Trout Steaks: Consumer Perceptions of a New Food Item

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Water quality standards and a limited water supply have dramatically restricted the expansion of the U.S. trout industry. Faced with production restrictions, producers have turned to value-added products to strengthen the economic growth of the industry. In the near future, trout steaks could surface in retail outlets as a new revenue source for the mature trout industry. A telephone survey of consumers in Chicago and Los Angeles was conducted by the University of Idaho in the spring of 1997 to determine consumer preferences for trout steaks and, ultimately, to determine the viability of this product form. Using a probit analysis, fresh trout steaks were found to be more popular than frozen trout steaks. Consumers that exhibited significantly higher preference for fresh trout steaks were Hispanic, had high school education (or less), and/or believed that trout was less expensive than other meats. Chicago respondents and individuals with an urban background tended to display a higher preference toward frozen trout steaks.

As compared to many other aquacultured food fish industries, the U.S. trout industry has been losing its market share. Trout production during 1996 was only 105 percent of its 1985 level, whereas production for all other categories of U.S. aquaculture was more than 255 percent of the 1985 level (National Marine Fisheries, 1996). Potential reasons for trout's apparent loss of market share are: (1) Trout is a mature industry with relatively slow growth in sales volume (that is, product price multiplied by the product quantity sold) (Lipton, 1992); and (2) the industry's need for large quantities of high-quality water in conjunction with concern about effluent water quality has hampered production growth due to environmental restrictions (Foltz, Dasgupta, and Devadoss, 1999).

By applying the product life cycle theory (Kotler, 1990) to historical sales price and quantity data, Lipton (1992) concluded that the trout industry is in a "growth maturity" stage. The product life cycle, as defined by Kotler (1990), is "the course of a product's (or product class) sales and profits during its lifetime. It involves five distinct stages: product development; introduction; growth; maturity; and decline." Typically, most of the technical difficulties in production have been overcome in mature industries. This implies that production-cost reduction is an unlikely path to growth in profitability. Stimulating sales growth would require producers and processors to offer different trout-based product forms to target markets that have indicated a demand for these differentiated products.

Trout steaks are a potential product form that could surface in retail outlets in the near future. Although wild-caught and farm-raised trout are usually relatively slender fish, it is possible to feed cultured trout in order to obtain a sufficiently large girth for a decent-sized steak. The catfish industry produces catfish steaks and describes them as "cross-section cuts from larger, dressed fish" (Southern Pride Catfish Co., 2000) although most catfish sales are whole or filleted (Papineau, 2000). In addition, lower processing costs for trout steak—when compared to other trout product forms, such as fillets—afford the opportunity for lower retail prices for trout steaks. For example, recent retail salmon pricing in the Pacific Northwest was found to be the following: whole fish—$4.49/lb.; steaks—$5.98/lb.; and fillets—$6.98/lb. (Papineau, 2000). This situation can be compared to recent retail catfish pricing in the Midwest: whole fish—$2.29/lb.; steaks—$2.59/lb.; and fillets—$3.39/lb. (Scott, 2000). Thus, it appears that trout steaks could be a viable product form and a new revenue source for the mature trout industry.

During the spring of 1997, the Social Survey Research Unit in the University of Idaho College of Agriculture conducted a telephone survey of consumers in Chicago and Los Angeles to obtain information about their trout product purchasing habits. The respondents indicated their preference for trout steaks based on a product description

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provided by the interviewer. The goal of this paper is to use the survey information to determine consumer perceptions of fresh and frozen trout steaks. Results of the empirical analysis can be used to characterize the trout-steak market and to provide valuable information for sellers. This information will allow sellers to develop successful marketing strategies.

The remainder of this paper is organized as follows. The next section contains a literature review, which is followed by a description of the materials and methods used in the empirical analysis of the survey data. The results of the analysis are presented in the section that follows materials and methods, and the paper ends with a discussion of results and a conclusion section.

Relevant Literature

Consumer perception studies exist for many fish/seafood products—such as catfish (Engle et al., 1990, 1991); crawfish (Dellenbarger, 1989); canned carp (Engle and Kouka, 1995); hybrid striped bass (Halbrendt, Wirth, and Vaughn, 1991); shrimp/lobster/salmon (Kinnucan, Nelson, and Hiarary, 1993); and trout (Shaw and Gabbott, 1992). However, there are very few examples of research focusing on the investigation of characteristics of consumers who exhibit preference, specifically toward value-added trout products (Foltz, Dasgupta, and Devadoss, 1999). For example, although Nauman et al. (1995) studied consumer purchasing behavior toward hybrid striped bass, trout, and salmon, they did not specifically analyze attributes of consumers who show preferences for value-added fish products.

