Socio-economic Factors Affecting Consumer Behaviour and Preference for Farmed and Wild Fish around Lake Victoria, Tanzania

MWANAHAMISI SALEHE[1]*, JOSEPH LUOMBA[1] AND ENOCK MLAPONI[1]

[1]Tanzania Fisheries Research Institute, P. O. Box 475, Mwanza, Tanzania

*Corresponding author email: mwanahamisisalehe@tafiri.go.tz

Abstract
The continued fish decline in most capture fisheries including the Lake Victoria fisheries have led to increased promotion of fish farming. However, little is known about consumers' behaviour and preference on farmed fish. This study presents the consumer behaviour and preference for farmed and wild fish within the Lake Victoria region in Tanzania. The study was conducted for fifteen days in October 2012. A total of 103 structured questionnaires were completed. Data collected was statistically analysed using categorical regression model and descriptive statistics to determine influence of socio-demographic characteristics on consumer behaviour. Results reveal that consumer behaviour and preference for fish is significantly affected by socio-demographic factors such as age, marital status, education, occupation, and place of residence. Based on these findings, we recommend that value chain actors should consider the socio-demographic characteristics of the market base when designing or developing their products to enhance trade of both farmed and wild fish in Lake Victoria region.

Keywords: Categorical regression model, Consumers, Fish, Food choice, Lake Victoria

Introduction

Worldwide, fish is categorized as food with low-fat and high protein and therefore has many health benefits (Sidhu, 2003; Mozaffarian and Rimm, 2006; Burger and Gochfeld, 2009). This fact creates an advantageous atmosphere towards fish trade and marketing. However, the case is not always the same to the farmed fish. Most studies that have compared consumers' attitude towards wild and farmed fish indicate that wild fish is much more preferred while farmed fish is normally perceived to be of low quality (Kole, 2003; Verbeke and Brunso, 2005; Verbeke *et al.,* 2007; and Batzios *et al.,* 2005; Claret *et al.,* 2014; 2016). However, fish consumption is normally influenced by many factors including socio-economic background, general food consumption patterns, personal health status and a number of attitudinal dimensions of consumers (Trondsen *et al.*, 2003). In East Africa, fish farming is relatively undeveloped but has high potential to increase fish production to boost food security and improve welfare of the poor communities (Shoko *et al.*, 2011; Kundu *et al.,* 2016). This is supported by the fact that the region harbours adequate water resources, suitable fish species, favourable temperatures and expanding fish markets due to continued increase of human population (Rutaisire *et al.,* 2009; FAO, 2016). Nevertheless, most of the local markets in East Africa are still dominated by wild fish because of low farmed fish production. For example, in Tanzania capture fisheries from Lake Victoria alone constitutes over 60% of the total fish production in the country (Shoko *et al.,* 2011; URT, 2015), while farmed

fish production is staggering at 4,840 tons (Dr. Mahika, *per comm*).

Regarding consumers' attitude, preference and behaviour towards farmed fish in Tanzania, some consumers detest farmed fish because farmed fish are unhealthy and of low quality (Salehe *et al*., 2012, Unpublished data). However, this has not been empirically established. It should be noted that, understanding of the consumer perception and preferences towards wild and farmed fish has widely been appreciated as important to the growth and sustainability of fish farming industry (Batzios *et al.,* 2005; Verbeke *et al.,* 2005). However, with the current expansion of fish farming in the country, it is important to have a better understanding on the consumer behaviour and preferences for the development of the economically viable and sustainable fish farming industry. This paper therefore, presents the research findings of how socio-demographic characteristics influences consumers' preference and behaviour between farmed and wild fish. This information is critical in providing a better understanding of the market potential for farmed fish and form the basis for market segmentation for fish and products of both farmed and wild fish around the Lake Victoria region.

