region residents while previously frozen, thawed fish was the least preferred (2% n = 610) by consumers (Figure 4).

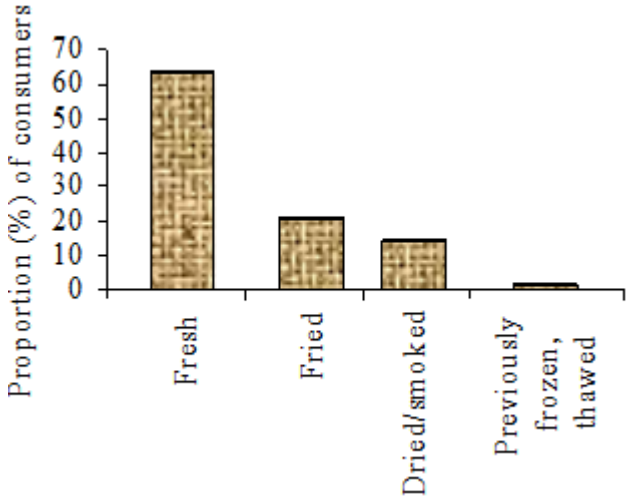

Figure 4: Forms of fish products preferred by consumers in Nyanza region, Kenya

3.3 Aquaculture vs. Wild-Caught Fish Preference

The survey noted that majority of the respondents prefer wild-caught fish (80% n = 538) while 10% prefer cultured fish. A dismal 7% of the respondents prefer both farmed and wild-caught fish while a few were unsure (3% n = 538). Table 7 identifies a cross tabulation of the reasons why consumers stated preference for each production method. The survey noted that wild caught fish is favored primarily for taste preference among Nyanza region consumers. Concern about environmental pollution, however, is a driver for some respondents who prefer cultured fish (Table 3).

Table 3: Cross-Tabulation of preferred fish production method and reason why

	Reason Preferred								
Production method	*Concern about Env Pollution*	*Concern about natural resource use Nat*	*Taste*	*Food safety*	*Price*	*Habit*	*Other*	*Unsure*	*Total*
Wild caught	36	55	131	42	6	47	20	5	342
Farmed	14	8	6	3	5	2	4	0	42
Unsure	2	3	11	5	9	3	12	92	137
Both	5	2	6	2	2	0	0	0	17
Total	51	74	154	52	22	52	36	97	538

A large number of participants had purchased or consumed both farm-raised and wild caught tilapia (41% n = 600) and catfish (34%; n=600). Majority of consumers have never purchased or consumed farm raised or wild caught Ningu (47%; n=600) (Table 4).

Table 4: Consumption/Purchase of fish by production method and type of fish species in Nyanza region, Kenya

	Tilapia		*Catfish*		*Ningu*	
Product type	Frequency	Percent	Frequency	Percent	Frequency	Percent
Wild-Caught	215	34	150	23	203	34
Farm-Raised	113	18	91	14	22	3
Both	265	41	220	34	95	16
Neither	48	8	180	28	280	47

3.4 Conjoint Analysis

Table 5 shows the descriptive statistics for the price variables used for each species in the conjoint choices. The mean for tilapia price attribute is much higher than that for other species. Table 6 presents the estimated results and statistical significance of the variables. Also noted in Table 5 are the sample size (N), the goodness-of-fit (adjusted pseudo-R^2 statistics) as well as the overall parameter significant test scores (the likelihood ratio statistics) for each model. The goodness-of-fit is similar across the three estimations and the attribute variables are jointly highly significant. Notably, the wild caught variables have positive coefficients for all species, while price, following intuition, has a negative relationship. The BUYNO variable is a constant term representing the option in the choice set to buy product alternative for a species. The variable is statistically significant and has a negative coefficient across all species models. Tilapia, catfish and *ningu* share an attribute for previously frozen products variables. The respective coefficients are negative and statistically significant for each model.

Table 5: Descriptive statistic for choice Experiment price variables

	Mean (SD)	*Min*	*Max*
Tilapia price ($)	4.00±0.22	3.50	4.50
Catfish price ($)	3.00± 1.45	2.30	3.60
Ningu price ($)	2.50±3.22	2.00	3.00

3.5 Marginal Values

The calculated marginal values for each species' set of attributes are presented in Table 6. Each marginal value represents consumers WTP for that particular attribute under that specific fish species, while holding all else constant. With the exception of *ningu*, the values clearly show consumers in Nyanza region are willing to pay more for wild caught fish products than farm raised fish products.

