imports of about 740,000 metric tons that same year. FAO, 2018 reported that production from global fisheries and aquaculture sub-sectors in 2016 reached 171 million metric tons, 88% of which was used for direct human consumption. This high level of fish production resulted in a record-high global average fish consumption of 20.3 kg/capita/year. It has been reported that fish consumption accounts for about 35% of animal protein consumption in Nigeria (USAID, 2014). Fish consumption is estimated at 13.3 kg/capita/year. Although this is higher than the regional average for Africa (9.9 kg/capita/year), it is still substantially lower than the global average of 20.3 kg/capita/year (FAO, 2018; World Fish, 2017b).

Different types of fish are consumed in Nigeria, among which include; Senegal jack (*Caranx senegalensis*), Marine catfish (*Arius mercatoris*), Alexandria's pompano (*Alectis alexandrines*), Mud catfish (*Clarias gariepinus*), Bonga fish (*Ethmalosa fimbriata*) and Baraccudas

(*Sphyraena africa*). The steady prevalence of under nourishment, amid the continually growing population over the past decade affect about 8.8 million people in 2007 and 14.3 million in 2016 (FAO, 2017b). The prevalence of food insecurity is higher in low income, urban households and in rural areas (Matemilola and Elegbede, 2017). As of 2017 stunting impacted 43.6% and wasting 10.8% of Nigerian children under 5 years of age (NBS and UNICEF, 2017). Disparities exist for fish consumption between and within countries are mainly due to location specific varieties, per capita consumption and geographic concentration of production (Tveterås, et. al., 2012). Currently, people are more enlightened with the growing awareness on the nutritional and health value of fish consumption which is contributing to the upsurge in disproportionate demand for fish. Fish products are consumed in fresh, dried and smoked forms in Nigerians (Veliu, Gessese, Ragasa and Okali, (2009). However, consumption depends on the interplay of demand and supply factors. On the demand side, factors such as income, population growth and prices influence quantity demanded whereas the supply side is relative to the fish production method and the cost of production.

People in Rivers State greatly depend on fish because that it is cheaper than livestock and non-ruminant animal protein. It is a source of food and relatively cheap source of animal protein to many people across developing nations, especially among the riverine areas. However, there is dearth information on consumption expenditure of the fresh and dried fish products in Rivers State. Empirical studies have been focused on demand and supply of fish products. However, not much has been carried out on consumption expenditure of fresh and dried fish products. It is on this background that this study compared the consumption expenditure of fresh and dried fish in Port Harcourt Metropolis. The broad objective of the study was to compare the consumption expenditure of fresh fish and dried fish among households in Port Harcourt Metropolis, River State. The specific objectives are to: describe the socioeconomic characteristics of fish consumers in the study area; examine the differentials in expenditure of fresh fish and dried fish consumption in the study area.; determine the effects of socio-economic

variables on household's consumption expenditure of fresh fish and dried fish consumption in the study area.;determine the amount of money spent on fresh fish and dried fish consumption in the study area.; identify the challenges affecting households in the consumption of fish products in the study area.

Materials and Methods: Study Area: This research was carried out in Port Harcourt Metropolis. Port Harcourt is the capital of Rivers State, located in southern Nigeria. Port Harcourt metropolis is located between Latitude 4°45'N and Latitude 4°55'N, and Longitude 6°55'E and Longitude 7°05'E in Rivers State. It is a city in the Niger Delta region of Nigeria. The city lies at the mouth of River Bonny in Rivers State. It is located at about 25 km from the Atlantic Ocean and is situated between the Dockyard creek/Bonny River and the Amadi creek. It lies at an average altitude of about 12 m above mean sea level. Port Harcourt metropolis spans over two local government areas (LGAs) viz Port Harcourt and Obio/Akpor LGA.

Population of the Study: The study comprises of both dried fish and fresh fish consumers who reside in Port Harcourt Metropolis.