Materials and Methods
The study was conducted in six riparian districts in Lake Victoria, Tanzania, where fish farming is known to exist. In this study, only household heads in the study areas were interviewed, and this was because they are the ones buying food and are aware of the food consumed at their homes.

The study employed mixed methods comprising literature reviews and in-person questionnaires. Review of literature involved both published journal articles and unpublished government and study reports was done. This guided in design of the study, development of the questionnaire and analysis. In this study, a questionnaire was considered an appropriate method because of its suitability to conducting structured interviews in which a similar set of questions are asked to respondents and a limited set of responses are expected in return. In addition, a questionnaire is easy to administer and to get large responses within a short time. The questionnaire contained two parts. The first part asked for demographic characteristics of respondents such as age, marital status, household income, place of residence and household size. The second part of the questionnaire had questions to gauge consumer behaviour and preferences towards farmed and wild fish. These questionnaires were used to get information on the sources of fish, sizes of the fish preferred and consumed, frequency of fish consumption and reasons for fish consumption. The key question was consumers preferred source when buying fish. Consumers were asked to choose between the following options: "wild", "farmed", "any" and "unsure" while for the key question consumers preferred fish species, they were asked to choose between "Tilapia", ''Catfish'' and "Other". Furthermore, consumers were asked to choose between the following options: " < 50g-100g", "100-300g", ''500-900g" and " > 1 kg" for the key question consumers preferred fish size. On other hand, consumers were asked also to choose between " daily", " At least once a week", " once a month" and " not in any particular pattern" for the key question how often consumers' family eat fish. Lastly, for the key question of reasons for choosing fish as a food in the family, consumers were asked to answer the following dichotomous items: "tradition", "fish is cheap", "fish is considered as healthy food", "taste" and "high nutritional value of fish", with the respective scores attributed: "no" =1 and "yes" =2.

Data for this study was collected for two weeks from 02th-16th October, 2012. In this study, it was important that all the riparian districts where aquaculture is practised are sampled. Thus, the survey covered 18 villages in six riparian districts within Lake Victoria namely; Muleba, Bukoba urban, Bukoba rural, Rorya, Tarime and Busega (Table 1). The study villages were randomly sampled from the list of all villages in each district using Microsoft Excel. This was done to provide equal opportunity for every village to participate in the study. At the same time, purposive sampling was employed to recruit survey respondents. This was important to sample only respondents who have consumed both farmed and wild fish.

Participation to the survey was voluntary. Names of the respondents were not recorded and their consent was obtained before completing the questionnaire. Respondents were also informed about the study objectives. Generally, all the respondents approached were willing to participate in the study. The generated data was analysed using Statistical Package for Social Science (SPSS Version 17). Quantitative analysis was done to describe the characteristics of the respondents. These are presented in terms of percentages and frequencies.

The categorical regression model and Pratt's measures of relative importance and tolerance were used for statistical analysis. Categorical regression model was chosen because the assumption of normality is relaxed and accepts smaller sample size compared to General linear model (Shrestha, 2009). The categorical regression method with optimal scaling is an extension of the general linear regression method. It quantifies data of categorical variables by attributing numerical values to the categories, resulting to an optimal linear regression equation of transformed variables. The model makes it possible to forecasts the values of a dependent variable for any combination of a set of independent (classification) variables and the effect of each of the classification variable on the dependent variables is described with the corresponding regression coefficient (Young *et al.*, 1976; Kooij and Meulman, 1997; Shrestha, 2009).

Several activities were undertaken in data analysis. First, respondents' socio-demographic characteristics was designated as an independent variable. Second, the three key questions "consumers' preferred source when buying fish", ''how often the family consume fish'', ''reasons for choosing fish as food'' were considered dependent variables. Third, reliability analysis by Cronbach's alpha coefficient of the items involved in each of the key questions was performed to determine the extent to which these items are related to each other and the overall index of the internal consistency of the scale as whole was produced. In all the tests, significance difference/correlation was estimated at α=0.05.