In spite of the sparse literature on value-added fish products, there are a significant number of studies related to consumer perceptions of trout. For example, Block (1984) surveyed 200 trout consumers from New York, Cleveland, St. Louis, Denver, and Los Angeles. He discovered that approximately 60 percent of all the respondent households prepared trout, with the remaining households relying on restaurants as a source of trout. His survey results also showed that consumers considered flavor (45.1 percent) and nutritional value (23.9 percent) as the two most attractive attributes of trout. When queried about what would make them purchase rainbow trout more often, consumers frequently responded by stating price reductions and increased availability of fresh trout.

Foltz, Dasgupta, and Devadoss (1999) used data from two regional surveys to identify characteristics of consumers who showed preference for whole trout and trout fillets. Results from this study indicated that individuals who were raised in rural communities, had recently moved to metropolitan areas, and were either Asian or Hispanic exhibited a significantly higher preference for whole trout. Trout fillets were preferred by consumers raised in urban communities, consumers preferring foods that are convenient to prepare, and Caucasian (White) consumers.

McCain and Guenthner's (1993) study of trout distribution by wholesalers and retailers indicated that retailers and distributors were generally critical of the advertising support received from the trout industry. Most retailers and wholesalers believed that less support was offered to support trout sales than was offered for the sale of other seafood/fish products.

Shaw and Gabbott's (1992) study of trout market development in Europe showed that consumers, as a result of changing lifestyles and increased awareness of nutritional issues, have been moving away from the consumption of red meats and toward the consumption of white meats and fish. Shaw and Gabbot indicated that, during the previous 10 years, European consumers showed a significant preference for trout fillets. Specific reasons for the increasing demand for fillets were identified as: (1) consumer preference for convenient-to-prepare food items and (2) the widespread use of pigmented feeds to produce pink fillets, which consumers find desirable.

Materials and Methods

Data for the empirical analysis came from a consumer telephone survey implemented by the Social Survey Research Unit (SSRU) in the University of Idaho's College of Agriculture during the spring of 1997. The sample was selected by a private firm that maintains and distributes database information, including telephone number listings. They generated the telephone numbers by using a random-digit dialing program that selected phone numbers in the sample area and screened out most business and government numbers. The survey was conducted with consumers in Los Angeles (405 respondents, with a 41 percent response rate) and Chicago (349 respondents, with a 38 percent response rate).

The survey questions attempted to elicit consumer attitudes and purchasing behavior toward

fish/seafood, poultry, and dairy products, and other meats. Trout steaks (both fresh and frozen) were among several product forms for which respondents could indicate preference, and they are the focus of this paper. Other forms included in the survey included: fillets (fresh and frozen); whole trout (fresh and frozen); smoked trout; breaded trout patties; canned trout; and trout pate. These other forms are discussed in further detail by Foltz, Dasgupta, and Devadoss (1999). Interviewers described trout steaks to interviewees as "cut across in one-inch thickness like salmon steaks." Salmon steaks were used as a reference since it was assumed that the majority of consumers were familiar with that product form. In the opinion of the national seafood product manager for Albertson's, Inc., the second largest U.S. grocery retailer, at least 80 percent of consumers would be familiar with salmon steaks (LeVasseur, 2000). Consumers were then questioned about their willingness to purchase trout steaks as well as other trout products. The survey also elicited consumer degree of willingness to buy fresh and frozen trout steaks by asking them to respond according to the following Likert scale: "definitely buy"; "probably buy"; "probably not buy"; and "definitely not buy." Answers to these and other similar questions generated the dependent variables for the regression analysis presented in this paper. Respondents were asked about their perceptions regarding the price of trout relative to other meat and other fish. This was an attempt to look at the price tradeoffs that most consumers make when choosing protein products. Finally, the survey developed a demographic profile for each respondent that included information on age, race, income, education level, current residence (Chicago or Los Angeles), and size of the respondent's childhood community. Summary statistics of consumer demographic characteristics are reported in Table 1.

Table 1. Demographic Characteristics of the Surveyed Consumers in Chicago and Los Angeles.