Sampling Technique: This study utilized a multi-stage sampling technique. The first stage involved the selection of four communities within the study area which includes; Rumuodara, Mgbuosimini, Diobu and Elekahia. A second stage sampling involved random selection of 20 respondents from each community totally 80 respondents which respondents were drawn from each of the aforementioned communities for the study.

Model specification

The Z –statistic is mathematically specified as:

$$Z = \frac{\bar{X} - \bar{Y}}{\sqrt{\frac{S^2_X + S^2_Y}{n_x + n_y}}}$$

Where,

The Z –statistic is mathematically specified as:

$$Z = \frac{\bar{X} - \bar{Y}}{\sqrt{\frac{S^2_X + S^2_Y}{n_x + n_y}}} \tag{3.1}$$

Where,

Z= The value by which the statistical significance of the mean difference would be judged

\bar{X} = Mean consumption expenditure of fresh fish consumed by the households in the study area

Method of Data Collection: Primary data were collected using a validated structured questionnaire that was administered to the respondents on a scheduled visit to the study area. In addition, interviews conducted by the researcher.

Instrument for Data Collection: The instrument for data collection was done using a designed questionnaire for the households. The questionnaire were made up of five sections based on my objectives. First sections were the Socio-economic characteristics of the respondents, determination of households' choice of either fresh fish or dried fish consumed in the study area. Secondly, the questionnaire examined the differences fresh and dried fish consumption, and as well as identified the challenges affecting households in the consumption of fresh fish and dried fish in the study area.

Validity of the Research Instrument: The questionnaire was validated for structure and content by expert evaluators in the Department of Agricultural Economics and Extension of the Faculty of Agriculture. The structural validity ensured superficial appearance of the instrument, while the content validity ensured that the items in each section are actually appropriate for the variable of interest.

Method of Data Analysis: Analysis of data was achieved using descriptive and inferential statistical tool. The objective analysis was achieved using descriptive statistics such as mean, and percentages, multiple regression analysis to examine the socio-economic variables and determinants of household consumption expenditure of fresh fish to dried fish.

\bar{Y} = Mean consumption expenditure of dried fish consumed by the households in the study area

Z =The value by which the statistical significance of the mean difference would be judged

\bar{Y} =Mean consumption expenditure of dried fish consumed by the households in the study area

\bar{X} = Mean consumption expenditure of dried fish consumed by the households in the study area

\bar{Y} = Mean consumption expenditure of dried fish consumed by the households in the study area

Z =The value by which the statistical significance of the mean difference would be judged

\bar{Y} =Mean consumption expenditure of fresh fish consumed by the households in the study area

\bar{X} = Mean consumption expenditure of fresh fish consumed by the households in the study area

S^2_x = Variance of Mean consumption expenditure of fresh fish consumed by the household from formal sources.

S^2_y = Variance of Mean consumption expenditure of dried fish consumed by the household from formal sources.

n_x = Sample size of households that consumed fresh fish

n_y = Sample size of households that consumed dried fish

Decision Rule: If Z-calculated i.e. Z estimated is greater than (>) the critical value which is 1.9600 for a two tailed test, then the null hypothesis will be rejected, but if otherwise accept the null hypothesis. The rule is applicable for a two tailed test.

Multiple regression models was used for the analysis of the data that was collected from the field to determine the effect of the socioeconomic variables on the consumption expenditure of fresh fish and dried fish in the study area.

Multiple Regression Analysis

The implicit form of regression model is expressed as;

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9...e)$ - - - - - 2

Where;

- Y = Consumption expenditure (in naira)
- X_1 = Average cost of fish (in naira)
- X_2 = Household Monthly income (in Naira)
- X_3 = Taste
- X_4 = Household size (in person)
- X_5 = Availability
- X_6 = Occupation of head of house
- X_7 = Price of Products (in naira)
- X_8 = Age of respondent (in years)
- X_9 = Religion
- X_{10} = Choice
- e = error term