Table 1: Number of Village visited (n=103)

Villages	Frequency	Percent
Manara	15	14.6
Omuga	4	3.9
Marasibora	10	9.7
Komuge	5	4.9
Rebu	9	8.7
Pemba	4	3.9
Nyamwaga	1	1
Sorage	1	1
Kimusi	1	1
Rorya town	2	1.9
Shigela	10	9.7
Nyaruhende	6	5.8
Bushagara	2	1.9
Kamachumu	7	6.8
Kanoni	3	2.9
Bunena	3	2.9
Ilogelo	11	10.7
Rwamishenye	9	8.7

Results

A total of 103 respondents were interviewed, comprising of 52 males and 51 females. Majority of respondents (75.7%) were permanent resident of the villages they were staying at the time of the study. In addition, crop farming represented by 74.8% is the major economic activity undertaken by the respondents (Table 2). In addition, 64% of the respondents have completed primary education. About 66% have a monthly income of less than 80 USD[1](Table 2).

Furthermore, 70.9% of respondents prefer Tilapia as their favourite fish, while only 1.9% prefer Catfish and 27.2% prefer other fish species which also found in Lake Victoria. It was also revealed that most consumers prefer big fish of 500 grams and above (Figure 1). Of the 103 respondents, 32% prefer Tilapia of 500-900 grams while 35.92% of them prefer Tilapia of above 1 kilogram. Further results also indicate that most consumers' (79.6%) like to eat fish in its fresh form compared to other forms (Figure 2).

---

[1] 1 USD was equivalent to 1285 TZS during data collection

Table 2: Socio-demographic characteristics of the sample (n= 103)

| Variable	Percent
Sex	
Male	50.5
Female	49.5
Age	
18-27	8.7
28-37	22.3
38-47	30.1
48-57	22.3
57-68	11.7
>68	4.9
Education level	
Primary	64.1
Secondary	18.4
Tertiary	10.7
Never went to school	6.8
Occupation	
Crop peasant farmer	74.8
Civil service	10.7
Private sector/self employed	12.6
Religious related	1.9
Marital status	
Single	6.8
Monogamous	77.7
Polygamous	13.6
Separated/divorced	1.0
Widow	1.0
Place of residence	
Urban	21.4
Semi-Urban	2.9
Rural	75.7
Household Monthly income (USD)	
< 80	66.0
80-155	13.6
155-250	7.8
250-300	3.9
>300	8.7
Household size (Number of people)	
Minimum	1
Maximum	16
Average	7
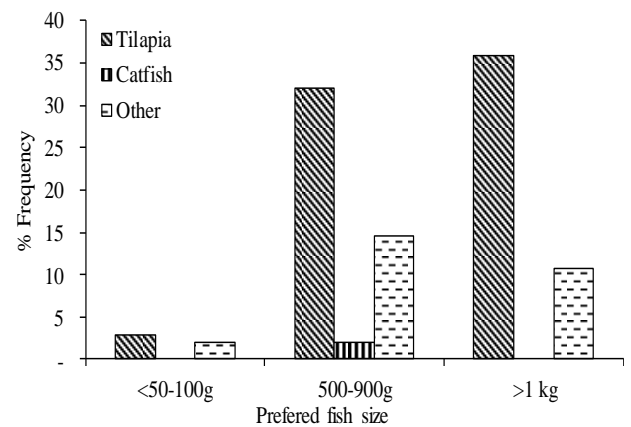
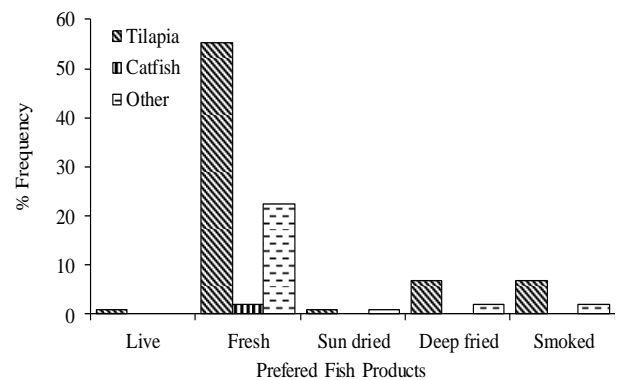**Figure 1**: Consumers' preferred fish types and sizes