	Chicago	*Los Angeles*	*Aggregate*
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
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
Asian or Pacific Islander	3.0	6.4	4.9
Black or African American	14.0	7.4	10.4
White or Caucasian	65.0	42.2	52.7
Hispanic, Latino, or Chicano	10.4	35.1	23.7
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

Several qualitative dependent variables were created from the survey results that pertain to a consumer's proclivity toward purchasing trout steaks. A binary dependent variable (y1)—which took on a one or zero value if a consumer wanted to buy trout steaks but not whole trout (y1 = 0 if a consumer did not want to buy trout steaks, otherwise y1 = 1)—was developed. Two multi-valued dependent variables (y2 and y3) were created to capture consumer willingness to buy fresh and frozen trout steaks, respectively. For example, y2 = 0 corresponded to a consumer's response of "definitely not" when asked about buying fresh trout steaks. Similarly, y2 = 1, 2, or 3 if a consumer indicated being "probably not," "probably," or "definitely" willing to purchase fresh trout steaks, respectively. The y3 variable was developed similarly for frozen trout steaks.

Studies of consumer preferences indicate a linkage between a consumer's purchasing decisions and perceptions of a product's attributes (both physical attributes and price) and the attributes of substitute and complementary products (Engle and Kouka, 1995). This combination is also supported by the suggestion that a consumer's demographic background affects beliefs. Along with a product's physical attributes (for example, appearance, aroma, taste, etc.), these consumer beliefs impact product perceptions. The actual purchasing decisions are based on these perceptions, product price, and prices of substitutes and complements (Foltz, Dasgupta, and Devadoss, 1999; Nauman et al., 1995; Fishbein, 1963). Based on the above hypotheses, several variables were created from the survey results that could potentially explain the variation of y1, y2, and y3 in the sample. These variables can be roughly classified into three groups: personal preferences group, rural or urban experiences, and demographics. Variables in the personal preferences group include appearance, odor, freshness, price, etc., describing consumer attitudes toward characteristics of trout steaks and other food products. The rural or urban experiences group contains variables that indicate whether a consumer was raised in a rural or urban community. The demographics category contains information about a consumer's age, race, income, household size, etc. A complete list of the explanatory variables and their definitions appears in Table 2. The regression models (described below) illustrate the linkage between y1, y2, and y3, and the explanatory variables.

A binary dependent variable, such as y1, could be considered as the observed effect of a continuous latent variable (y^*) such that y1 = 1 if y^* is greater than a threshold parameter (usually taken to be zero) and y1 = 0 otherwise (Maddala, 1992). If $\mathbf{X}$ is a (k×1) vector of k regressors such that y^* and $\mathbf{X}$ are related by $y^* = \beta'\mathbf{X} + \varepsilon$, then $P(y1=1) = P(y^* > 0) = P(\varepsilon > -\beta'\mathbf{X}) = \Phi(\beta'\mathbf{X})$, where β is a conformable coefficient vector and Φ is the standard normal cumulative distribution function, assuming that ε is a standard normal error term. Given a sample of observations for y1 and $\mathbf{X}$, a likelihood function can be formed and maximized with respect to the (k×1) vector of coefficients β in order to obtain the probit maximum likelihood estimates (MLEs) $\hat{\beta}$. The marginal effect of the kth continuous variable regressor (x_k) is given by:

$$\frac{\partial P[y1=1]}{\partial x_k} = \phi(\hat{\beta}'\mathbf{X})\,\hat{\beta}_k,$$

where ϕ denotes the standard normal probability distribution function (PDF) and $\hat{\beta}_k$ is the probit MLE of x_k's coefficient; however, if x_k is a dummy variable, the above marginal effect-methodology is not applicable. The effect of x_k on P(y1=1) can be obtained by comparing $\Phi(\hat{\beta}'\mathbf{X})$ over the entire range of $\hat{\beta}'\mathbf{X}$ for the two values of the dummy variable x_k; therefore, if $\hat{\beta}_k$ is positive, $\Phi(\hat{\beta}'\mathbf{X})$ increases over the entire range of $\hat{\beta}'\mathbf{X}$ if x_k changes value from zero to one. If $\hat{\beta}_k$ is negative, the opposite effect is observed.

The variation in the values of y2 and y3 in the sample of observations is explained using an ordered probit model (Greene, 1993). The ordered probit methodology (discussed at length in Greene (1993)) can be considered an extension of the binary probit regression. Similar to the probit dependent variable, an ordered probit dependent variable (say, y2) can be considered the observed effect of an underlying continuous latent

Table 2. Definitions of Independent Variables Used in the Regression Models.

