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John Foltz
University of Idaho

Siddhartha Dasgupta
Aquaculture/Fisheries Center, University of Arkansas at Pine Bluff

Stephen Devadoss
University of Idaho

Consumer Perceptions of Trout as a Food Item

Abstract: The impacts of socioeconomic/demographic characteristics, experiences and preferences of consumers on trout purchasing decisions were estimated using Probit and Ordered Probit regression techniques. Data from a survey of consumer purchasing behavior and personal attributes were used to deduce factors that led to either a high or low likelihood of purchasing trout products. Analysis of data pertaining to whole trout and value-added products yielded consistently different characteristics of consumers who show a high affinity toward purchasing one or more of such products. Results from these analyses were used to suggest techniques for marketing whole trout and value-added trout products to specific segments of the consumer population.

The U. S. trout industry as a whole has been losing its position in the aquaculture marketplace during a time marked by high consumer concern for health, diet and food quality. During 1996, trout production was 105 percent of its 1985 level, whereas for all other categories of U.S. aquaculture, production was more than 255 percent of the 1985 level (National Marine Fisheries, 1996).

Direct all correspondence to: John Foltz, Associate Professor, Department of Agricultural Economics and Rural Sociology, University of Idaho, Moscow, ID 83844-2334. jfoltz@uidaho.edu

There are several potential underlying reasons for trout's apparent loss of market share. Trout has been one of the earliest cultured food fish species in the United States. Lipton's (1992) application of the product life cycle theory (Kotler, 1990) to the trout industry indicates that it is a mature industry — characterized by relatively flat sales volume (i.e., price of the product multiplied by the quantity of product sold). He indicated that growth in sales could be aided by offering a variety of product forms. Trout production is also restricted by environmental regulations that could contribute to its low growth rate. For example, Idaho, the largest trout producing state (Idaho Agricultural Statistics, 1998), has had a moratorium on new trout facilities for a number of years based on water availability from the Snake River aquifer which feeds all of the Idaho trout facilities, and due to concern for the effluent water quality leaving the trout farms (Fornshell, 1999).

Given the challenges facing the trout industry, production expansion could be induced by decreasing production costs, increasing demand for trout and opening new market segments (Lipton, 1990). The market-based changes could be achieved by introducing new trout products and/or modifying existing products. However, a pre-requisite to product modification is for trout producers and processors to have information about consumer preferences toward different trout products. This knowledge would be useful in designing new value-added products, developing advertising campaigns and identifying market niches for different trout products

Studies of consumer perceptions exist for various fish/seafood products such as catfish (Engle et al., 1990, 1991), crawfish (Dellenbarger, 1989), canned carp (Engle and Kouka, 1995), hybrid striped bass (Halbrendt et al., 1991), shrimp/lobster/salmon (Kinnucan et al., 1993), and trout (Shaw and Gabbott, 1992). However, investigation of the characteristics of consumers who exhibit preference specifically toward whole trout or value-added trout products such as fillets is not found in the literature. For example, although Nauman, Gempesaw, Bacon, and Manalo (1995) study consumer purchasing behavior with respect to finfish products such as hybrid striped bass, trout and salmon, their research does not specifically consider value-added fish products and the attributes of consumers who show preference for such products. Given that consumers are increasingly interested in food items that are nutritious and convenient to prepare, the marketing of easy-to-prepare food products should be of growing importance to trout processors (Shaw and Gabbott, 1992). Hence, this paper fills a void in the literature by investigating consumer perceptions toward whole trout and value-added trout products.

The goal of this article is to provide a better understanding of consumer purchasing behavior towards trout products. Specific objectives are to: 1) identify trends in consumer perceptions of trout product attributes such as appearance, aroma and nutritional content, 2) explain consumer purchasing decisions by

investigating the impact of factors such as an individual's socioeconomic/demographic attributes and beliefs/tastes on consumer choices and 3) identify market niches associated with whole-dressed trout and trout fillets. Results of this study should be useful in understanding consumer demand for trout products, which will help sellers to formulate marketing strategies that target trout products to specific segments of the consumer population.

The remainder of the paper is organized into six sections. The next section contains a literature review, which is followed by sections describing the method of analysis, data, results and a discussion of the results. The last section contains concluding remarks that discuss implications of this study.

Literature Review

One method of addressing the importance of a consumer's experience, socioeconomic background and preferences in purchasing decisions involves use of an evoked set. This technique, which investigates consumer decision behavior when confronted with the choice of alternative goods or services, is discussed extensively by Jarvis and Wilcox (1973). They justified this method of analysis from different theoretical frameworks and also provided considerable empirical support. Kinnucan, Nelson, and Hiariay (1993) applied this method to investigate the preference structure of U. S. consumers for fresh fish and seafood products. Their results indicated that consumer attitude about quality, freshness, flavor, preparation convenience and nutritional value are important determinants of fish and seafood purchasing decisions. Gempesaw, Bacon, Wessells, and Manalo (1995) conducted a more recent study of consumer preferences in seafood using evoked sets. They surveyed 10,000 residents of the Northeast and Mid-Atlantic regions of the United States to determine consumer preferences for northeastern aquaculture/seafood products. This included consumption patterns and consumer perceptions of the relative quality and safety of farm-raised products as opposed to wild-harvested products. Results from their study indicated that respondent-characteristics such as urban residence, high income (in excess of $50,000), families with children/teenagers and families without senior citizens exert significant positive influence over trout purchasing decisions.