Figure 2: Consumers' preferred fish products

Additionally, Cronbach's alpha (α) coefficient analysis produced a value that was equal to 0.88. This shows a strong reliability of internal consistency and scale of dependent variables (key questions "consumers' preferred source when buying fish", "how often the family eat fish" and "consumers' reasons for buying fish as food"). Moreover, statistical results for the overall evaluation and validity of the applied categorical regression models resulted in relatively moderate values of multiple R, and F values of the ANOVA tests (level of significance: α=0.05).

Specifically, the key question "consumers' preferred sources when buying fish" yielded the multiple R of 0.64, while a value of 0.57 was estimated for the model of the key question " how often consumers' family eat fish". Furthermore, the model estimated a value of 0.59 for the last key question "consumer's reasons for choosing fish as a food".

On the other hand, ANOVA tests for the F-values produced the following results; F (37,61) = 1.140, α=0.320 was estimated for the model of the key questions "consumers' preferred sources when buying fish", while values of F (19,80) = 2.030, α=0.01 was estimated for the key question " how often consumers' family eat fish". Furthermore, F (18,79) = 2.34, α=0.01 was estimated for the model of the key question "consumers" reasons for choosing fish as a food". The F values indicate that the categorical regression models are acceptable for two questions except for the key question "consumers' preferred sources when buying fish".

Majority of consumers interviewed (56.3%) stated they prefer farmed fish while 37.9% indicated preference for wild fish. On other hand 4.9 % of respondents stated they eat fish from any source either farmed or wild. Statistically, the standardized coefficients (Table 3) indicate that the transformed variables , "marital status", "age" and "education"

are significant in pointing out the possible effects on consumers' preferred source (farmed, wild or any) when buying fish with the highest significant beta values in the model. The three variables, additive importance accounts for about 60.2% while the remaining independent variables exhibited lower importance (39.8%) in total.

Partial correlation coefficients indicate that, removing the effects of other variables, "marital status" accounts about 16.73% [or $(0.409)^2$] of the variation in predicting the "consumers' preferred source when buying fish". The rest of the variables accounts for smaller portion of variance if the effects of the other variables are removed. On other hand, by removing the effects of other variables from "marital status" the remaining part of this variable becomes smaller to about 11.83% [or $(0.344)^2$]. The tolerance values of all variable are high indicating lack of multicollinerity (Table 3).

Table 3: Categorical regression model of the key question "consumers' preferred source when buying fish"

Independent Variables	Standardized coefficients		Correlations			Importance	Tolerance	
	Beta	S. E	Zero order	Partial	Part		After	Before
Sex	0.054	0.107	0.077	0.067	0.052	0.010	0.918	0.801
Age	**0.351**	0.124	0.221	0.384	0.320	**0.190**	0.827	0.776
Education level	**0.311**	0.151	0.246	0.342	0.28	**0.187**	0.807	0.708
Marital status	**0.370**	0.178	0.248	0.409	0.344	**0.225**	0.866	0.877
Place of residence	0.235	0.171	0.272	0.278	0.223	0.156	0.900	0.549
Occupation	0.250	0.186	0.175	0.285	0.229	0.107	0.836	0.553
Household size	0.299	0.110	0.146	0.333	0.272	0.107	0.824	0.894
Household income	0.155	0.120	0.050	0.192	0.151	0.019	0.939	0.716

