# Shrimp Purchasing Behavior and Preferences of Seafood Dealers

**Ferdinand F. Wirth and Kathy J. Davis**
**University of Florida, IFAS**
**Food and Resource Economics Department**
**Indian River Research and Education Center**
**2199 South Rock Road**
**Fort Pierce, Florida, 34945-3138**
**E-mail: ffwirth@mail.ifas.ufl.edu**

**Abstract:** The U.S. shrimp farming industry has been expanding in the southern U.S. in response to strong market demand for shrimp. U.S. farmers have difficulty competing with imports in frozen shrimp commodity markets. This study identified the shrimp purchasing behavior and preferences of seafood wholesalers and retailers in nine southeastern U.S. states to provide shrimp farmers the market information needed to develop successful marketing strategies. Results of a mail survey, including a conjoint analysis experiment, of the seafood dealers are presented and discussed. There appears to be strong market potential for fresh, farm-raised shrimp in a variety of sizes, but there is considerable dealer resistance to the whole or live, head-on shrimp form. Shrimp farmers interested in successfully marketing to seafood dealers may be required to process their product in order to offer shrimp tails, rather than whole shrimp.

**Keywords:** Shrimp, Buyer Preferences, Marketing

***Selected Paper prepared for presentation at the Southern Agricultural Economics Association Annual Meeting, Mobile, Alabama, February 1-5, 2003***

# Shrimp Purchasing Behavior and Preferences of Seafood Dealers

**Ferdinand F. Wirth and Kathy J. Davis**[1]

## Introduction

Shrimp is the leading seafood consumed in the U.S. (NFI). Per capita consumption of shrimp was 3.4 pounds/person in 2001, 23% of total U.S. seafood consumption. Demand for seafood in the U.S. far exceeds the amount produced by U.S. commercial fishermen and aquaculture producers. In 2001, 882.6 million pounds of shrimp, about 85% of the total supply, were imported into the U.S., primarily from Southeast Asia. These imports were valued at $3.6 billion and accounted for 37% of the value of total edible fishery product imports (NMFS). Domestic farmed shrimp production accounts for less than 5% of the total U.S. supply (Harvey).

The U.S. shrimp farming industry has been expanding rapidly in Florida and other southern states in response to the excess domestic market demand for shrimp. The most viable candidate shrimp species for large-scale culture in Florida appears to be the Pacific white shrimp, *Litopenaeus vannamei,* because of its market popularity, fast growth, adaptability to diverse salinities, and its large size. In the past, expansion of marine shrimp species culture in Florida has been constrained by high coastal land prices, competing uses of coastal land, and concerns over potential environmental damage to sensitive coastal ecosystems. However, aquaculture researchers in Florida have successfully acclimated the marine shrimp *Litopenaeus vannamei* to hard freshwater at the age of three weeks (12-15 days post-larvae). The freshwater found in much of central and south Florida and other southern states contains the correct mineral balance to support this species. Farmers with hard freshwater wells are now able to successfully raise shrimp from post-larvae to commercial market size in inland locations.

U.S. shrimp farmers, including those in Florida, wish to harvest and market their shrimp as quickly as possible. However, U.S. farm-raised shrimp cannot compete effectively on price with imports in fresh-frozen shrimp commodity markets for the most popular forms and sizes. Further, although some farms will undoubtedly develop processing capability, the equipment, packaging, and marketing required to assure the success of value-added products and satisfy food safety requirements (HACCP) are beyond the capability or interest of many farmers. Thus, the shrimp product forms leaving the farm are generally live shrimp or fresh, head-on shrimp. Shrimp farmers in Florida and other southern states are particularly interested in the potential for marketing their product directly to seafood dealers (retailers and wholesalers) as live shrimp or fresh, head-on shrimp. Shrimp farmers are investigating the feasibility of this and other marketing alternatives.

This research is part of a larger study designed to identify and characterize the most attractive direct markets for fresh, farm-raised shrimp. The specific objectives of this phase of the research

[1] Authors are Assistant Professor and Coordinator of Economic Analysis, respectively, with the University of Florida, IFAS, Food and Resource Economics Department, Indian River Research and Education Center, 2199 South Rock Road, Fort Pierce, Florida, 34945-3138.

were (1) to identify the shrimp purchasing behavior, preferences, and attitudes of seafood dealers (wholesale and retail) in the southeastern U.S., and (2) to characterize marketing challenges and opportunities associated with the seafood dealer market.