Given our results, consumers on average would be willing to pay \$0.80/Kg, \$ 0.30/Kg and \$ 1.50/Kg more for the wild-caught tilapia, catfish and *ningu,* respectively. Similarly, consumers are willing to pay 1.50/Kg more for farm-raised ningu. For previously frozen tilapia, catfish and *ningu,* Nyanza province consumers are willing to pay \$ 2.00/Kg (50%), \$ 1.80/Kg (60%) and \$ 1.00/Kg (40%) less, respectively, holding other factors unchanged. The survey also indicated that consumers would be willing to pay more for fried fish products irrespective of the production method (Table 7).

Table 6: Conditional Logit Model Estimation Results

Variable	*Description*	*Coefficient*	*Std. Error*
	Tilapia		
BUYNO	choice to buy	-1.824***	0.122
TILWC	Wild caught	0.898***	0.022
TILF	Farm-raised	-0.661***	0.162
TILPFR	Previously frozen	-0.122***	0.235
TILFR	Fried	0.723***	0.178
TILD	Dried	-0.652***	0.164
TILPRICE	Price	-0.112***	0.093
N=300 ; adj. Pseudo-R^2=0.054; LR=107.68			
	Catfish		
BUYNO	choice to buy neither		0.201
CATWC	Wild caught	0.591***	0.120
CATF	Farm-raised	-0.412***	0.100
CATPFR	Previously frozen	-0.221***	0.116
CATFR	Fried	0.673***	0.010
CATD	Dried	-0.872***	0.016
CATPRICE	Price	-0.054***	0.203
N=299; adj. Pseudo-R^2=0.032; LR=87.77			
	Ningu		
BUYNO	choice to buy neither		0.152
NINGWC	Wild caught	0.721***	0.059
NINGF	Farm-raised	0.652***	0.070
NINGPFR	Previously frozen	-0.451***	0.103
NINGFR	Fried	0.899***	0.016
NINGD	Dried	-0.451***	0.201
NINGPRICE	Price	-0.189***	0.162
N=285; adj. Pseudo-R^2=0.055; LR=228.86			

** and *** represent statistical significance at the 5% and 1% levels respectively

Table 7: Marginal values for species-specific attributes calculated from conditional logit

Variable	**Description**	**Coefficient**	**Percent of Avg. price**
	Tilapia		
BUYNO	choice to buy neither	-3.80***	
TILWC	Wild caught	0.80***	20%
TILF	Farm-raised	-1.00***	-25%
TILPFR	Previously frozen	-2. 00***	-50%
TILFR	Fried	1.00***	25%
TILD	Dried	-1.50***	-38%
	Catfish		
BUYNO	choice to buy neither	-2.50 ***	
CATWC	Wild caught	0.30***	10%
CATF	Farm-raised	-0.50***	-17%
CATPFR	Previously frozen	-1.80***	-60%
CATFR	Fried	0.60***	20%
CATD	Dried	-0.20***	-7%
	Ningu		
BUYNO	choice to buy neither	-1.524**	
NINGWC	Wild caught	1.50***	60%
NINGF	Farm-raised	1.50***	60%
NINGPFR	Previously frozen	-1.00***	-40%
NINGFR	Fried	2.00***	80%
NINGD	Dried	-0.80***	32%

** and *** represent statistical significance at the 5% and 1% levels respectively

4. Discussions

The demographic survey noted higher proportion of female (52%) consumers than male consumers (48%) in Nyanza region. Our survey achieved a good representation of the State's population in terms of age groups, education and income levels [7]. The results of the current study indicated that fish consumption was significantly related with household size, income, education and religion. Education is assumed to enlighten consumers about the health and other benefits of fish consumption hence, positively influences the generally preference of consumers [14], [17]. These results accord with previous findings that socio-demographic characteristics like income and education influence consumer's preference for fish [3], [4], [6], [9], [10], [11], [12], [13], [17], [19] [20], [23].

Most consumers consumed fish both at home and in restaurants, an indication that fish is a delicacy in the region hence served in hotels. Majority (63%) of the respondents indicated that their fish consumption is likely to stay the same in the following year with very few (7%) predicting a significant increase, suggesting a marginal increase in consumption to continue the current national trend.

The survey noted that consumers mostly preferred tilapia than any other species in Nyanza region (Figure 2). The preference for tilapia in Nyanza region could be because of religion as some religions like Sevent Day Adventist (SDA) do not eat catfish. Notably, the consumer preference of tilapia could also be influenced by availability as tilapia is the most produced species both from the wild and by culture [7]. Ningu consumption in Nyanza region was significantly lower probably reflecting its unfamiliarity or unavailability in the markets.