The results also show 52.4% of respondents eat fish once a month, while 21.4% indicated to eat fish daily and 16.5% eat fish at least once a week. Statistically, the standardized coefficients of the transformed variables "marital status", "age" and "occupation" were significant in predicting the possible effects on the key question "how often consumers' family eat fish" where the beta values of standardized

coefficients scored higher compared to the other variables (Table 4). On other hand, the largest importance to predict the key question " how often consumers' family eat fish" corresponds to "age" accounting for 20% then followed by "marital status" and "occupation" which both scored 18% each. The three variables additive importance accounts for about 56%. Partial correlation

coefficients indicate that, removing the effects of other variables, "marital status" explains about 12.25 percent [or $(0.35)^2$] of the variation in the dependent variable "how often consumers' family eat fish" The rest of the variables explain smaller portion of the variance if the effects of the other variables are removed. Besides, by removing the effects of other variables from "marital status" the remaining part of this variable becomes smaller about 9.61 percent [or $(0.31)^2$]. The tolerances of all variables are high indicating lack of multicollinearity (Table 4).

Table 4: Categorical regression model of the key question "how often consumers' family eat fish"

Independent Variables	Standardized coefficients		Correlations			Importance	Tolerance	
	Beta	S. E	Zero order	Partial	Part		After	Before
Sex	0.12	0.10	0.09	0.13	0.11	0.03	0.79	0.80
Age	**-0.30**	0.14	-0.21	-0.32	-0.28	**0.20**	0.85	0.78
Education level	0.25	0.18	0.11	0.27	0.23	0.08	0.82	0.71
Marital status	**0.33**	0.20	0.18	**0.35**	**0.31**	**0.18**	0.88	0.88
Place of residence	0.21	0.15	0.21	0.21	0.18	0.13	0.71	0.55
Occupation	**0.26**	0.20	0.22	0.28	0.24	**0.18**	0.80	0.55
Household size	0.16	0.32	0.12	0.18	0.15	0.06	0.90	0.90
Household income	-0.17	0.27	-0.25	-0.20	-0.16	0.13	0.90	0.72

Table 5: Categorical regression model of the key question "reasons for choosing fish as a food"

Independent Variables	Standardized coefficients		Correlations			Importance	Tolerance	
	Beta	S. E	Zero order	Partial	Part		After	Before
Sex	0.01	0.10	0.07	0.01	0.01	0.00	0.81	0.80
Age	-0.13	0.28	-0.21	-0.15	-0.12	0.08	0.86	0.78
Education level	**-0.37**	0.20	-0.27	-0.39	-0.34	**0.29**	0.82	0.70
Marital status	**0.29**	0.15	0.21	0.33	0.28	**0.17**	0.94	0.86
Place of residence	**0.46**	0.21	0.25	**0.43**	**0.38**	**0.32**	0.70	0.55
Occupation	0.21	0.21	0.01	0.21	0.17	0.01	0.70	0.55
Household size	0.07	0.39	0.05	0.09	0.07	0.01	0.89	0.89
Household income	0.19	0.36	0.21	0.20	0.16	**0.11**	0.78	0.71

Furthermore, on the reason for choosing fish for food, 40% stated that fish is cheap compared to other source of protein. This was followed by 33% who stated that they choose fish because it is healthy and a nutritious food. Statistically, the standardized coefficients of the transformed variables "place of residence", "education level" and "marital status" found significant in pointing out the possible effects on the key question "Consumers' reasons for choosing fish as food (Table 5). The independent variables indicated that the largest importance to predict the "Consumers' reasons for buying fish as food corresponds to "place of residence" accounting for 32% followed by 29% of "education level" and

17% to "marital status". The three variables, additive importance accounts for about 78%. Partial correlation coefficients indicate that, removing the effects of other variables, "place of residence" explains about 18.49 percent [or $(0.43)^2$] of the variation in the dependent variable "reasons for choosing fish as food. The rest of the variables explain smaller portion of the variance if the effects of the other variables are removed. Furthermore, by removing the effects of other variables from "place of residence" the remaining part of this variable becomes smaller about 14.44 percent [or $(0.38)^2$]. The tolerances of all variables are high indicating lack of multicollinerity (Table 5).