## Literature Review

In the initial project phase, a literature review was conducted to identify what is known about shrimp attitudes, preferences and purchase behaviors of seafood dealers (wholesale and retail). Relatively little information specific to shrimp was available; most recent research was found to focus on wild-caught and farmed finfish. This further emphasizes the need for reliable market research information for farm-raised shrimp.

The retail food business in the United States is gigantic and dominated by supermarkets; the few remaining specialty retail seafood markets are on the coasts or in large cities such as Chicago, and many of these combine retail sales with a wholesale or restaurant business. Similarly, specialty wholesalers of seafood are located almost exclusively in coastal states or the largest inland cities and primarily supply restaurants (Dore). Activities associated with the wholesale, retail, and food service sectors of the seafood industry create significant economic activity within many non-coastal metropolitan areas of the country; this is becoming even more pronounced given the rapid development of inland aquaculture (Adams). Although some retail food stores do buy through wholesale grocers, most supermarkets are supplied through their own purchasing departments, with smaller chains more likely to buy direct (Dore). Market analyses for several aquaculturally produced finfish (Golz and Nelson, Wirth, Halbrendt, and Vaughn) have demonstrated a strong retailer and wholesaler preference for highly processed product (fish fillets), consistent with a noted consumer preference for convenience and ease of preparation.

Shrimp prices vary according to a wide variety of factors including size, supply, quality, origin, and species or color (Yokoyama, Nakamoto, and Wanitprapha). Many species of shrimp are consumed in the United States, but white shrimp are generally preferred. Shrimp is sold in a variety of fresh or frozen product forms, including whole or tails, shell-on or peeled, and round or split and deveined. Sales and shipments are reported by size categories of shell-on shrimp tails, defined by count per pound. Customary commercial size classifications in the U.S. are U/15 (under 15 shrimp/lb), 16/20, 21/25, 26/30, 31/35, etc.

General information concerning retailer and wholesaler shrimp purchase behavior was extracted from two earlier studies. Shang interviewed 63 fish distributors in Hawaii and found that the shrimp dealers sold shrimp in six forms: frozen head-off, frozen peeled and deveined, breaded, canned, dried, and fresh. Frozen head-off was the most important category, accounting for about 70% of the total volume sold; fresh shrimp accounted for only 1% of the total volume. Dealers preferred large shrimp for frozen tails and frozen peeled and deveined shrimp. Firms which indicated foreign imports as their major supply source most often cited “best price” as their reason, firms that relied on U.S. supply sources did so for “best quality” or “steady supply.”

Schumann surveyed 87 Florida shrimp broker/distributors. Of 18 respondents to the question about willingness to purchase live shrimp, only 2 indicated that they currently purchase live shrimp and 6 confirmed that they would probably purchase live shrimp in the future. Shrimp

buyers indicated a willingness to pay $3.50/lb - $4.80/lb for farmed shrimp in 1999, and an interest in marketing full shrimp farm production capacity.

Although market information specific to shrimp is very limited, there appears to be a strong demand for high quality, reasonably priced shrimp. The shrimp farmer is ideally situated to provide a consistent supply of fresh shrimp, and can adapt production to meet buyer demands for size. However, shrimp farmers may encounter some resistance to direct marketing of whole shrimp. Most distributors appear to be unfamiliar with the live shrimp or fresh, head-on shrimp product forms.

## Methods and Materials

This study was designed to characterize the seafood dealer market and identify opportunities and challenges associated with marketing to seafood dealers. A four-page survey instrument was developed and administered by mail to 3038 seafood dealers in the nine southeastern U.S. states (AL, AR, FL, GA, LA, MS, NC, SC, and TN). Survey recipients were selected by Standard Industrial Classification (SIC) Code, and included the entire population of seafood wholesalers, retailers, and processors in the nine states. The survey asked questions concerning the location and size of the seafood business, business sales structure, shrimp buying practices, and preferences for various shrimp product features. A conjoint analysis experiment was included to quantify the utility value and relative importance of key shrimp product attributes that are within the control of shrimp farmers: size, refrigeration state, form, and price. A thank-you/reminder postcard was mailed to each dealer approximately four days after the survey.