Regression Model Functional Form

Linear Function

$Y=b_0+b_1X_1+b_2X_3+b_4X_4+b_nX_n...+e$ - - - - - 3

Semi log function

$Y=b_0+b_1logX_1+b_2logX_2+b_3logX_3+b_4logX_4+b_nX_n.....+e$ - - - - - 4

Double log function

$Log Y=b_0+b_1logX_1+b_2logX_2+b_2logX_3+b_4logX_4+b_nX_n.....+e$ - - - - - 5

Exponential function

Fish Consumption Preference and Expenditure in Port Harcourt Metropolis, Rivers State, Nigeria

$$\text{Log } Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_nX_n + \dots + e \quad - \quad - \quad - \quad - \quad - \quad - \quad 6$$

A 5-point Likert scale was adopted in identifying constraints which affect household consumption expenditure. Their response was ranked very low=1 low=2 moderate=3 high=4 very high=5. These values were added to obtain a value which was divided by 5 to obtain a mean score. If the mean is greater than 2.5, it was seen as a major constraint, mean less than 2.5

indicates the constraint is not as challenging as the others.

RESULTS AND DISCUSSION: Socio-economic characteristics of respondents.: This section presents the descriptive statistics of categories of households in Port Harcourt metropolis in terms of gender, age in years, household size in number, education, marital status,

Table 1: Socio-Economic Variables of the respondents.

Variable	Frequency	Percentage(%)
Gender		
Male	31	38.8
Female	49	61.3
Marital status		
Single	24	30
Married	45	56.3
Widowed	8	10.8
Separated	3	3.8
Age (in years)		
<21	2	2.8
21-30	15	17.9
31-40	17	21.2
41-50	30	37.8
51-60	14	17.7
61-70	2	2.6
71 and above	0	0
Education level		
Non formal	11	13.8
Primary	1	1.3
Secondary	24	30.0
Tertiary	44	55.0
Household size (in person)		
1-5	55	68.8
6-10	7	8.8
11-15	4	5.0
16 and above	14	17.5
Household head		
Male	63	78.8
Female	17	21.3
Occupation		
Salary earner	35	43.8
Self employed	40	50.0
Others	5	6.3

Source; Field data, 2021

The socio-economic characteristics show that the majority of the respondents were females with 61.3%. This implies that women constituted a larger percentage of respondents in the study area. The analysis of the age of the respondent shows that they were in their most active and productive age bracket of 41-50 years with a percentage of 37.8%, followed by 31-40 years of 21.2%. Majority of the respondents of 56.3% are married, 30% single and 3.8% separated. This agrees with Fakoya, 2002 that marriage confers some level of responsibility and commitment on individuals who are on it. Most of the respondents had

formal education up to their tertiary level of 55% and secondary level of educational attainment was 30% in the study area. The average household size in the study area was 5 persons. 78.8% were male household heads, with females comprising 21.3%. 50.0% were self-employed, who were engaged in multiple activities to support themselves and their households financially.

Differentials in expenditure of fresh fish and dried fish consumption in the study area

This section examines the consumption expenditure of the various fish products in the study area.

Table 2: Fresh Fish and dried Fish Consumption Preference

Variable	Frequency	Percentage	Monthly Expenditure (₦)
Fresh fish	40	50.0	992,250.00
Dried fish	40	50.0	1,166,400.00
Total	80	100.0	2,158,650.00

Source: Field Data 2021

The result in Table 4.2 shows that fish preference was evenly distributed among the respondents of the study area. The result also shows that more money was spent on the consumption of dried fish than fresh fish due to the cost of dried fish.

Households’ Consumption Expenditure on Fresh Fish and Dried Fish Consumption:

This section presents the various effect of the socio-economic variable on household’s consumption expenditure of fresh fish and dried fish in the study area.