Demographic Group	
Age	Consumer's age
City	Dummy variable—1 if consumer is a Chicago resident; 0 if a Los Angeles resident
Hispanic	Dummy variable—1 if consumer is Hispanic
Household Size	Consumer's household size
Income50K	Dummy variable—1 if consumer's annual income is more than $50,000
Low Education	Dummy variable—1 if consumer education level is high school or below
White	Dummy variable—1 if consumer is White
Rural/Urban Group	
Large Community	Dummy variable—1 if consumer's childhood community size was at least 2,500
Small Community	Dummy variable—1 if consumer's childhood community size was less than 2,500
Years	Number of years that the consumer has lived in either Chicago or Los Angeles
Personal Preferences Group	
Appearance	Dummy variable—1 if appearance of fish product is important to the consumer
Beef Buy	Dummy variable—1 if consumer eats beef at least once a month
Cooking Time	Dummy variable—1 if cooking time is important to the consumer
Freshness	Dummy variable—1 if freshness of fish product is important to the consumer
High Price	Dummy variable—1 if consumer considers fish to be more expensive than meats
Odor	Dummy variable—1 if fish odor is important to the consumer
Price	Dummy variable—1 if price of fish product is important to the consumer
Try Shellfish	Dummy variable—1 if consumer has eaten shellfish within 3 or 4 years prior to the survey date

variable y^* such that $y2 = 0$ if $y^* \leq 0$; $y2 = 1$ if $0 < y^* \leq \mu 2_1$; $y2 = 2$ if $\mu 2_1 < y^* \leq \mu 2_2$; and $y2 = 3$ if $y^* > \mu 2_2$, where $\mu 2_1$ and $\mu 2_2$ ($0 < \mu 2_1 < \mu 2_2$) are unknown threshold parameters of y^*. The corresponding y^* and threshold parameters of y3 are not necessarily the same as those of y2. Hence, an ordered probit regression, with y2 as the dependent variable, on a set of independent variables (X) results in estimated coefficients of X and estimates of $\mu 2_1$ and $\mu 2_2$. The ordered probit regression with y3 as the dependent variable results in the estimated regression coefficients and threshold parameters corresponding to y3.

The marginal effects of the kth continuous variable regressor (x_k) are obtained by:

$$\frac{\partial P[y2=0]}{\partial x_k}; \frac{\partial P[y2=1]}{\partial x_k}; \frac{\partial P[y2=2]}{\partial x_k}; \text{ and } \frac{\partial P[y2=3]}{\partial x_k}.$$

Mathematical details of these computations are discussed in Greene (1993) and are omitted for sake of brevity. The effects of a dummy-variable regressor on P[y2 = 0]; P[y2 = 1]; P[y2 = 2]; and P[y2 = 3] can be computed 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 $\hat{\delta}_k$ 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 $\hat{\delta}_k$ is a statistically significant negative number. In either case, however, 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).

From a nominal perspective, all regressors that could potentially impact a dependent variable should be included in each regression model; however, from a practical standpoint, this was not feasible because several regressors were highly collinear. For example, certain ethnic groups in our sample had a significantly higher number of non-college-trained individuals when compared to respondents of other ethnic groups (of 173 Hispanic respondents, 113 (or 65 percent) had up to a high

school education or less; of 581 non-Hispanic respondents, 136 (or 23 percent) had up to a high school education or less). This resulted in a high collinearity between the corresponding dummy variables representing ethnic group and education. Such collinearity was also observed among other groups of regressors; hence, inclusion of all independent variables in regressions invariably resulted in severe multicollinearity problems (Greene, 1993). In order to avoid this, we selected the explanatory variables from the three categories (Table 2) that best explained the variation of a dependent variable across the sample. The goodness-of-fit criteria used in our analysis are maximization of the likelihood ratio index and maximization of the count R^2 (that is, percentage of correct predictions of the dependent variable values) (Greene, 1993; Maddala, 1992).

Results

Descriptive Results

Only 245 respondents in our sample (33 percent) indicated that they would consider purchasing trout (this includes all product forms—whole trout, fillets, steaks, smoked trout, etc.). The remaining surveyed consumers were not willing to indicate their purchasing choices for any trout products, perhaps because of their unfamiliarity with the fish; hence, the following analyses are restricted to the 245 respondents labeled as the potential trout consumers in the sample. Of these respondents, 71.4 percent responded as either willing to "definitely buy" or to "probably buy" the product (this included 72.3 percent of Chicago respondents and 71.0 percent of Los Angeles respondents).