### Conjoint Analysis

Conjoint analysis has become a popular marketing research tool for designing new products. Conjoint analysis refers to any decompositional method that estimates the structure of buyers' preferences for a product's features, given the buyers' overall evaluations of a set of alternative products that are pre-specified in terms of levels of different features (Green and Srinivasan). Using conjoint analysis, a researcher can analyze a heterogeneous product market and obtain results that can be highly disaggregated to homogeneous groups of buyers. Alternatively, aggregating results for buyers who have similar preference or utility functions can be useful in modifying current products or services and in designing new ones for selected market segments (Green and Wind).

The features and feature levels that define the conjoint design must be carefully selected. The features correspond to important product characteristics or characteristics hypothesized to influence purchase behavior. The feature levels are sample values for each of the selected factors, and the levels should span the realistic range of each feature. Table 1 summarizes the features and levels selected for the conjoint analysis experiment in this study.

The conjoint experiment employs a full-profile approach, in which respondents rate a set of hypothetical products defined by a specified level for each feature. In a full-factorial design, in which every possible combination of feature levels is rated, the number of products to be rated quickly becomes very large and the task becomes unrealistic for the survey participant. A

fractional factorial design is generally used instead, in which an orthogonal subset of feature level combinations is selected. The orthogonality permits the researcher to estimate all single-factor, or main, effects, although information concerning feature interactions is lost (Green).

Table 1. Conjoint Experiment Shrimp Features and Feature Levels

| Feature | Feature Levels |
|---|---|
| Size (tail count/lb | x-large (16-25) |
| | large (26-35) |
| | medium (36-50) |
| State | fresh (never frozen) |
| | frozen |
| Form | whole |
| | shell-on tails |
| | peeled & deveined tails |
| Purchase Price | $3.00/lb |
| | $5.50/lb |
| | $8.00/lb |

For this study the orthogonal design was developed using CONJOINT DESIGNER, a software package from Bretton-Clark. Only nine hypothetical products were required to represent the designs described in Table 1, as opposed to 54 for a full-factorial design. In addition, the experiment included two "training" products defined by the combinations of feature levels expected to be most desirable and least desirable, and one "holdout" product defined to closely resemble realistically marketable farm-raised shrimp. Holdout products are used to validate results as well as to gather data on particular products of interest (Herman). The coefficients of the conjoint model are estimated using only the products that determine the orthogonal design, without use of any holdout products. The actual ratings of the holdout products can then be compared to those predicted by the conjoint model as an indication of the predictive validity of the model. The 10 shrimp products presented to the survey participants are described in Table 2.

Several important product characteristics, such as farm-raised vs. wild-caught, raw vs. cooked, and domestic vs. imported, were deliberately omitted from the conjoint experiment in order to limit the number of tasks required of the survey respondents. Seafood dealers were asked to rate each of the products shown in Table 2 on a scale of 0 - 10, where 0 was the least desirable combination of product attribute levels, and 10 was the most desirable combination of product attribute levels.

## Model Specification

A conjoint preference model is used to estimate the influence of various product features on preferences indicated by the respondents. The specification of the conjoint preference model, as described by Wirth, Halbrendt, and Vaughn, involves two steps. First, the functional form for each product feature must be specified. Next, the functional forms for each feature are combined into a conjoint preference model for estimation.

Table 2. Hypothetical Products Rated by Seafood Dealers

| Product # | Size | State | Form | Price |
|---|---|---|---|---|
| 1 | medium | frozen | p & d | $8.00/lb |
| 2 | medium | fresh | tails | $3.00/lb |
| 3 | large | fresh | whole | $8.00/lb |
| 4 | x-large | frozen | tails | $8.00/lb |
| 5 | medium | frozen | whole | $5.50/lb |
| 6 | x-large | frozen | whole | $3.00/lb |
| 7 | large | frozen | tails | $5.50/lb |
| 8 | large | frozen | p & d | $3.00/lb |
| 9 | x-large | fresh | p & d | $5.50/lb |
| 10 ("holdout") | large | fresh | whole | $5.50/lb |

There are three ways to model a buyer's utility function for each product feature: a part-worth, or dummy variable function model, a linear vector model, and a quadratic ideal-point model. Green and Srinivasan provide a detailed theoretical discussion of the three functional forms. The most general and most commonly used utility model is the part-worth model, which is especially appropriate for qualitative variables. The part-worth model requires separate estimates of the impact or part-worth of each level of a feature. Quantitative features with two or three feature levels, such as price, can be modeled using the part-worth model, the vector model, or the ideal-point model.