Discussion

Our results show consumers' behaviour and preference for fish around Lake Victoria, Tanzania is significantly influenced by five socio-demographic factors: age, marital status, education, place of residence, and occupation. The five variables scored higher beta values and percentage of importance indicating significant strength relationship with the dependent variables ("consumers' preferred source when buying fish", "how often consumers' family eat fish" and "reasons for buying fish as food").

The survey targeted the household heads because they have the purchasing power for the food of the family. Families and households provide important sets of interpersonal relationships that influence food choice. Family members interact and negotiate and sometimes some members even discount their own interest or shape the food choice of others (Furst *et al.*, 2006).

More than seventy percent of the respondents interviewed were household heads of between 28 and 57 years old. Since most of the household in Tanzania is dominated by young people, these might have both positive and negative impacts on fish consumption behaviour around the region. Age cohort or consumers born in the same period that share experiences, memories, and preferences, have proven to have some impacts on food choice and consumption behaviour. Verbeke et al (2007) found older people (> 55 years) believe wild fish is healthier than farmed fish when compared with other age category (25-45 years).

Furthermore, Olsen (2003) found age to be positively related to the consumption behaviour of seafood in Norway, which also concured with Osler et al. (1997) and Trondsen et al. (2003 and 2004). Parents have the purchasing power but children's sometimes also influence on what can be eaten in the family. Trondsen et al. (2003) indicated that within a given household the number of children, and children's age form a complex pattern that may operate as barrier to fish consumption. Erdogan et al. (2011) found younger consumers to have low consumption frequency compared to the older consumers. The fact that seafood is healthier food compared to other source of protein make consumers who are aged to have high fish consumption frequency than other age categories. About sixty percent of the respondents had completed primary school and only few completed secondary and tertiary education. This concurs with the data at the National Bureau of Statistics (NBS), which shows that majority of citizens have completed primary education.

Education is an important factor that enables consumers in evaluating the links between fish and its nutritional and health facts. Majority of consumers interviewed prefer most farmed fish rather than wild fish because of quality assurance. Most of them stated that farmed fish are poison free and normally sold fresh or alive. Myrland et al. (2000) found that people with higher education had higher fish consumption rates compared to others.

Occupation and income are related factors; and most of the respondents interviewed were crop peasant farmers with household income of less than 100 USD per month. The results confirmed the fact that, fish farming is an important strategy to improve food security in rural areas since majority of respondents interviewed living in the rural areas consider fish to be cheap and healthier food than other source of protein such as meat.

In Lake Victoria, 'place of residence' was found to be very important independent variable in pointing out the two key questions "how often consumers' family eat fish" and "reasons for choosing fish as a food". This finding supports the observations that there is a link between geographical place of residence and the consumption of seafood of the respondents (Myrland *et al.*, 2000; Trondsen *et al.*, 2004; Cardoso *et al.*, 2013). Cardoso et al. (2013) found consumers living close to the sea to have a high consumption rate and preference to the wild fish than those living in inland region. This can also be attributed to general fish availability in the region, and ability to buy large quantities of fish at relatively low price to cater for large families compared to other protein sources. The results concured with what was found in household survey

conducted in year 2005 around the Lake Victoria in Tanzania where majority of respondents interviewed (90.2%) reported fish is their main sauce for their daily meal because fish is more abundant compared to other source of protein (Onyango et al. 2006). The results also show that consumers mostly prefer Tilapia fish in its fresh form. This is different from Salehe et al. (2014) who found consumers also prefer other forms of value added products of fish but their choices are limited with fish products availability in the market. In this light, improving consumers' preference and market performance of all fish species found in Lake Victoria region through value addition is highly required.