Other studies involving consumer perceptions of trout include Block's (1984) survey of 200 trout consumers from each of the following cities: New York, Cleveland, St. Louis, Denver and Los Angeles. Results from his study indicated that approximately 60 percent of all the respondent households prepared trout at least occasionally, with the remaining households relying on restaurants as a source of trout. When specifically asked what they considered to be the most attractive aspect of trout as a food item, its flavor was mentioned most often (45.1%), followed by its nutritional attributes (23.9%). Block also queried

consumers regarding what would influence them to purchase rainbow trout more frequently. Among those who responded with suggestions, the most frequent statements made were price reductions and increased availability of fresh trout. Block indicated that although reducing the price was suggested by 24.3 percent of the respondents, since over 50 percent of those interviewed did not know what price trout was selling for in the grocery store, it would seem reasonable to assume that a lower price would go unnoticed by many shoppers.

McCain and Guenthner (1993) studied trout distribution by wholesalers and retailers (which included specialty fish markets and seafood departments/meat departments in grocery stores that carry fish as part of their product line). Their results indicated that retailers and distributors were generally critical of the advertising support received from the trout industry. Most did not believe that the trout industry provided good advertising support or useful sales support materials. Retailers wanted more point of sale materials from trout suppliers. Both retailers and wholesalers indicated that less support was offered to support trout sales than for other seafood/fish products. McCain and Guenthner found that 15 percent of the responding retailers believed that trout is harder to prepare than other fish and that most consumers prefer trout without head and bones.

Shaw and Gabbott (1992) summarized recent development of trout markets and marketing in Europe, noting that there are strong parallels with markets in the U.S. They stated that, in general, Europeans, as a result of changing lifestyles and increased awareness of nutritional issues, have been moving away from consuming red meats and toward white meats and fish. Shaw and Gabbot indicated that, over the previous ten years, two developments in trout products have been of particular significance: first, the increasing importance consumers give to the quality of products, and second, the production of trout fillets. They outlined several specific reasons for the importance of fillets with respect to developing demand: consumer preference for food items that are convenient to prepare, requiring shorter preparation times (which is due to changing lifestyles in Europe partially resulting from a greater proportion of working women), and the widespread use of pigmented feeds to produce pink fillets, which consumers find more acceptable.

Cheng and Capps (1988) analyzed demand for fresh/frozen shellfish and finfish (which included cod, flounder/sole, haddock, perch and snapper but not trout) in the United States. They determined that the factors influencing expenditure on seafood commodities were price, household income, household size, value of any coupon offered, geographic region, population density, race and seasonality. They found that expenditure on fish products was more sensitive to changes in household size than to changes in household income.

Cremer, Williamson, and Wheeler (1983) surveyed 158 restaurants and grocers (both retail and wholesale) in Kentucky to gauge the current and potential demand for trout and catfish. They found that 29 percent of the restaurants offered fresh

trout, and that the most popular trout product form was filleted trout, which was preferred by 45 percent of the retail grocers and 33 percent of the restaurants.

Methods of Analysis

In accordance with the goals of this paper, data were collected and analyzed to investigate consumer attitudes toward trout products. Consumer purchasing decisions were explained from the standpoint of socioeconomic factors, consumer beliefs/experience, product attributes and marketing methods employed by sellers. This line of analysis stems from the hypothesized linkage between consumer attitudes and purchasing decisions (Engle and Kouka, 1995). Theoretical and empirical studies of consumer behavior suggest that a consumer's socioeconomic and demographic characteristics affect beliefs, which, in conjunction with product attributes, impact product perceptions. Using such perceptions, consumers make the decision to purchase the product based on its price and prices of substitute and complementary products (Engle and Kouka, 1995; Nauman et al., 1995; Fishbein, 1963).

The analysis used in this paper consists of explaining consumer willingness to purchase whole-dressed trout and a popular value-added trout product: fillets. Two types of dependent variables were created from the data: binary choice (or zero-one) variables, which indicate whether (variable = 1) or not (variable = 0) a consumer wants to purchase a product, and multi-choice variables, which give different degrees of willingness to purchase products. The multi-choice variables were designed from survey questions in which respondents had the opportunity to indicate on a Likert scale that they would "definitely buy", "probably buy", "probably not buy", or "definitely not buy" a product. Probit and Ordered Probit regression techniques were used to explain the binary choice and multi-choice variables, respectively, as discussed below.

Binary Choice Model (Probit): A binary choice variable is often considered to be the observed effect of values taken by an underlying, continuous, unobserved (or latent) variable (Maddala, 1992). Assuming the error term in the regression of the latent dependent variable follows a standard Normal distribution, the probability that a binary choice variable ($y1$) = 1, i.e., a consumer is willing to purchase a trout product, is given by: P[Consumer *i* Buys Trout Product] = $\Phi(\beta\ \mathrm{NX_i})$ where β is a ($k \times 1$) vector of regressor coefficients, $\mathrm{X_i}$ is a ($k \times 1$) vector of values of k regressors for the ith consumer and Φ denotes the standard Normal cumulative distribution function (CDF). Hence, given a sample of n observations $\{(y1_i, \mathrm{X_i}): I = 1,\ldots, \mathrm{n}\}$, a likelihood function can be developed from the above design and maximized with respect to β in order to obtain the Probit maximum likelihood estimates (MLE) $\hat{\beta}$.

If the kth regressor (x_k) is a continuous variable, its marginal effect on the Ith

consumer's probability of purchase is given by: $\frac{\partial P[y1_i = 1]}{\partial_{X_{ki}}} = \phi(\hat{\beta}\ N\ X_i)\ \hat{\beta}_k$ where ϕ denotes the standard Normal probability distribution function (PDF) and $\hat{\beta}_k$ is the Probit MLE of x_k's coefficient. However, the effect of a dummy-variable regressor on a consumer's purchasing probability is given by comparing $\Phi(\hat{\beta}\ NX)$ over the entire range of $\hat{\beta}NX$ for the two values of the dummy variable. Hence, if x_k is a dummy variable and $\hat{\beta}_k$ is a statistically significant positive number, $\Phi(\hat{\beta}\ NX)$ (weakly) increases for all values of $\hat{\beta}\ NX$ (i.e., $P[y1=1]$ increases) if x_k changes value from zero to one. The opposite effect is observed if $\hat{\beta}_k$ is a statistically significant negative number.