The part-worth function model posits that for a set of 't' features, where $y_{jp}$ denotes the level of the pth feature for the jth product, the preference $S_j$ is given by

$$S_j = \sum_{p=1}^{t} f_p(y_{jp}) \qquad (1)$$

where $f_p$ is the function denoting the part-worth of different levels of $y_{jp}$. In practice, $f_p(y_{jp})$ is estimated only for the selected set of feature levels, with values for intermediate levels obtained by linear interpolation (Green and Srinivasan).

Most researchers use *a priori* notions of the shape of each feature's utility function to determine the choice of an appropriate model. For this study, the part-worth function model is used to model all four shrimp product features: size, state, form, and price. The part-worth model provides the greatest flexibility in the shape of the utility function for each of the product features. However, this model also requires estimation of the greatest number of parameters (perhaps reducing the reliability of the estimates).

This study employed 'mean deviation coding' for the dummy variable specification and the coefficients were estimated using ordinary linear regression. This dummy variable coding technique is mathematically equivalent to traditional dummy variable coding, but the coefficient for the base level is easily calculated as the negative sum of the coefficients for the other k-1

levels. The intercept is the overall mean preference rating, and dummy variable coefficients measure deviation from the mean rating (Harrison, Ozayan, and Meyers).

In conjoint analysis, a buyer's utility for a product, as represented by the preference rating, is the additive sum of the buyer's utilities for each product feature. In the econometric specification of buyer preferences, the product features are combined to form an additive, main-effects conjoint preference model. The model for this study can be expressed as follows:

$$\text{Rating} = f(\text{Size, State, Form, Purchase Price}) \qquad (2)$$

where the rating equals the preference rating given to the hypothetical shrimp products by survey respondents.

## Results and Discussion

Mail Survey

A four-page survey instrument was mailed to 3038 seafood dealers in the nine states comprising the southeastern U.S. A total of 253 (8.3%) surveys were returned as undeliverable. Two hundred and fifty (250) of the remaining 2785 surveys were completed and returned, giving an effective response rate of 9.0%. The survey included questions concerning the location and size of the seafood business, business sales structure, shrimp buying practices, and the conjoint experiment described in the Methods and Materials section.

Almost half (46%) of the responding dealers were located in Florida, followed by Louisiana (16%), Georgia (11%) and North Carolina (10%). The businesses were fairly evenly distributed between rural, suburban, and urban locations (22% to 35%), with fewer in resort areas. The great majority (87%%) of the seafood dealers can be classified as small businesses, with 25 or fewer employees.

Dealers were asked to describe their business in terms of the percentage of their total sales in each of four specified categories: wholesale to wholesale, wholesale to retail, retail, and other. For this report, dealers were classified as "wholesalers" if they indicated that more than 50% of their total sales were wholesale to wholesale and/or wholesale to retail. Similarly, dealers were classified as "retailers" if they indicated that more than 50% of their total sales were retail. Respondents were fairly evenly split between these designations, but approximately 70% of responding dealers reported some retail sales, suggesting that many seafood dealers are diverse, selling in multiple markets.

Dealers were then asked several questions about their current shrimp buying practices. Of those responding, 85% (212) indicated that they currently purchase shrimp and reported their total annual shrimp purchases. Table 3 presents the total pounds purchased by these dealers; about two-thirds of dealers who buy shrimp purchase 50,000 pounds or less annually. Almost 10% buy more than one million pounds annually.