The corresponding percentage for frozen trout steaks (of 244 respondents) was 28.7 percent, with 33.0 percent of Chicago respondents and 26.0 percent of Los Angeles respondents exhibiting preference for this product. Clearly, the surveyed consumers found fresh trout steaks to be more acceptable than frozen trout steaks. Although a higher proportion of Chicago consumers displayed preference for frozen trout steaks, a chi-squared test indicated that the preference probability distribution was not significantly different between the two cities (test statistic = 5.714, p-value = 0.126). A similar test also showed no significant differences in the consumer preference distribution for fresh trout steaks across the two cities.

Of the 20 Asian, 22 Black, 77 Hispanic, and 102 White consumers who indicated their preference for fresh trout steaks, a higher proportion of Hispanics and Asians (88 percent and 70 percent, respectively) responded as either willing to definitely buy or probably buy the product (Table 3). The corresponding percentages for Blacks and Whites were 64 percent and 66 percent, respectively. A chi-squared test comparing the preference distributions across the four ethnic groups found that not all four distributions were statistically identical (test statistic value = 13.17, p-value = 0.004). Since a higher proportion of Hispanics indicated preference for fresh trout steaks than did the three other ethnic groups, the above test was re-run with the Hispanic data removed. The resultant test statistic of 0.202 (p-value = 0.904) indicated that the preference distributions for Asians, Blacks, and Whites were not significantly different from each other; hence, Hispanics exhibited a significantly different preference distribution for fresh trout steaks than Asians, Blacks, and Whites. In the case of frozen trout steaks, as shown in Table 4, more Black and White consumers found the product acceptable than did Asian and Hispanic consumers. However, a chi-square test, similar to the fresh trout steak case, revealed no significant difference in the preference distributions across the four ethnic groups.

A consumer's education level also seemed to influence his/her willingness to purchase trout steaks. All respondents were categorized into individuals with at most a high school education and individuals with some college training (that is, those having either a 2-year, 4-year, or graduate degree). Of 87 respondents with a high school education (or less), 79 percent indicated that they would either definitely buy or probably buy fresh trout steaks (Table 3). Of 154 respondents with some college education, only 68 percent indicated a similar preference for fresh trout steaks. A chi-square test showed that the two preference distributions were significantly different for α = 5.1 percent (that is, test statistic = 3.807, p-value = 0.051). Twenty-three percent of respondents with a high school education (or less) and 31 percent of respondents with some college education found frozen trout steaks acceptable (Table 4). A difference test for frozen trout steaks data gave a test-statistic value of 1.464 (p-value = 0.226), indicating that the preference distribution for the product was not significantly different across the two education categories.

Table 3. Percentage of Consumers With Specific Attributes Who Were Willing to Either "Definitely Buy" or "Probably Buy" Fresh Trout Steaks.

	Chicago	LA	Aggregate
		%	
Race			
Asian consumers	75	69	70
Black consumers	67	60	64
Hispanic consumers	93	87	88
White consumers	73	59	66
Education			
Consumers with high school education (or less)	80	79	79
Consumers with college training (2-year, 4-year, or graduate degree)	70	66	68
Childhood Community Size			
Consumers from rural communities or towns of 2,500 residents at least	63	87	79
Consumers from towns larger than 2,500 residents	74	66	69
Relative Price Perspective of Trout, Compared With Other Meats			
Consumers who believe trout is more expensive	74	76	75
Consumers who believe trout costs "about the same"	83	70	74
Consumers who believe trout is less expensive	43	46	45

Table 4. Percentage of Consumers With Specific Attributes Who Were Willing to Either "Definitely Buy" or "Probably Buy" Frozen Trout Steaks.

	Chicago	LA	Aggregate
		%	
Race			
Asian consumers	25	25	25
Black consumers	33	30	32
Hispanic consumers	21	29	27
White consumers	40	22	31
Education			
Consumers with high school education (or less)	24	23	23
Consumers with college training (2-year, 4-year, or graduate degree)	33	29	31
Childhood Community Size			
Consumers from rural communities or towns of 2,500 residents at most	13	17	15
Consumers from towns larger than 2,500 residents	38	29	32
Relative Price Perspective of Trout, Compared With Other Meats			
Consumers who believe trout is more expensive	37	23	28
Consumers who believe trout costs "about the same"	24	34	31
Consumers who believe trout is less expensive	29	17	21

A consumer's childhood community size also influenced their preference for frozen trout steaks. Respondents were classified as individuals who were raised in a rural community or a town of less than 2,500 residents and individuals raised in towns with more than 2,500 residents. Of 52 respondents in the first category, only 15 percent exhibited willingness to either definitely buy or probably buy frozen trout steaks (Table 4). The corresponding proportion of respondents raised in towns with more than 2,500 residents (189 respondents) was 32 percent. A chi-squared test indicated a significant difference in the two preference distributions (test statistic = 5.694, p-value = 0.017). A similar test conducted for fresh trout steaks across the two childhood community-size categories, gave a test statistic of 2.004 (p-value = 0.157); that is, the preference distributions for fresh trout steaks were not significantly different.