Multi-Choice Model (Ordered Probit): Similar to the binomial Probit model, an Ordered Probit model is conceptualized around a regression $y^* = \gamma NX + \varepsilon$, where y^* denotes an unobserved dependent variable, γ is a $(k \times 1)$ vector of regressor coefficients and ε is a standard Normal error term. Assume a consumer's choice is one of four alternatives ($y2 = 0, 1, 2,$ or 3) corresponding to the Likert scale discussed above. Suppose $y2 = 0$ if $y^* \leq 0$, $y2 = 1$ if $0 < y^* \leq \mu_1$, $y2 = 2$ if $\mu_1 < y^* \leq \mu_2$ and $y2 = 3$ if $y^* > \mu_2$, where μ_1 and μ_2 $(0 < \mu_1 < \mu_2)$ are unknown threshold parameters of y^* to be estimated with γ. Since ε is distributed standard Normal, P[consumer will definitely not buy a product, i.e., $y2 = 0$] $= \Phi(-\gamma NX)$, P[consumer will probably not buy a product i.e., $y2 = 1$] $= \Phi(\mu_1 - \gamma NX) - \Phi(-\gamma NX)$, P[consumer will probably buy a product, i.e., $y2 = 2$] $= \Phi(\mu_2 - \gamma NX) - \Phi(\mu_1 - \gamma NX)$ and P[consumer will definitely buy a product, i.e., $y2 = 3$] $= 1 - \Phi(\mu_2 - \gamma NX)$. Using this structure and a sample of n observations $\{(y2_i, X_i): I = 1, \ldots, n\}$, a likelihood function is developed and maximized with respect to γ, μ_1 and μ_2 in order to obtain the Ordered Probit MLEs $\hat{\gamma}$, $\hat{\mu}_1$ and $\hat{\mu}_2$, respectively.

The marginal effects of a continuous-variable regressor x_k on the probability of a consumer making each of the four possible choices are evaluated from the following expressions:

$$\frac{\partial P[y2 = 0]}{\partial_{X_k}} = -\phi(-\hat{\gamma}NX)\hat{\gamma}_k, \frac{\partial P[y2 = 1]}{\partial_{x_k}} = \{\phi(-\hat{\gamma}NX) - \phi(\hat{\mu} - \hat{\gamma}NX)\}\ \hat{\gamma}_k, \frac{\partial P[y2 = 2]}{\partial_{X_k}} = \{\phi(\hat{\mu} - \hat{\gamma}NX) - \phi(\hat{\mu} - \hat{\gamma}NX)\}\ \hat{\gamma}_k,$$

$$\text{and } \frac{\partial P[y2 = 3]}{\partial_{X_k}} = \phi(\hat{\mu} - \hat{\gamma}NX)\gamma_k$$

where $\hat{\gamma}_k$ is the Ordered Probit MLE of x_k's coefficient. Effects of a dummy-variable regressor on a consumer's probability of making each of the four possible choices are evaluated by comparing the resultant probabilities when the dummy

variable takes its two values, holding the other variables at their sample means (Greene, 1993). Hence, if x_k is a dummy variable and $\hat{\gamma}_k$ is a statistically significant positive number, changing x_k from zero to one would decrease P[$y2 = 0$] and increase P[$y2 = 3$]. The opposite effect is warranted if is a statistically significant negative number. However, in either case, the impact of changing x_k on P[$y2 = 1$] and P[$y2 = 2$] is ambiguous and exact identification would require computations based on the empirical results (Greene, 1993).

DATA

Information about consumer perceptions was obtained through focus group interviews and a consumer survey. The focus groups were carried out during the fall of 1996. The consumer survey was implemented by the Social Survey Research Unit (SSRU) in the University of Idaho College of Agriculture during the spring of 1997.

Four 2-hour focus group interviews were conducted by a private firm in which groups of consumers were interviewed in each of the following cities: Chicago and Los Angeles, representing the Midwest and Western regions of the United States. Each of the regional focus groups was then broken into trout eaters and non-trout fish eaters. Topics discussed included taste, appearance, preparation characteristics, usage scenarios, product safety, substitute products and price. Data from the focus group interviews are not presented here and are available upon request, and were used primarily to help develop the consumer survey.

Information from the focus groups was used to develop consumer questionnaires for several distinct groups: vegetarian, non-fish or seafood eater, non-trout fish eaters and trout eaters. A single survey was implemented using a Computer Assisted Telephone Interview (CATI) system, which generated a different "survey" for each of the above groups, via a "skip pattern" given their responses to the questions. The sample was selected by a private firm which maintains and distributes database information, including telephone number listings. They generated the telephone numbers by using a random digit dialing program which selected numbers in the sample area and screened out business and government phone numbers. The survey was conducted with consumers in Los Angeles and Chicago.