Table 3. Average annual consumption expenditure of fish products in study area

Variable	Frequency	Percentage (%)
Annual income		
200,000-299,999	5	6.3
300,000-399,999	11	13.8
400,000-499,999	14	17.6
500,000-599,999	5	6.3
600,000-699,999	6	7.6
>700,000	39	48.5
Fresh fish type		
Catfish	46	57.5
Bonga fish	8	10.0
Tilapia	12	15.0
Mackerel	14	17.5
Dried fish type		
Catfish	36	45.0
Bonga fish	10	12.5
Tilapia	13	16.3
Mackerel	21	26.3
Source of purchasing fresh fish		
Open market	70	87.5
Fish supplier	9	11.3
Super market	1	1.3
Source of purchasing dried fish		

Fish Consumption Preference and Expenditure in Port Harcourt Metropolis, Rivers State, Nigeria

Open market	43	53.8
Fish supplier	35	43.8
Super market	2	2..5
Consumption frequency		
Daily	43	53.8
Weekly	35	43.1
Monthly	2	2.5

Source; Field survey, 2021

The result in Table 3 shows that 48.5% of the household heads earned over ₦700,000 as an average annual income while 6.3% earned average income of ₦250,000. The mean annual income of the household head is ₦960,000. From the result, the major specie of fresh fish consumed is catfish (57.5%), Bonga fish (10%), tilapia (15%) mackerel (17.5%) while the

major dried fish type consumed is catfish (45%), Bonga fish (12.5%), tilapia (16.3%) and mackerel (26.3%). From the result, consumers' major source of purchasing fish is the open market and also that of the dried fish type. 53.8% consume fish daily, 43.1% consume fish weekly while 2.5% consume fish monthly.

Multiple linear regression result

The results of the effects of socio-economic variables on household consumption expenditure in the study area.

Table 4: Multiple regression results

Variables	Linear	Semi-log	Double-log	Exponential
Constant	-41962.9	7.50685	-2.74014	-296324
Cost of Fish (X ₁)	-1.298 (-0.2795)	0.000 (1.032)	0.300 (0.8665)	-381.379 (-0.03239)
Income (X ₂)	0.030 (3.570)***	6.274 (2.316)*	0.231201 (3.258)***	7624.24 (3.162)***
Taste (X ₃)	-0.641 (-1615.21)	0.012 (0.1466)	-0.033 (-0.2919)	-3658.63 (-0.9479)
Household size (X ₄)	1588.28 (1.429)	0.040 (1.131)	0.086 (1.206)	3487.98 (1.437)
Fish availability (X ₅)	9587.51 (2.975)***	14385.4 (2.856)**	0.492 (3.354)***	0.305120 (2.880)***
Occupation (X ₆)	8601.00 (1.809)	0.213 (1.398)	0.419 (1.990)*	13264.5 (1.855)*
Price (X ₇)	34.9427 (3.646)***	0.000 (3.234)***	0.836 (2.650)**	27359.1 (2.552)**
Age (X ₈)	291.441 (2.714)***	0.012 (3.492)***	0.459 (3.642)***	10588.6 (2.473)**
Preference (X ₉)	-1470.22 (-0.5685)	-1608.86 (-0.4036)	-0.023 (-0.1985)	-0.0249716 (-0.2937)
R ²	0.579	0.6151	0.632	0.522
F-ratio	14.12160***	16.436	17.704	11.249

Source; Field survey, 2021

Note; *** implies significance at 1% ** implies significance at 5% &* at 1%. Values outside parentheses are coefficient of the variables, values inside parentheses are the t-statistics.

The results on Table 4 shows the results of all models used in testing for the best fit independent variable and the estimates were evaluated for their performance using the standard economic criteria such as R², F-ratio, t-ratio, a priori expectation and a number of significant variables. Among the four models, the double log multiple regression model was chosen as a lead equation and was used for discussion because it was the best fitted for this analysis with a higher number of significant variables and a coefficient of multiple regression (R²) of 63% and in addition has a higher F-ratio. The R² of 0.63 implies that 63% of the variation in model was explained by the independent variables introduced in the model. The F-ratio revealed that the model was a good fit to the data. Monthly income, fish availability and age of the respondents were positive and statistically significant at 1% level while price of the commodity and occupation were also positive and statistically