A consumer's belief about the relative cost of trout when compared to other meats exerted influence on their trout-steak purchasing decision. Table 3 shows that, of 138 respondents who consider trout to be more expensive, 75 percent indicated a willingness to either "definitely buy" or "probably buy" fresh trout steaks. The corresponding figures for consumers who believed trout to cost about the same as other meats (70 respondents) and for consumers who believed trout to be less expensive than other meats (20 respondents) were 74 percent and 45 percent, respectively (Table 3). A chi-square test gave a test statistic value of 8.239 (p-value = 0.016); that is, the three preference distributions were not statistically identical.

Since the preference distributions for consumers considering trout to be either more expensive or to cost "about the same" as other meats are similar, these two data categories were aggregated. This resulted in a comparison test between the preference distributions of consumers believing that trout was not less expensive than other meats versus consumers believing that trout was less expensive than other meats. The corresponding chi-square test statistic was 8.212 (p-value = 0.004), implying that consumers who believed trout was less expensive than other meats had a significantly different preference distribution for fresh trout steaks than did consumers who believed that trout was not less expensive than other meats. A corresponding analysis was conducted for frozen trout steaks. This resulted in a chi-square test statistic of 0.729 (p-value = 0.694), indicating that consumer perceptions about the relative price of trout did not affect their preference distribution for frozen trout steaks.

Regression Results

Table 2 contains the definitions of independent variables that were developed from the consumer survey. These variables were classified into three groups: a demographic group; a rural/urban group; and a personal preferences group. The three groups help to identify explanatory variables that highlight a respondent's demographic background (for example, age, household size, income, etc.); rural or urban experiences (for example, size of childhood community and years of residence in a metropolitan area); and personal preferences with respect to food products (for example, prefers food that requires brief cooking time or considers fish to be more expensive than other meats), respectively.

Results from the probit regression of the binary dependent variable y1 (y1=1 if a consumer is willing to purchase trout steaks but not the whole fish) appear in Table 5. A respondent's beef-consumption behavior, childhood community size, ethnic background, and price perception of fish/seafood products significantly affected their trout-steak purchasing decision. The significant coefficient estimate of the beef buy regressor indicates that consumers who purchase beef relatively infrequently are more likely to buy trout steaks but not the whole fish. Caucasian consumers, raised in large communities, who consider fish to be more expensive than other meats exhibit a higher likelihood of purchasing trout steaks. The marginal effects in Table 5 show that infrequent beef consumption increases the probability of buying trout steaks (but not whole trout) from 0.209 to 0.706. Similarly, having a large childhood community size increases this purchasing probability from 0.096 to 0.276.

Table 6 contains the results of the ordered probit regression of y2 (that is, four degrees of a consumer's willingness to purchase fresh trout steaks). The results show that only two regressors have significant effect on y2: high price and Hispanic. Respondents who consider fish to be more expensive than other meats (that is, high price = 1) have a higher likelihood of "definitely" purchasing and lower likelihood of either "probably," "probably not," or "definitely not" purchasing fresh trout steaks. Marginal effects associated with high price in Table 6 show that a shift in consumer opinion about the price of fish, relative to other meats, could increase the probability of "definitely" buying fresh trout steaks from 0.381

Table 5. Probit Regression Results With Dependent Binary Variable: Consumer Buys Trout Steaks But Not the Whole Fish.

Independent Variable	Coefficient Estimate	t-ratio	Marginal Effect on P(y = 1)†
Intercept	-0.820	-1.474	
Beef Buy	-1.335	-2.899*	0.706→0.209
City of Residence	0.357	1.434	
Cooking Time	0.290	1.054	
High Price	0.681	2.637*	0.126→0.321
Income50K	-0.403	-1.517	
Large Community	0.713	2.007*	0.096→0.276
Tried Shellfish	-0.338	-1.364	
White	0.728	2.828*	0.148→0.376

Note: Sample size = 159; Likelihood Ratio Index = 0.182; Count R^2 (Maddala, 1992) = 0.793.
* signifies that the estimated coefficient is significantly different from zero with $\alpha = 5\%$.
† "Effect on P(y=1)" 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, p. 675, for details), on a consumer's likelihood of buying trout steaks but not whole trout.