Taste is the most important reason participants consume fish, results corroborated by the findings of O'Dierno *et al.* [18]. Studies performed by Johnston and Roheim [12] also reported that species when ranked were always preferred by taste, regardless of production method. The results of the current study could be an indicator that a perception of taste is important in purchasing decision for fish in the province. Notably, fresh fish is by far the most popular (63%) type of fish product purchased in Nyanza region. These results suggest that there is a strong preference for fresh fish in Nyanza region and probably its environs. Fresh fish is a major market product in Kenya [17] [22] hence traders could ensure that consumer's demands are met. Kenyans are traditionally used to the consumption of fresh tilapia, and fresh fish in general, because of the frequent supply of fresh fish from especially Lake Victoria to open markets [22].

The survey found out that consumers prefer wild-caught to farm raised fish. Wild caught fish is favored primarily for taste preferences among consumers in Nyanza region. The results of the present study concur with those of several

other studies, which indicate that wild caught fish is the most preferred due to taste [2], [3], [22].

Although in a non-linear environment such as the conditional logit model, the magnitude of the coefficients themselves cannot be readily interpreted, evaluating the coefficient signs and statistical significance may help draw comparison across the three species models. The wild caught variables have positive coefficients for all species, suggesting that consumers are more likely to chose the fish product if it is wild-caught. Price following intuition has a negative relationship; an indication that consumers are less likely to purchase higher priced fish products of any species. The results are in line with the findings of other authors who have indicated that price is an important attribute that determine utility values for aquatic food [8], [11], [12], [20], [21], [26]. The BUYNO variable is statistically significant and has a negative coefficient across all species model. The negative relationship can be interpreted as a decrease in consumer utility if the consumers do not choose this species in a choice situation due to the lack of appeal for the product alternatives. The respective coefficients for all species were negative for previously frozen products suggesting that consumers are less likely to purchase fish products that were previously frozen.

Marginal values clearly show consumers are willing to pay more for wild caught fish products than farm raised fish products for tilapia and catfish. Comparing in terms of percent of average price, consumers are willing to pay more for cultured *ningu* than wild caught catfish and tilapia. Tilapia and catfish are both already farmed species, while farm-raised *ningu* in Kenya markets is still on the horizon. This comparison suggests that the magnitude of price premiums may decrease as consumers become more familiar with the cultured species. Notably, consumers are willing to pay more for fried fish of any species regardless of production method. This is a niche that aquaculture producers in Nyanza region need to tap to add value to their products as farmed fish is inferior to wild-caught fish in Nyanza province. By value addition through frying, aquaculture farmers could increase their profit margin and at the same time ensuring that products reaching consumers in the market are of the required form. The higher absolute WTP for wild caught tilapia compared to catfish is reflective of the higher average unit price of tilapia (Table 4). The conditional logit estimation by Jaffry *et al.* [11] generated similar parameters for product form and sources. Other analyses concluded price premiums of similar magnitude for product attribute [2], [13]. Because wild-caught tilapia is a high value, high quality product, it is not surprising that WTP for wild-caught tilapia is much higher than the other species in our study. Tilapia is caught locally and sold fresh in fish markets; this also explains the low WTP for previously frozen tilapia.

5. Conclusions and Recommendations

The results of this study show that there is a strong preference for wild-caught fish in Nyanza region, primarily due to taste and the preference varies by species. Consumers are willing to pay more for wild caught than farm-raised tilapia and catfish. However, consumers have equal preference for both wild caught and farm-raised *ningu* with equal price premiums. The case study of Nyanza region confirms the unique markets for fresh fish and that consumers are marginally increasing their fish consumption based on taste and health interests. The result of this study suggest that *ningu* culture is a niche that fish farmers need to venture into since there is a strong demand for *ningu* in Nyanza region yet wild-caught *ningu* is neglegible. As researchers strive to substitute fish meal and fish oil in cultured fish, there is need to emphasize on the optimum levels where the taste of cultured fish is not compromised. Notably, value added fish products like fried fish is on high demand and hence this product can be developed into a niche marketing strategy by fish farmers. Findings from consumer market studies can strengthen the relationship between fisheries and aquaculture management.

A caveat of this study includes the potential for hypothetical bias in the conjoint analysis which relies on stated preferences rather than actual purchases observed in real market data. Notably, the design of choice experiments varies by study, including the range of prices used to cover the potential WTP. Further research from this study may include an investigation of varying preferences among consumers based on their different characteristics. Also, an examination of survey methodologies can be performed since mixed models were used for this study. More flexible choice models may also be applied to reveal consumer heterogeneity. Finally, it may not be a big surprise to see that the study reported that the conjoint analysis identifies price premiums for wild-caught fish, as the survey was conducted in regions that boarder L. Victoria. It would be interesting to compare the results from Nyanza region with similar preference studies conducted in different geographical locations with other species to provide a robust global perspective.

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