Conclusion and Recommendations

This study provides important information which form the basis for market segmentation of fish products for both farmed and wild fish. Even though fish farming involves high financial investment and operating costs; wild fisheries still control the fish markets through supply and price of fish in the country. Therefore, marketing segmentation is an important marketing strategy that can help to differentiate between wild and farmed fish in the markets for profitable fish farming industry. Since consumers believe fish is healthier with higher nutritional content, creating good atmosphere for marketing of both farmed and wild fish is critical. Drawn from this observation, fish producers, processors and marketers around the Lake Victoria in Tanzania will need to take special consideration on the socio-demographic factors such as age, education, marital status, occupation and place of residence when designing and developing the fish products and other marketing strategies for high consumption of both farmed and wild fish.

On a different note, the sampling strategy of the study targeted the household heads who have consumed both wild and farmed fish, and secondly the common fish farming practice in Tanzania is pond farming which is normally done in rural areas where there is enough land for pond construction. These two factors might have caused the bias and made the variables marital status and place of the residence found significant factors influencing the consumer preference and behaviour around Lake Victoria while the situation might give different in other data set. Nevertheless, the study has provided important information that can applied to improve consumption of both farmed and wild fish.

References

Batzios, C. H., Moutopoulos, D. K., Arampatzis, G and Siardos, G. (2005). Understanding Consumer's Attitude on Fish Quality and Marketing Aspects in the Greek Market. *Agricultural Economics Review* **6**: 1.

Burger, J. and Gochfeld, M. (2009). Perceptions of the risks and benefits of fish consumption: Individual choices to reduce risk and increase health benefits. *Environmental Research* **109**: 343–349.

Cardoso, C., Lourenço, H., Costa, S., Gonçalves, S., and Nunes, M. L. (2013). Survey into the seafood consumption preferences and patterns in the Portuguese population. Gender and regional variability. *Appetite* **64**: 20–31.

Claret, A., Guerrero, L., Gartzia, I., Garcia-Quiroga, M., and Ginés, R. (2016). Does information affect consumer liking of farmed and wild fish? *Aquaculture* **454**: 157–162.

Claret, A., Guerrero, L., Ginés, R., Grau, A., Dolores Hernández, M., Aguirre, E., Benito Peleteiro, J., Carlos Fernández-Pato, C., Rodríguez-Rodríguez, C. (2014). Consumer beliefs regarding farmed versus wild fish. *Appetite* **79**: 25–31.

Erdogan, B.E., Mol, S., and Coşansu, S. (2011). Factors influencing the consumption of seafood in Istanbul, Turkey. *Turkish Journal of Fisheries and Aquatic Sciences* **11:** 631-639.

FAO. 2016. The State of World Fisheries and Aquaculture (2016). Contributing to food security and nutrition for all. Rome. 200 pp.

Furst, T., Connors, M., Bisogni, C. A., Sobal, J., and Falk, L. W. (1996). Food choice: a conceptual model of the process. *Appetite*, **26**(3), 247-266.

Kundu, R., Muchiri, M., Njiru, M., and Nyamweya, C. (2016). Effect of Social and Economic Drivers on Success of Small Scale Fish

farming in Western Kenya. *African Journal of Tropical Hydrobiology and Fisheries* **14:** 29- 44.

Kole, A. P. W. (2003). Consumer opinions towards farmed fish, accounting for relevance and individual knowledge. In Luten, J.B., Oehenschlager, J., and Olafsdottir, G. (eds). *Quality of fish from catch to consumer. Labelling, monitoring and traceability*: Wageningen Academic Publishers, 393-400.

Kooij, A. J. Van der and Meulman, J.J. (1997). MURALS: In: W. Bandill a and E. Faulbaun (eds.). *Multiple Regression and Optimal Scaling using alternating least squares*. Softstat '97, (pp. 99-106), Stuttgart: Lucius and Lucious.