Table 3. Number of Pounds of Shrimp Purchased Annually by Dealers who Sell Shrimp

| Pounds of Shrimp | Number of Dealers | Percent of Dealers |
|---|---|---|
| 1 - 50,000 | 144 | 67.6 |
| 50,0001- 100,000 | 19 | 8.9 |
| 100,001- 250,000 | 20 | 9.4 |
| 250,001-1,000,000 | 12 | 5.6 |
| 1,000,001-5,000,000 | 9 | 4.2 |
| more than 5,000,000 | 9 | 4.2 |

These dealers were also asked to list the percentage of their total shrimp purchases in each of several specified sizes and product forms. Figure 1 shows the percent of responding shrimp buyers who indicated they currently purchase any shrimp in the specified sizes and forms. The results indicate that shrimp dealers carry the full range of sizes from 16/20 count to counts smaller than 41/50 count. Figure 2 shows the shrimp product forms currently being purchased by responding shrimp dealers. The vast majority of shrimp dealers carry shrimp tails, but more than 50% of shrimp dealers purchase some whole, head-on shrimp. A significant proportion of shrimp dealers also purchase peeled & deveined (p&d) tails and peeled & undeveined (pud) tails.

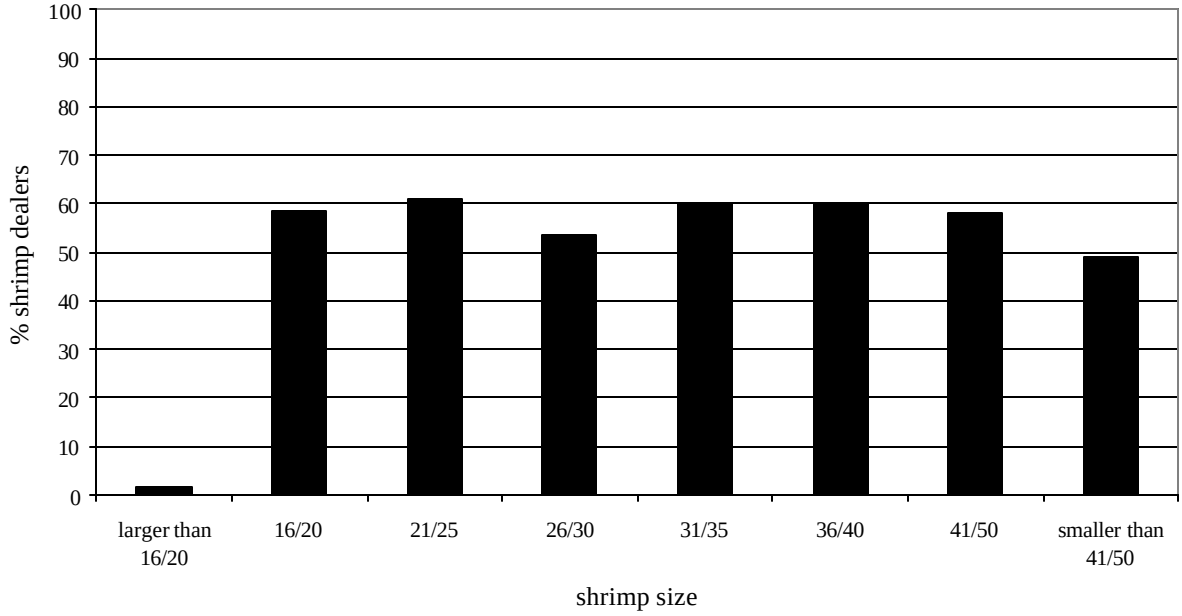


Figure 1. Percent of Shrimp Dealers Currently Buying Any Shrimp in Specified Sizes

The dealers were asked several questions specific to farm-raised shrimp. Of the dealers responding, 73% were familiar with aquaculture and 54% indicated they currently buy farm-raised shrimp, although the source country of origin was not identified. Seventy-five percent (75%) would offer farm-raised shrimp if it were readily available and 72% would be willing to purchase shrimp directly from a farmer. Only 38% of dealers were familiar with Pacific White

shrimp raised in fresh water, but 55% would be willing to purchase these shrimp. These results suggest that shrimp farmers will find a ready market for their product.