In Los Angeles, 994 telephone interviews were conducted out of which 405 were completed, resulting in a response rate of 41 percent. The corresponding figures in Chicago were 921 interviews out of which 349 were completed, for a response rate of 38 percent. Respondents differed considerably in age (average age: 44), education (30.8 percent had some college or vocational training), income (largest income group: $50,001-$75,000, with 17.4 percent of respondents in this category), and ethnic background (52.7 percent White, 23.7 percent Hispanic,

Table 1. Demographic Characteristics of the Surveyed Consumers

	Chicago	*Los Angeles*	*Aggregate*	*1990 U.S. Census**
Average years of residence in the community	32	25	29	
Maximum (minimum) years of residence in the community	85 (0)	73 (0)	85 (0)	
Average household size	3	3	3	
Average age	44.6	44.7	44.6	35.3
Maximum (minimum) age	85 (18)	95 (18)	95 (18)	
Education level (percentage of sampled consumers				
Less than high school	3.8	5.6	4.7	
High school graduate	23.1	33.0	28.4	
Some college or vocational training	30.7	31.0	30.8	
College graduate	28.7	19.4	23.7	
Advanced degree	13.7	11.0	12.3	
Ethnic group (percentage of sampled consumers)				
Native American	0.9	0.3	0.5	0.7
Asian or Pacific Islander	3.0	6.4	4.9	3.7
Black or African American	14.0	7.4	10.4	12.1
White or Caucasian	65.0	42.2	52.7	72.1
Hispanic, Latino or Chicano	10.4	35.1	23.7	11.4
Biracial or mixed ethnic	1.2	1.5	1.4	
Other	5.3	7.1	6.3	
Annual family income (percentage of sampled consumers				
Less than $10,000	6.1	3.8	4.9	
$10,000–$15,000	4.9	5.2	5.1	
$15,001–20,000	5.7	8.0	6.9	
$20,001–$30,000	16.7	20.8	18.8	
$30,001–$40,000	15.2	17.3	16.3	
$40,001–$50,000	13.6	12.1	12.8	
$50,001–$75,000	20.8	14.2	17.4	
$75,001–$100,000	11.0	10.0	10.5	
More than $100,000	6.1	8.7	7.4	
Total number of observations	349	405	754	

*Source: United States Census, 1990.

10.4 percent African American, 4.9 percent Asian/Pacific Islander, 0.5 percent Native American and 1.4 percent with mixed ethnicity). The average number of years that respondents had lived in Los Angeles or Chicago was 29 years, ranging from less than 1 year to 85 years. Demographic characteristics of the sampled consumers, disaggregated by Chicago and Los Angeles residents, are reported in Table 1, and are compared with the U. S. average of several variables.

RESULTS

Descriptive Results

Table 2 provides information on the percentage of respondents that have tried different fish /seafood products within five years prior to the survey date. Tuna and shrimp were the two most popular products: tuna was more popular with Los Angeles respondents and shrimp was more popular with Chicago respondents. Salmon and crab were the next two popular products in the aggregate sample,

Table 2. Percentage of Respondents Trying Different Fish and Seafood Within 5 Years of the Survey Date

Fish/Seafood type	*Chicago*	*Los Angeles*	*Aggregate*
Freshwater fish	50.2	37.0	43.1
Bass	28.7	34.6	31.8
Catfish	52.0	39.5	45.3
Trout	36.1	52.4	44.9
Perch	54.8	16.8	34.4
Shellfish	48.6	36.5	42.1
Crab	50.8	58.7	55.0
Lobster	48.9	52.7	50.9
Oysters	29.0	31.4	30.3
Shrimp	83.8	82.2	82.9
Saltwater fish	44.2	42.2	43.1
Pollock	34.6	33.2	33.9
Salmon	63.9	64.9	64.4
Sole	29.0	8.1	33.9
Tuna	81.6	84.9	83.4

although perch and catfish were more popular with Chicago respondents than crab. Table 2 shows that trout was more popular with Los Angeles respondents and 44.9% percent of all respondents had tried trout.

Table 3 indicates that non-trout buyers in both cities were primarily concerned with food safety issues in deciding not to purchase trout. Odor and appearance of the fish were the next two most important reasons for not buying trout. Lack of food preparation information was also an important reason for over 25 percent of non-trout buyers in each city.

Table 4 lists consumer preferences with respect to buying whole trout and different value-added trout products. Clearly, fresh trout fillet was the most popular and frozen whole trout was the least popular product. Table 4 shows that a higher proportion of Chicago respondents showed inclination towards purchasing frozen fillets and smoked trout. Contingency table analysis (Pearson, 1911) was used to determine if Chicago respondents had a higher acceptance probability of frozen fillets than Los Angeles respondents. The resulting test statistic[1]value was 7.2146 (p-value = 0.0072) indicating a greater proportion of Chicago respondents than Los Angeles respondents considered frozen fillets acceptable. Similar tests were conducted for fresh whole trout, frozen whole trout and smoked

Table 3. Reasons for Non-Trout Buyers Not to Purchase Trout

	Percentage of respondents		
Reason	*Chicago*	*Los Angeles*	*Aggregate*
Food safety issues	49.3	51.0	50.1
Odor	45.0	46.1	45.3
Appearance of the whole fish; head, skin, bones, etc.	31.0	33.5	32.2
Lack of product and preparation information	29.2	25.2	27.4

Table 4. Product Preferences Among Trout Consumers

	Probability of purchase (expressed as a percentage)											
	Very likely to buy			*Somewhat likely to buy*			*Slightly likely to buy*			*Not likely to buy*		
Trout product	*Chg*	*LA*	*Agr*	*Chg*	*LA*	*Agr*	*Chg*	*LA*	*Agr*	*Chg*	*LA*	*Agr*
Fresh fillet	48.4	55.4	52.8	38.5	28.0	31.9	6.6	7.0	6.9	6.6	9.6	8.5
Frozen fillet	18.5	9.0	12.6	28.3	25.5	23.5	14.1	5.2	8.5	39.1	65.2	55.5
Fresh whole	23.1	41.4	34.7	24.2	29.9	27.8	19.7	7.6	12.1	33.0	21.0	25.4
Frozen whole	2.2	5.1	4.0	12.0	13.5	12.9	9.8	3.9	6.1	76.1	77.6	77.0
Smoked trout	20.0	18.8	19.3	21.1	20.1	20.5	10.0	8.4	9.0	48.9	52.6	51.2