Table 6. Ordered Probit Regression Results Explaining Consumer Willingness-to-Buy Fresh Trout Steaks.

Regressor	Coeff. Est.	t-ratio	Marg. Effect on P(y=0)†	Marg. Effect on P(y=1)	Marg. Effect on P(y=2)	Marg. Effect on P(y=3)
Intercept	0.237	0.667				
City	0.300	1.507				
Cooking Time	0.163	0.773				
High Price	0.327	1.721*	0.196→0.118	0.117→0.090	0.306→0.283	0.381→0.510
Hispanic	0.694	3.078**	0.198→0.062	0.118→0.059	0.306→0.230	0.378→0.649
Household Size	0.080	1.211				
Income50K	-0.088	-0.426				
Large Comm.	-0.041	-0.152				
$\mu 1$	0.370	4.214**				
$\mu 2$	1.159	9.055**				

Note: Sample size = 159; Likelihood Ratio Index = 0.06; Count R^2 (Maddala, 1992) = 0.48.
* signifies that the estimated coefficient is significantly different from zero with $\alpha = 10\%$.
** signifies that the estimated coefficient is significantly different from zero with $\alpha = 5\%$.
† "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, 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 0.510. Table 6 also gives evidence that Hispanic consumers have a significantly higher likelihood of purchasing fresh trout steaks than do consumers of other ethnic backgrounds. The marginal effects show that, ceteris paribus, Hispanic consumers are much more likely to "definitely" buy fresh trout steaks (purchasing probability = 0.649) than are non-Hispanic consumers (purchasing probability = 0.378).

Similar to Table 6 in its layout, Table 7 indicates the effect of independent variables on respondents' willingness to purchase frozen trout steaks. The results show that a consumer's city of residence, household size, income level, and education level significantly affect his/her purchasing decision for frozen trout steaks. The city regressor indicates that Chicago consumers have a significantly higher proclivity toward purchasing frozen trout steaks than do Los Angeles consumers. Respondents with larger households also exhibit a higher preference for frozen trout steaks. The marginal effects show that increase in a consumer's household size by unit results in higher likelihood for "probably" and "definitely" pur-

Table 7. Ordered Probit Regression Results Explaining Consumer Willingness to Buy Frozen Trout Steaks.

Regressor	Coeff. Est.	t-ratio	Marg. Effect on P(y=0)†	Marg. Effect on P(y=1)	Marg. Effect on P(y=2)	Marg. Effect on P(y=3)
Intercept	-0.194	-2.81**				
City	0.353	1.788*	0.332→0.216	0.131→0.113	0.306→0.321	0.231→0.351
Cooking Time	0.347	1.544				
High Price	0.051	0.257	0.196→0.118	0.117→0.090	0.306→0.283	0.381→0.510
Household Size	0.123	2.000**	-0.042	-0.006	0.007	0.041
Income50K	-0.398	-1.658*	0.242→0.382	0.118→0.135	0.321→0.291	0.319→0.193
Large Community	0.315	1.253				
Low Education	-0.476	-2.24**	0.238→0.406	0.117→0.136	0.321→0.283	0.324→0.175
$\mu 1$	0.342	4.601**				
$\mu 2$	1.170	8.126**				

Note: Sample size = 159; Likelihood Ratio Index = 0.05; Count R^2 (Maddala, 1992) = 0.57.
* signifies that the estimated coefficient is significantly different from zero with α = 10%.
** signifies that the estimated coefficient is significantly different from zero with α = 5%.
† "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, 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.

chasing frozen trout steaks by the amount of 0.007 and 0.041, respectively. Table 7 shows that consumers with annual income less than $50,000 have a greater willingness to purchase frozen trout steaks than do individuals with income in excess of $50,000. Finally, Table 7 gives evidence of a connection between trout-purchasing tendency and consumer education level: Respondents with some college training have a significantly higher probability of purchasing frozen trout steaks than do individuals with a high school education (or less).

Discussion and Conclusions

The results of this paper help to identify niche markets for trout steak. The descriptive results clearly show that fresh trout steaks are more popular than frozen trout steaks. Consumers that have exhibited significantly higher preference for fresh trout steaks are Hispanic, individuals with a high school education (or less), and/or respondents who do not believe that trout is less expensive than other meats. Chicago respondents and individuals with an urban background tend to display a higher preference toward frozen trout steaks.