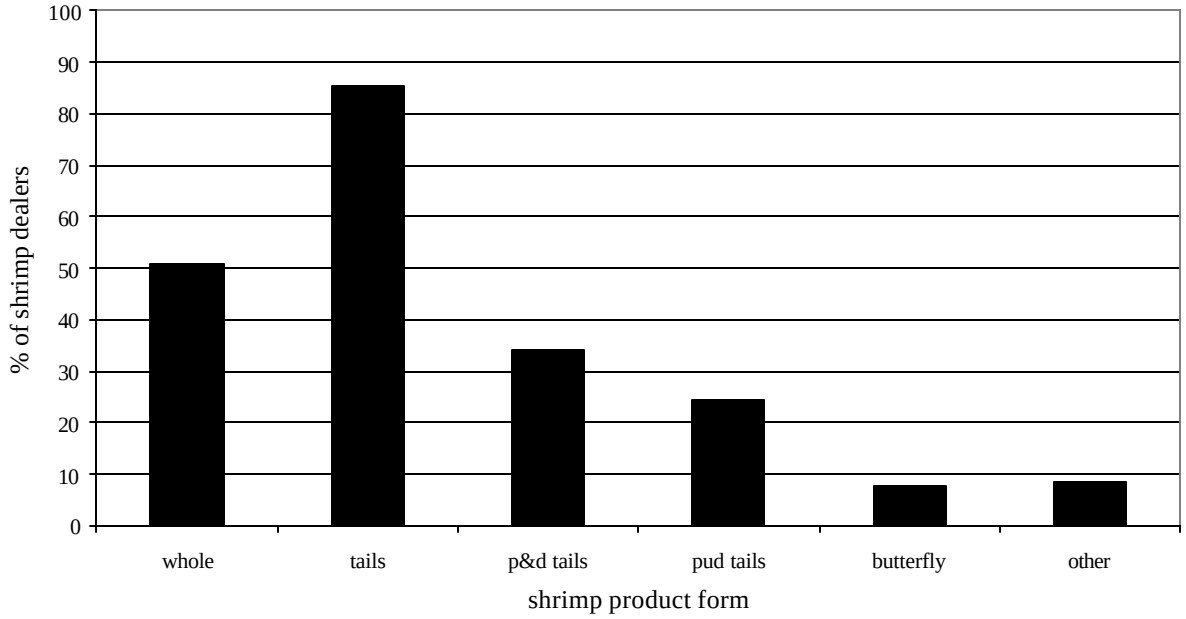


Figure 2. Percent of Shrimp Dealers Currently Buying Any Shrimp in Specified Forms

Figure 3 shows the percent of dealers in each sales category that indicated willingness to buy shrimp directly from a shrimp farmer. About 18% of dealers classified as "wholesalers" for this study (more than 50% of total sales described as wholesale to wholesale and/or wholesale to retail) specifically stated that they were not willing to buy directly from shrimp farmers, while only 7% of "retailers" were unwilling to buy direct. Willingness to buy directly from farmers does not appear to be directly correlated with any of the other basic dealer characteristics recorded in this survey. Due to survey length constraints, dealers were not specifically asked about their willingness to buy whole shrimp directly from farmers.

Finally, dealers were asked to rate various shrimp product features from 0-10, with 10 indicating the feature is "most important" in their shrimp purchase decisions. Table 4 shows the mean rating (ranking) of each product feature for all dealers combined and for those identified as wholesalers or retailers. Ratings were consistent among wholesalers and retailers. Quality, freshness, and smell were the three most important shrimp product features to the responding dealers, each with mean rating greater than 8.5. Unfortunately, from the perspective of U.S. shrimp farmers, production source (imported vs. wild-caught vs. farm-raised) and country-of-origin appear to be relatively unimportant to dealers. Dealers also do not consider the whole (head-on) shrimp form, or fresh (never frozen) state to be very important.