Note: Results contained in this table refer to the percentage of respondents who expressed a certain opinion. 'Chg' stands for Chicago, 'LA' stands for Los Angeles and 'Agr' stands for the aggregate sample.

trout. The corresponding test statistic values were 14.1068 (p-value = 0.0002) for fresh whole trout, 0.8435 (p-value = 0.3583) for frozen whole trout and 0.0949 (p-value = 0.7580) for smoked trout. Hence, a larger proportion of Los Angeles respondents than Chicago respondents considered fresh whole trout acceptable. However, the acceptance probabilities for frozen whole trout and smoked trout were not statistically different between the two cities. Concerning other value-added trout products, i.e., breaded trout patty, canned trout and trout pate, the majority of respondents indicated that they were "not likely" to purchase those products (62.5%, 72.5% and 73%, respectively).

Table 5 reports certain characteristics of respondents who purchased trout products that include the whole fish. Clearly, a large proportion of trout buyers considered trout to be a healthful food item. Table 5 also shows that over 74 % of trout buyers had eaten freshwater fish as a child. Table 6 indicates certain characteristics attributable to trout fillet buyers who would not purchase the whole fish. Of such respondents, over 98 percent considered the appearance of the fish

Table 5. Characteristics of Respondents Who Purchased Trout Products Including the Whole Fish

	Percentage of respondents		
Respondents who:	*Chicago*	*Los Angeles*	*Aggregate*
Bought trout because they consider it to be a healthful food item	89.1	85.4	86.7
Bought trout and have eaten freshwater fish as a child	74.4	79.4	77.6
Bought trout after reading literature concerning trout	15.2	8.5	10.9

Table 6. Characteristics of Respondents Who Purchased Trout Fillet But Not the Whole Fish

	Percentage of respondents		
	Chicago	*Los Angeles*	*Aggregate*
Consider appearance of fish product as important	97.4	100	98.7
Raised in large communities	87.9	66.7	70.7
White	74.4	44.4	60.0

Table 7. Consumer Preferences for Store Presentation and Type of Purchasing Decision

Purchasing Decision	*Percentage of respondents*		
	Chicago	*Los Angeles*	*Aggregate*
Impulse item	60.0	50.4	53.8
On shopping list	29.3	37.0	34.3
Neither on list, nor an impulse item	10.7	12.6	11.9

product to have an important influence on their purchasing decision. Other results show that the majority of such consumers had been raised in cities of size greater than 10,000 and a large proportion (74.4 %) of Los Angeles trout fillet buyers were White.

Table 7 indicates that most trout buyers considered trout to be an "impulse item", i.e., such individuals did not plan to purchase trout products when shopping. They decided to buy trout only after seeing the product in a retail outlet.

Regression Results

Table 8 contains definitions of independent variables used in the regression models that were developed from the survey questionnaire. These regressors were classified into three categories that were assumed to explain consumer perceptions: a consumer's socioeconomic/demographic background, rural/urban experience and personal preferences. The regressor selection procedure in each model was based on choosing variables from each of the three categories that maximized a regression model's Likelihood Ratio Index. (Greene, 1993). Goodness-of-fit in each regression model is also reported by the proportion of correct predictions or count R^2 (Maddala, 1992).

Table 9 contains results of a Probit regression where the dependent variable is the binary choice of purchasing trout products including the whole fish. A chi-squared test statistic value of 49.82 (p-value $= 1.57\times10^{-8}$) indicates joint significance of all regressor coefficient estimates. The results show that respondents who had lived longer in the Chicago or Los Angeles area were less inclined to purchase trout. Chicago respondents showed a lower probability of purchasing trout than Los Angeles respondents. Table 9 also indicates that respondents who were raised in communities of size less than 2,500, had an income of at least $30,000, were neither Black nor White, and /or considered odor as an important criterion in fish purchasing decisions exhibited a higher probability of buying trout.

Table 10 reports the results from an Ordered Probit regression where the dependent variable represents four degrees of consumer willingness to purchase trout products that include the whole fish. A chi-squared test statistic value of 51.39 (p-value $= 0.7 \times 10^{-8}$) indicates joint significance of all regressor

Table 8. Categories and Definitions of Independent Variables Used in the Regression Models

Socioeconomic/Demographic Background Category:	
Age	Consumer's age
Household	Consumer's household size
No Fishing	Dummy Variable; 1 if consumer has never been fishing as a child or adult
Income	Dummy variable; 1 if consumer's annual income is over $30,000
White	Dummy variable; 1 if consumer is White
Other Race	Dummy variable; 1 if consumer is neither White nor Black
City	Dummy variable; 1 if consumer is a Chicago resident (0 if Los Angeles resident)
Rural/Urban Experiences Category:	
Years	Number of years that the consumer has lived in either Chicago or Los Angeles
Small Community	Dummy variable; 1 if consumer's childhood community size was less than 2,500
Large Community	Dummy variable; 1 if consumer's childhood community size was at least 2,500
Consumer Preferences Category:	
Freshness	Dummy variable; 1 if freshness of fish product is important to the consumer
Cooking Time	Dummy variable; 1 if cooking time is important to the consumer
Odor	Dummy variable; 1 if fish odor is important to the consumer
Appearance	Dummy variable; 1 if appearance of fish product is important to the consumer
Price	Dummy variable; 1 if price of fish product is important to the consumer
High Price	Dummy variable; 1 if consumer considers fish to the more expensive than meats
Beef Buy	Dummy variable; 1 if consumer eats beef at least once a month
Try Shellfish	Dummy variable; 1 if consumer has eaten shellfish within 4 years prior to the survey date

coefficient estimates. The marginal effects of increasing the 'Years' regressor indicate an increase in the likelihood of either "definitely not" or "probably not" purchasing trout and a decline in the likelihood of either "probably" or "definitely" buying trout. Hence, consumers who had lived longer in the Chicago and Los Angeles area have a greater desire of not purchasing trout products that include the whole fish. The remaining regressors in Table 10 are dummy variables of which 'Small Community', 'Income', 'Other Race', 'Odor' and 'Freshness' have statistically significant coefficient estimates (α = 10%). The effects of a zero-to-one change in the value of each dummy variable on the four willingness-to-purchase probabilities were similar for 'Small Community', 'Income', 'Other