The probit regression results revealed characteristics of consumers who indicated willingness to purchase trout steaks but not whole trout. Such individuals tend to be White, are relatively infrequent consumers of beef and shellfish, and/or have been raised in larger communities. The ordered probit regression results identify consumer attributes that either increase or decrease a respondent's likelihood of purchasing fresh and frozen trout steaks. For example, consumers who consider the price of fish as an important factor in influencing their purchasing decision and consumers with larger households tend to exhibit a greater tendency toward the purchase of fresh trout steaks. On the other hand, individuals showing a greater willingness to buy frozen trout steaks tend to be Chicago residents, from larger communities, and/or have a preference for foods with relatively short preparation time.

By integrating the descriptive and regression results, certain key findings about consumer perceptions of trout steaks are apparent. First, a consumer's ethnicity affects their willingness to buy trout steaks: Hispanic consumers have a higher preference for fresh trout steaks than do consumers belonging to other ethnic groups. White consumers tend to display a higher likelihood of purchasing trout steaks and not whole trout. Second, a consumer's childhood background affects their perception of trout steaks: Individuals raised in larger communities show a greater willingness to buy trout steaks than do individuals with a rural or small-town background. Third, fish price perceptions influence trout-purchasing decisions: Individuals who consider product price to be very im-

portant in making a purchasing decision and individuals who consider trout to be more expensive than other meats tend to show a higher tendency to be willing to buy trout steaks.

Several results from this study are consistent with the conclusions drawn in other studies related to consumer perceptions of trout. For example, the considerably high popularity of fresh trout steaks over frozen trout steaks echoes Block's (1984) survey results, which indicate that consumers prefer fresh trout over frozen fish. Other conclusions of this paper are similar to the results from the Foltz, Dasgupta, and Devadoss (1999) study. For example, Foltz, Dasgupta, and Devadoss (1999) showed that individuals showing preference toward trout fillets tend to be from larger urban communities, have preference for food products with relatively short preparation time and/or be relatively infrequent consumers of beef—results that are also applicable for individuals showing preference for trout steaks. However, the conclusions related to the impact of a consumer's education, household size, and fish-price perceptions are unique to this study.

The results of this study provide some clear marketing implications for trout steaks. For example, relatively high consumer acceptance suggests that processors would find it easier to market fresh trout steaks than frozen trout steaks. Other results indicate that fresh trout steaks should be sold in retail outlets with a proportionately high Hispanic clientele and that frozen trout steaks would sell better in Chicago markets than in Los Angeles markets. Since consumers with larger households show preference toward trout steaks, sellers might consider marketing the product in family-size packages. Retail outlets could provide coupons to encourage the purchase of such volume packages and discount trout steak prices if customers made a minimum total cash purchase (which is likely if an individual is grocery shopping for a large household).

An important development from the results is the preference for trout steaks among Hispanics, consumers with a large household size, and consumers who consider trout to be more expensive than other meats. In our sample, 64 percent of Hispanic respondents earned an annual income of less than $30,000. Hence, the majority of Hispanic consumers in our sample can be considered as belonging to a relatively low-income category; thus, characteristics of consumers exhibiting a high preference for trout steaks suggest individuals with either a limited or inflexible food budget. This is likely to be the result of price perceptions: Potential customers expect trout steaks to be a cheaper value-added fish product (when compared to fillets) as is the case with catfish and salmon. In showing preference for trout steaks, individuals with a limited food budget might be considering the convenience of value-added products, over the whole-dressed fish, and the lower price of fish steaks over fillets. Hence, the marketing success of trout steaks might depend on pricing the product competitively with respect to trout fillets and steaks of other popular fish species (for example, catfish and salmon). Given the larger girth of trout required for reasonably sized steaks, the production costs of trout designated for use as steaks will be higher than the costs for trout designated for use as fillets. As fish grow larger, feed efficiency declines since nutrition is needed to support both maintenance and growth; that is, for large fish, a greater percentage of feed goes for maintenance. Thus, it is more costly per pound to produce larger fish. Although the processing costs of steak production are typically less than those for fillet production, it is unclear whether the competitive pricing of trout steaks can recover potentially higher production costs. Given the importance of these issues to the success of trout steaks in the consumer market, additional research into production, processing, market pricing, and profit margins associated with trout steaks is required.

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