significant at 5% and 10% level respectively. The statistical significant and positive signs of income, household size, price, and age imply that as these variables increases, consumption expenditure of fish products increases in the study area. This confirms to what Falaye and Jenyo-Oni, (2009), that fish consumption (demand) appear to be on increase. Also, it can be confirmed that a unit increase in monthly income, household size, price and age would result to 0.23%, 0.086%, 0.83%, and 0.45% increase in the consumption expenditure respectively. The F-ratio of 17.7 with the probability values of 0.000 for consumption expenditure reveals that the identical consumption expenditure socio-economic characteristics such as monthly income, household size, price, and age jointly significantly influence the household consumption expenditure of fresh fish and dried fish.

Table 5: Z-test analysis on the quantity and consumption expenditure of fresh fish and dried fish in the study area.

Variable	N	Mean	Mean difference	Z	Critical value	Sig
Quantity						
Fresh fish	40	-0.2376875	-0.65568967	2.94	0.0001	0.284
Dried fish	40	0.4180022	-0.65568967			
Consumption Expenditure						
Fresh fish	40	0.0376806	0.10394661	-2.651	0.0000	0.947
Dried fish	40	-0.0662660	0.10394661			

Source: Field Data, 2020.

The result in Table 5 shows the Z-test value of the differences in the mean quantity and consumption expenditure of fresh and dried fish indicated a z statistics value of 2.94 and -2.651 respectively with a p value of 0.000 for fresh and dried fish implying that under a 2 tailed test. The differences in the quantity and consumption expenditure of fresh and dried fish

products showed a 1% level of statistical significance. Therefore, the null hypothesis which states that there is no significant difference in the quantity and expenditure on fresh and dried fish products consumed by household in the study area were rejected.

Table 6. Constraints of fresh fish and dried fish consumption among households.

Variable	Mean	Variable	Mean
Fresh fish		Dried fish	
Unavailability of fresh fish	2.825	Unavailability of dried fish	2.850

Price of fresh fish	3.538	Not readily availability in the market	1.963
Insufficient money	2.975	Insufficient money	2.850
Poor preservative measures	2.900	Poor preservative measures	2.913
Poor quality of fish products	3.050	Health implication	2.938
Not readily availability in market	3.563	Price of dried fish products	2.838
Health implication	2.950	Poor quality of fish products	2.313

Source: Field Survey, 2021.

Decision rule; mean >2.5 = Major challenge factor.

Major challenges faced by household in consumption and purchase of different fish types and products. The result showed that not readily availability in market, poor quality of fish products, price of fresh fish, etc were major challenges faced by fresh fish consumption while unavailability of dried fish, insufficient money, poor preservative measures, price of dried fish products etc were challenges dried fish consumers faced while consuming the products.

CONCLUSION: The study concludes that there was a significant different in the amount and quantity of fresh and dried fish purchased among households in the area. Catfish was a major fish product consumed in both fresh and dried forms and was mainly purchased from open market. Major challenges faced by both dried and fresh fish consumers among others include; not readily availability in market, poor quality of fish products, price of fresh fish, etc. Therefore, the following recommendations are made. Since cat fish was the highest sought for and consumed fish products in the area, it is advised fish farmers should increase its supply in the market to earn more income at the same time making the fish products more affordable for consumers.

REFERENCES

High Level Panel of Experts (2014).Sustainable fisheries and aquaculture for food security and nutrition. A report by the High Level Panel of Experts on Food Security and Nutrition. Committee on World Food Security, Rome

<2.5 = not a major challenging factor.