Table 9. Probit Regression Results with Dependent Binary Variable: Consumer Buys Trout Products Including the Whole Fish

Independent variable	*Coefficient estimate*
Intercept	−1.152*
Years	−0.012*
Age	0.007
Small Community	0.315*
Income	0.315*
Other Race	0.457*
Odor	0.620*
City	−0.317*

Note: Likelihood Ratio Index = 0.077. Count R^2 (Maddala, 1992) = 0.65. Chi-squared test statistic = 49.82 implying joint significance of all regressor coefficient estimates.
'*'signifies that the estimated coefficient is significantly different from zero with α = 10%.

Table 10. Ordered Probit Regression Results Explaining Consumer Willingness to Buy Trout Products that Include the Whole Fish

Regressor	*Coefficient estimate*	*Effect on* $P(y = 0)^{\dagger}$	*Effect on* $P(y = 1)$	*Effect on* $P(y = 2)$	*Effect on* $P(y = 3)$
Intercept	−0.631*				
Years	−0.009*	0.0027	0.0006	−0.0021	−0.0012
Appearance	0.177				
Small Community	0.321*	0.2411→0.1529	0.4133→0.3774	0.2772→0.3479	0.0685→0.1218
Income	0.292*	0.2907→0.1995	0.4177→0.4018	0.2410→0.3097	0.0506→0.0890
Other Race	0.321*	0.2622→0.1692	0.4163→0.3875	0.2613→0.3345	0.0602→0.1089
Odor	0.328*	0.3285→0.2201	0.4156→0.4085	0.2155→0.2933	0.0404→0.0781
Freshness	0.843*	0.5277→0.2196	0.3512→0.4084	0.1092→0.2937	0.0119→0.0783
$\mu 1$	1.100*				
$\mu 2$	2.190*				

Note: Likelihood Ratio Index = 0.041. Count R^2 (Maddala, 1992) = 0.45. Chi-squared test statistic = 51.39 implying joint significance of all regressor coefficient estimates.

'*'signifies that the estimated coefficient is significantly different from zero with $\alpha = 10\%$.

†'Effect on $P(y = 0)$' indicates either 1) the marginal effect of a continuous regressor or 2) the effect of a zero-to-one value shift of a dummy variable regressor, computed at the sample average of the other regressors (see Greene[22] p. 675 for details), on a consumer's likelihood of "definitely not" buying a product. The headings 'Effect on $P(y = 1)$', 'Effect on $P(y = 2)$' and 'Effect on $P(y = 3)$' are similarly defined and correspond to a consumer's likelihood of "probably not", "probably" and "definitely" buying a product, respectively.

Race' and 'Odor'. In each case, the value shift caused a decline in the likelihood of "definitely not" and "probably not" purchasing trout and increased the likelihood of "probably" and "definitely" purchasing trout. Hence, respondents raised in smaller communities (size $<$ 2,500), having an income of at least $30,000, who were neither Black nor White and/or who considered odor as an important fish purchasing criterion have a higher likelihood of buying trout products that include the whole fish. The impacts of a zero-to-one value shift in the 'Freshness' regressor on the four purchasing probabilities were similar, except the likelihood of "probably not" buying trout increased for consumers who considered freshness important.

Table 11 contains the Probit regression results where the dependent variable is the binary choice of purchasing trout fillets but not the whole fish. A chi-squared test statistic value of 25.49 (p-value = 0.0003) indicates joint significance of all regressor coefficient estimates. Table 11 shows that the regressors 'Beef Buy'[2], 'Large Community' and 'White' have statistically significant coefficient estimates ($\alpha = 10\%$). The coefficient estimate of 'Cooking Time' is not significant at the 10% type-1 error level but is significant at the 10.89% level. The results show that respondents who were infrequent beef consumers, from large communities, or are White have a higher likelihood of purchasing trout fillets and not the whole fish. The 'Cooking Time' regressor also has a similar effect on the fillet purchasing probability.

Tables 12 and 13 report results from Ordered Probit regressions where the dependent variables are the four consumer willingness-to-purchase probabilities for fresh and frozen trout fillets, respectively. Chi-squared test statistics are 14.47

Table 11. Probit Regression Results with Dependent Binary Variable: Consumer Buys Trout Fillets But Not the Whole Fish

Independent variable	*Coefficient estimate*
Intercept	−0.927*
Beef Buy	−1.116*
Cooking Time	0.408
Large Community	0.761*
Income	−0.124
White	0.729*
High Price	0.368

Note: Likelihood Ratio Index = 0.128. Count R^2 (Maddala, 1992) = 0.72. Chi-squared test statistic = 25.49 implying joint significance of all regressor coefficient estimates.
'*'signifies that the estimated coefficient is significantly different from zero with α = 10%.