Mozaffarian, D., and Rimm, E. B. (2006). Fish intake, contaminants, and human health: evaluating the risks and the benefits. *Jama*, **296**(15), 1885-1899.

Myrland, O., Trondsen, T., Johnston, R.S., and Lund, E. (2000). Determinants of seafood consumption in Norway: lifestyle, revealed preferences, and barriers to consumption. *Food Quality and Preference* **11**: 169-188.

Olsen, S. O. (2003). Understanding the relationship between age and seafood consumption: the mediating role of attitude, health involvement and convenience. *Food Quality and Preference* **14**: 199–209.

Onyango, P.O., Salehe, M.A., and Mrosso, H.D. (2006). Socio-economic Baseline Survey of Fishing Communities in Lake Victoria, Tanzania. IFMP Technical report.

Osler, M., Heitmann, B. L., and Schrroll, M. (1997). Ten years' trends in the dietary habits of Danish men and women: cohort and cross-sectional data. *European Journal of Clinical Nutrition* **51**: 535- 541.

Salehe, M., Luomba, J., Musiba, M., Mlaponi, E., and Mghamba, K. (2014). Consumer Preference on Value Added Products of Farmed Fish in Lake Victoria Basin, Tanzania *Asian Journal of Applied Science and Engineering* **3**: 28-33.

Salehe, M.A., Luomba, J., and Mlahagwa, E. (2012). Market Potential and Consumer Preference on Farmed Fish around Lake Victoria. Technical Report TAFIRI- ASARECA.

Rutaisire, J., Charo-karisa, H., Shoko, A. P., and Nyandat, B. (2009). Aquaculture for increased fish production in East Africa. *African Journal of Tropical Hydrobiology and Fisheries* **12:** 74-77.

Shoko, P. A. A., Matola, H.D., Mzighani, S., and Mahika, G.C. (2011). Fish pond performance of Nile tilapia *Oreochromis Niloticus* (Linnaeus, 1758) in the Lake Victoria basin, Tanzania. *J. Aqua Trop.* Vol **26**: 17-28.

Shrestha, S. (2009). Categorical Regression Models with Optimal Scaling for Predicting Indoor Air Pollution Concentrations inside Kitchens in Nepalese Households. *Nepal Journal of Science and Technology,* **10**: 205-211.

Sidhu, K. S. (2003). Health benefits and potential risks related to consumption of fish or fish oil. *Regulations in Toxicology and Pharmacology* **38**: 336–344.

Trondsen, T., Braaten, T., Lund, E., and Eggen, A. E. (2004). Health and seafood consumption patterns among women aged 45 – 69 years. A Norwegian seafood consumption study. *Food Quality and Preference* **15**: 117 – 128.

Trondsen, T., Scholderer, J., Lund, E., and Eggen, A. E. (2003). Perceived barriers to consumption of fish among Norwegian women. Research Report. *Appetite* **41**: 301-314.

United Republic of Tanzania (URT). (2015). Annual statistics report. Ministry of Agriculture, Livestock and Fisheries.

Verbeke, W., Vanhonacker, F., Sioen, I., van Camp, J., and De Henauw, S. (2007). Perceived importance of sustainability and ethics related to fish: a consumer behaviour perspective. *Ambio* **36**: 580 – 585.

Verbeke, W., and Brunso, K. (2005). Consumer awareness, perception and behaviour towards farmed versus wild fish. The Economics of Aquaculture with respect to Fisheries. 95th EAAE Seminar Civitavecchia, Rome.

Verbeke, W., and Vackier, I. (2005). Individual determinants of fish consumption: application of the theory of planned behaviour. *Appetite*, **44**(1), 67-82.

Young, F.W., De Leeuw, J., and Takane, Y. (1976). Regression with qualitative and quantitative variables: An alternative least squares method with optimal scaling features. *Psychometrical* **41**: 505-529.