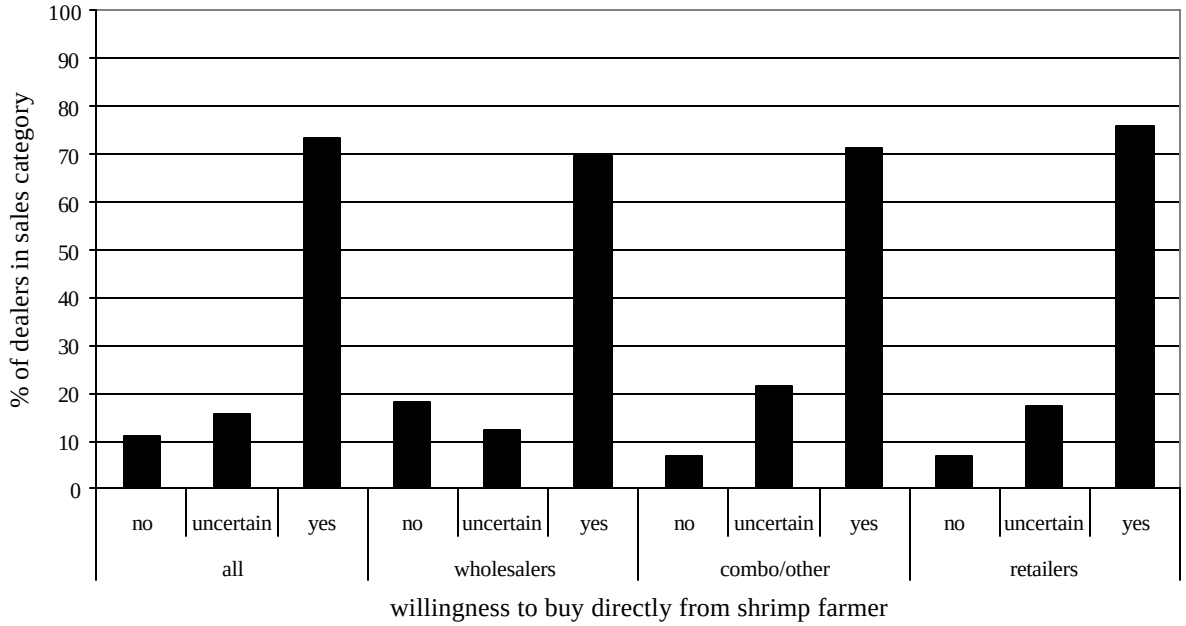


Figure 3. Dealer Willingness to Buy Directly from Shrimp Farmers within Each Sales Category

Conjoint Analysis

The seafood dealers were asked to rate ten hypothetical shrimp products on a scale of 0-10, with 0 indicating least preferred and 10 indicating most preferred. These products were designed to permit quantification of seafood dealer preferences for four shrimp product features that are within the control of shrimp farmers: size, state, form and price. Nine of the hypothetical products were selected to create an orthogonal fractional factorial design for the analysis. The tenth "holdout" product was selected to represent the most feasible whole shrimp product for shrimp farmers to market directly, without processing. The specific product features and feature levels were described in the Methods and Materials section and listed in Table 1 and the ten products included in the conjoint experiment are described in Table 2.

The conjoint model parameters were estimated using ordinary least squares regression; results are shown in Table 5. Coefficients were estimated for the entire sample of dealers, and for subgroups of dealers who attributed more than 50% of their total sales to wholesale (wholesale-to-wholesale and wholesale-to-retail combined) or to retail. The coefficients for all dealers combined were statistically significant at p=0.05, except for the coefficients for state=fresh, and for price=$5.50/lb (significance varies for dealers in each sales category). The regression constant was estimated at 3.829 for all dealers, and is interpreted as the mean preference rating, with feature level coefficients measuring deviation from that rating in response to a particular product attribute. The adjusted R-Square value computed for this model, interpreted as the proportion of the variability in the dependent variable, rating, that can be explained by the variability in the independent variables, size, state, form, and price, is very low at 0.096, due to the highly cross-sectional nature of the data. Aggregating responses across individuals introduces additional variation due to differences in each respondent's subjective rating for the

same product (Harrison, Ozayan, and Meyers). The F-statistics indicate that all models were statistically significant at the " = 0.05 level.