(p-value = 0.006) and 16.86 (p-value = 0.002) for fresh and frozen fillet models, respectively, indicating joint significance of coefficient estimates in both models. In Table 12 'Age', 'Cooking Time' and 'Income' have statistically significant coefficient estimates (α= 10%). Marginal effects for 'Age' indicate that younger respondents had a higher likelihood of "definitely" purchasing fresh fillets but a lower likelihood of "probably", "probably not" or "definitely not" purchasing fresh fillets. If the 'Income' dummy variable shifts value from zero to one, the probability of "definitely" buying fresh fillet decreases and the remaining three probabilities increase. The 'Cooking Time' dummy variable has the opposite effect, i.e., respondents who consider cooking time to be important had a higher probability of "definitely" buying fresh fillets and lower probabilities of "probably", "probably not" or "definitely not" buying fresh fillets. Table 13 reports that the coefficient estimates of 'Beef Buy' and 'Large Community' are statistically significant. The impacts of the 'Beef Buy' dummy variable on the four willingness-to-purchase probabilities show that frequent beef consumers had a lesser inclination

Table 12. Ordered Probit Regression Results Explaining Consumer Willingness to Buy Fresh Trout Fillets

Regressor	*Coefficient estimate*	*Effect on* $P(y = 0)^{\dagger}$	*Effect on* $P(y = 1)$	*Effect on* $P(y = 2)$	*Effect on* $P(y = 3)$
Intercept	1.556*				
Age	−0.007*	0.0011	0.0006	0.0011	−0.0028
Cooking Time	0.366*	0.1318→0.0689	0.1031→0.0692	0.3409→0.2925	0.4242→0.5695
Income	−0.272*	0.6611→0.1088	0.673→0.0922	0.2888→0.3293	0.5778→0.4698
$\mu 1$	0.395*				
$\mu 2$	1.309*				

Note: Likelihood Ratio Index = 0.03. Count R^2 (Maddala, 1992) = 0.54. Chi-squared test statistic = 14.47 implying joint significance of all regressor coefficient estimates.
'*'signifies that the estimated coefficient is significantly different from zero with α = 10%.
†'Effect on P(y = 0)' indicates either 1) the marginal effect of a continuous regressor or 2) the effect of a zero-to-one value shift of a dummy variable regressor, computed at the sample average of the other regressors (see Greene[22] p. 675 for details), on a consumer's likelihood of "definitely not" buying a product. The headings 'Effect on P(y = 1)', 'Effect on P(y = 2)' and 'Effect on P(y = 3)' are similarly defined and correspond to a consumer's likelihood of "probably not", "probably" and "definitely" buying a product, respectively.

Table 13. Ordered Probit Regression Results Explaining Consumer Willingness to Buy Frozen Trout Fillets

Regressor	*Coefficient estimate*	*Effect on P(y = 0)*†	*Effect on P(y = 1)*	*Effect on P(y = 2)*	*Effect on P(y = 3)*
Intercept	−0.291*				
Beef Buy	−0.206*	0.4688→0.5449	0.0693→0.0680	0.2329→0.2106	0.2349→0.1765
Large Community	0.415*	0.6276→0.4643	0.0637→0.0693	0.1819→0.2326	0.1268→0.2328
No Fishing	−0.211				
$\mu 1$	0.174*				
$\mu 2$	0.816*				

Note: Likelihood Ratio Index = 0.03. Count R^2 (Maddala, 1992) = 0.56. Chi-squared test statistic = 16.86 implying joint significance of all regressor coefficient estimates.

'*'signifies that the estimated coefficient is significantly different from zero with α = 10%.

†'Effect on P(y = 0)' indicates either 1) the marginal effect of a continuous regressor or 2) the effect of a zero-to-one value shift of a dummy variable regressor, computed at the sample average of the other regressors (see Greene[22] p. 675 for details), on a consumer's likelihood of "definitely not" buying a product. The headings 'Effect on P(y = 1)', 'Effect on P(y = 2)' and 'Effect on P(y = 3)' are similarly defined and correspond to a consumer's likelihood of "probably not", "probably" and "definitely" buying a product, respectively.

to "probably" or "definitely" purchase frozen fillets. However, the 'Large Community' dummy variable shows that respondents raised in larger communities had a lesser inclination to "probably" or "definitely" purchase frozen fillets.

Discussion

The findings of this study identify market niches associated with trout products that include whole-dressed trout and trout fillets. The descriptive results from Tables 2 and 4, in conjunction with the estimated coefficient of the 'City' regressor in Table 9, show that a larger proportion of Los Angeles residents than Chicago residents found whole trout acceptable. Other descriptive results suggest that most whole trout buyers consider the product to be healthful and many such consumers have eaten freshwater fish as a child (Table 5). Regression results from Tables 9 and 10 outline characteristics of consumers who show preference towards trout products that include whole trout. Typically, such respondents: 1) had become recent residents of Chicago and Los Angeles, 2) had been raised in small communities and/or 3) were neither Black nor White (in our sample this indicates individuals that are predominantly of Asian or Hispanic background).

The marketing implications of these results are: 1) whole trout sellers should market more product in the Los Angeles region than in the Chicago region and 2) sellers should market whole trout in ethnic outlets or in communities with a large proportion of Asian or Hispanic residents. Advertising campaigns for whole trout should highlight the healthfulness of trout and its relatively mild taste (i.e., not very fishy). Such advertisements could also feature traditional American and ethnic dishes that could be prepared with whole trout. Pictures and phrases that evoke childhood experiences of eating freshwater fish could also prove useful in advertising trout.

The empirical results indicate that trout fillet consumers were mostly from larger communities (Tables 6, 11 and 13), were infrequent eaters of Beef (Tables 11 and 13) and/or White (Tables 6, 11 and 13). Other results show that younger respondents, who attach importance to food with short preparation times, have a higher likelihood of buying fillets (Table 12). Preparation convenience is an obvious reason for consumers to choose fillets over whole fish. Hence, marketing strategies should emphasize that trout fillets are convenient-to-prepare and healthful food items. Such strategies should highlight characteristics of fillets such as no bones (or few bones), short cooking time and relatively low in fat and high in protein. Given the popularity of fillets (Table 2), processors should consider developing other fillet-based value-added products such as nutritionally complete trout dinners which include side-items (e.g., vegetables, rice, rolls, etc.). Advertising for such products should include information focusing on the healthiness of trout, food-safety benefits of farm-raised trout over wild-caught trout and relatively short preparation time when compared to meats such as chicken and beef. Other results show that frozen fillet sellers should market more in the Chicago region than the Los Angeles region due to the product's relatively higher acceptance probability (Table 4).