Matemilola, S and Elegbede, I. (2017). The challenges of food security in Nigeria. *OALib*04(12): 1–22. <https://doi.org/10.4236/oalib.1104185>

NBS and UNICEF National Bureau of Statistics and the United Nations International Children’s Emergency Fund. (2017). Multiple indicator cluster survey 2016-17: Survey findings report, 538. www.unicef.org/nigeria/NG_publications_mics_201617feb2018.pdf

Omotesho, O.A. and A. Muhammad-Lawal, (2010). Optimum Food Plan for Rural Households’ Food Security in Kwara State, Nigeria: The Goal Programming Approach. *Journal of Agricultural Biotechnology and Sustainable Development*, 2 (1), pp.7-14. Available online at <http://www.academicjournals.org/jabsd>

Barange M, Bahri T, Beveridge MCM, Cochrane KL, Funge-Smith S and Poulain, F (2018).Impacts of climate change on fisheries and aquaculture: synthesis of current knowledge, adaptation and mitigation options. FAO Fisheries and Aquaculture Technical Paper No. 627. Rome, FAO. 628 pp

Falaye, A. E and Jenyo-Oni, A. (2009).Aquatic biodiversity and the implication in artisanal Fishing production. *African Journal of Livestock Extension*. 7:39-43.

- FAO Food and Agriculture Organization(2017b). Fishery and aquaculture country profile: Nigeria. Fisheries and Aquaculture Department. Country Profile Fact Sheets. Rome: FAO. www.fao.org/fishery/facp/NGA/en#CountrySector-Overview
- FAO Food and Agriculture Organization of the United Nations Statistics Division(2017a). Country indicators: Nigeria. www.fao.org/faostat/en/#country/159
- FAO. (2018). The State of World Fisheries and Aquaculture: Meeting the Sustainable Development Goals. FAO, Rome. 2018.
- Lynch, A. J and Macmillan, J.R. (2017).The role of fish in a globally changing food system. In: *Agroclimatology: Linking Agriculture to climate*. *Doi:10.2134/agronmonogr60.2014.0059*.
- Mafimisebi, T.E., (2010). Measurement of technical efficiency of farmed catfish production in Southwest, Nigeria: A Stochastic frontier production function approach.The conference proceedings of the 15th Biennial conference of the Institute of Fisheries Economics and Trade, Montpellier, France, 12-17 July, P.12.
- Millen, B., Lichtenstein, A. H, Abrams, S. Adams-Campbell, L, Anderson, C. Brenna, J. T, Campbell, W. Clinton, S, Foster, G. Hu, F. Nelson, M. Neuhouser, M. Pérez-Escamilla, R.Siega-Riz, A. M and Story, M. (2015).Scientific report of the 2015 Dietary Guidelines Advisory Committee of Disease Prevention and Health Promotion Washington, DC.
- Nesheim, M. C and Yaktine, A. L. (2007).Seafood choices: Balancing benefits and risks. The National Academic Press, Washington, DC.
- Tveteras S, Asche F, Bellamare, M. F, Smith, M. D, Guttormsen, A. G, Lem, A. Lien, K and Vannuccini, S. (2012). Fish is food – the FAO’s Fish Price Index. *PLoS ONE*; 7(5): e36731
- Veliu, A., Gessese, N., Ragasa, C. and Okali, C. (2009). Gender Analysis of Aquaculture Value Chain in NorthEast Vietnam and Nigeria. Agriculture and Rural Development Discussion Paper 44. The World Bank.
- Vannuccini, S, Kavallari, A, Bellu, L.G, Muller, M and Wisser, D. (2018).Understanding the impact of climate change for fisheries and aquaculture: global and regional supply and demand trends and prospects. In M. Barange, T. Bahri, M.C.M. Beveridge, K.L. Cochrane, S. Funge-Smith and F. Poulain (eds.) Impacts of climate change on fisheries and aquaculture: synthesis of current knowledge, adaptation and mitigation options. FAO Fisheries and Aquaculture Technical Paper No. 627. Rome, FAO. Pp 41-57.
- USAID, (2014). Markets, increasing competitiveness and food security in Nigeria. Available at: http://www.nigeriamarkets.org/index.php?option=com_content&view=article&id=123&Itemid=67
- WorldFish. (2017a). CGIAR Research Program on Fish-Food Systems (FISH). Penang, Malaysia.
- World Fish. (2017b). WorldFish in Nigeria: Factsheet. Penang, Malaysia: WorldFish. Factsheet: 2017-17.