The descriptive results from Table 7 report that trout is an "impulse-item" for most shoppers. However, lack of product and preparation information induced over 25 percent of non-trout buyers to not purchase trout (Table 3). Hence, to improve retail sales, trout outlets should consider making the products more visible to consumers by using strategies such as eye-catching slogans, in-store advertisement, and coupons. Sellers should consider developing recipes that give variety to the methods of trout preparation, focusing on recipes that are low in fat and relatively easy to prepare. Retail outlets of trout products should consider free distribution of such recipes and conveniently locate the necessary spices, vegetables and other side-items to encourage consumers to purchase trout.

Conclusions

Nauman et al. (1995) maintain that to evaluate consumer demand one must "use an integrated framework focusing on experiences, perceptions, preferences and choices" (p. 139). This paper gives insight into consumer demand for trout products by investigating consumer perceptions of trout and explaining their purchasing decisions from the standpoint of their socioeconomic /demographic background, rural/urban experiences and personal preferences. This study also draws significant conclusions regarding characteristics associated with consumers that show tendency toward purchasing either trout products that include the whole fish or only trout fillets. Such information is important in developing efficient

marketing strategies and providing sellers with ideas for new trout products for which there is a potential high demand.

Several key findings were obtained from the survey data. First, a large segment of consumers purchase trout because of its nutritional value. Second, fillets are in higher demand than any other value-added trout products that were investigated in this study. Third, non-buyers dislike trout because of food-safety concerns, odor and appearance of the whole fish. Nauman et al. (1995) remark that the demand for fish products suffers from a lack of product information and not from a lack of consumer interest. Hence, an initial step to increasing consumer demand for trout would require disseminating positive information about trout products and developing product forms that have more widely acceptable attributes such as appearance and aroma.

Several results from this study are consistent with conclusions drawn from other related studies. For example, Nauman et al. (1995) found that the knowledge that the fish is farm-raised always has a significant positive impact on consumer preference for trout. Our survey indicated that 49.7 percent of respondents prefer farm-raised over wild trout due to reasons of food safety. Gempsaw et al. (1995) discovered that higher income consumers are more likely to purchase trout, which agrees with our findings.

Another important aspect of this study is in identifying characteristics that are common for consumers that display preferences for specific trout products. Results from the regression models indicate that individuals having a high likelihood of purchasing whole-dressed trout, among other trout products, tend to be Asian or Hispanic, have had childhood experience in eating freshwater fish and/or are from smaller communities. However, other results indicate that individuals with an urban background, desiring nutritious foods that are easy to prepare and/or are sensitive to fish odor and appearance, prefer fillets over whole trout. These results help identify market niches associated with whole trout and trout fillets. This information is invaluable to sellers seeking to target certain products to specific segments of the population. Therefore, the results of this study could form the basis of an effective marketing program designed to increase revenues earned by the trout industry.

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Notes

1. Data for these tests were obtained from survey questions in which respondents indicated whether they were very likely, somewhat likely, slightly likely or not likely to purchase a trout

product. In this form, the data were disaggregated into Chicago and Los Angeles respondents, expressed in a 4 by 2 contingency table and tested for statistically equal willingness-to-purchase likelihoods. The chi-squared test-statistic values (with 3 degrees of freedom) for fresh fillet, frozen fillet, fresh whole trout, frozen whole trout and smoked trout were 3.1243 (p-value = 0.3729), 18.0461 (p-value = 0.0004), 16.5178 (p-value = 0.0009), 4.7425 (p-value = 0.1917) and 0.3725 (p-value = 0.9458), respectively. Hence, consumer willingness to buy frozen fillet and fresh whole trout differed according to the consumer's region (i.e., Chicago or Los Angeles). The willingness-to-purchase likelihoods were not significantly different between Chicago and Los Angeles consumer with respect to fresh fillet, frozen whole trout and smoked trout. The 2 by 2 contingency table analyses presented in the paper for frozen fillets, fresh whole trout, frozen whole trout and smoked trout disaggregated the data between Chicago and Los Angeles respondents with respect to those willing (or not willing) to purchase a product. We grouped respondents indicating that they are either "very likely" or "somewhat likely" to buy as consumers willing to purchase a product; the "slightly likely" or "not likely" to buy respondents were grouped as consumers not willing to purchase a product.

2. The dummy variable 'Beef Buy' is equal to one if a respondent is an infrequent beef consumer (i.e., eats beef less than once a month). Since infrequent beef consumption could be due to ethnicity or religious affiliation, we investigated if there was a potential relation between 'Beef Buy' and 'Other Race'. The data indicated that of 461 Black or White respondents and 265 'Other Race' respondents (i.e., Asian or Pacific Islander, Hispanic, mixed and other ethnicity), 62 and 27 were infrequent beef consumers, respectively. Using this information, contingency table analysis was used to verify if the likelihood of being an infrequent beef eater (i.e., Beef Buy = 0) differed between a 'Black/White' consumer and an 'Other Race' consumer. The resulting chi-squared test statistic value (with 1 degree of freedom) was 1.6615 (p-value = 0.197) indicating that the null hypotheses was not rejected, i.e., the likelihood of being an infrequent beef consumer was not statistically different across the two ethnic categories.

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