Table 4. Mean Rating and Ranking of Shrimp Features in Purchase Decisions

| Product Feature | Mean Rating (Ranking) | | | |
|---|---|---|---|---|
| | ALL DEALERS | WHOLESALERS | COMBO/OTHER | RETAILERS |
| Quality | 9.51 (1) | 9.57 (1) | 9.38 (1) | 9.61 (1) |
| Freshness | 8.82 (2) | 8.88 (2) | 8.44 (5) | 9.03 (3) |
| Smell | 8.75 (3) | 8.66 (3) | 8.31 (6) | 9.12 (2) |
| Price | 7.73 (4) | 8.04 (5) | 7.06 (10) | 7.78 (4) |
| Color | 7.61 (5) | 8.04 (4) | 7.44 (8) | 7.44 (5) |
| Size | 7.51 (6) | 7.80 (6) | 8.13 (7) | 7.27 (7) |
| Consistent Size | 7.37 (7) | 7.70 (7) | 8.94 (3) | 7.10 (8) |
| Taste | 7.17 (8) | 7.19 (8) | 8.56 (4) | 7.38 (6) |
| Consistent Taste | 6.93 (9) | 6.97 (9) | 9.31 (2) | 6.94 (9) |
| Tails | 6.49 (10) | 6.42 (11) | 7.13 (9) | 6.79 (10) |
| Raw | 5.88 (11) | 5.86 (12) | 5.33 (12) | 6.08 (11) |
| Frozen | 5.82 (12) | 6.63 (10) | 4.27 (15) | 5.79 (12) |
| Fresh | 4.64 (13) | 4.22 (15) | 4.33 (14) | 5.00 (13) |
| Whole | 4.23 (14) | 4.29 (14) | 4.19 (16) | 4.32 (14) |
| Country-of-Origin | 4.19 (15) | 4.32 (13) | 5.44 (11) | 4.14 (15) |
| P & D | 3.44 (16) | 3.53 (18) | 4.56 (13) | 3.23 (16) |
| Wild-Caught | 3.40 (17) | 3.73 (17) | 4.06 (17) | 3.16 (17) |
| Nutritional Value | 3.14 (18) | 4.11 (16) | 2.38 (19) | 2.74 (19) |
| Farm-Raised | 3.00 (19) | 3.36 (19) | 2.31 (20) | 3.01 (18) |
| Imported | 2.73 (20) | 3.26 (20) | 2.93 (18) | 2.65 (20) |
| Cooked | 1.50 (21) | 2.04 (21) | 0.93 (21) | 1.25 (21) |

Table 5. Results of Regression, Conjoint Analysis

| | ALL DEALERS | | WHOLESALERS | | COMBO/OTHER | | RETAILERS | |
|---|---|---|---|---|---|---|---|---|
| | Coeff. | Sig. | Coeff. | Sig. | Coeff. | Sig. | Coeff. | Sig. |
| CONSTANT | 3.829 | 0.000 | 3.751 | 0.000 | 4.411 | 0.000 | 3.913 | 0.000 |
| Size x-large | 0.485 | 0.000 | 0.661 | 0.004 | 0.903 | 0.086 | 0.255 | 0.174 |
| Size large | 0.279 | 0.040 | 0.336 | 0.144 | 0.069 | 0.894 | 0.335 | 0.074 |
| State fresh | 0.060 | 0.553 | -0.140 | 0.416 | 0.068 | 0.863 | 0.142 | 0.310 |
| Form whole | -0.921 | 0.000 | -0.872 | 0.000 | -0.868 | 0.098 | -1.031 | 0.000 |
| Form tails | 1.510 | 0.000 | 1.364 | 0.000 | 1.403 | 0.008 | 1.656 | 0.000 |
| Price $3/lb | 0.664 | 0.000 | 0.994 | 0.000 | 1.090 | 0.038 | 0.536 | 0.004 |
| Price $5.50/lb | 0.234 | 0.085 | 0.193 | 0.401 | 0.653 | 0.213 | 0.203 | 0.278 |
| F | 29.507 | 0.000 | 12.456 | 0.000 | 3.307 | 0.003 | 15.344 | 0.000 |
| Adj. R-Square | 0.096 | | 0.111 | | 0.101 | | 0.094 | |

The regression coefficients provide a direct measure of utility for the levels specified for each feature. The effects coding technique used in this study constrains the utility of the levels of each feature to sum to 0, so the utility of the base level for each attribute is easily calculated. The relative importance of each attribute is then the range of utility over all levels of that attribute, expressed as a percentage of the sum of the utility ranges for all attributes. It is unlikely that any of the specified features or levels genuinely have no importance at all in buyer decisions. Thus, the estimated coefficients were used in these calculations, even if they were not significantly different from zero. The results of this analysis are presented in Tables 6 and 7. Only ratings of the nine products included in the fractional factorial design were used to determine the utility and relative importance of each attribute.

Table 6. Utility of Shrimp Product Features and Levels to Seafood Dealers

| Feature | Level | Utility | | | |
|---|---|---|---|---|---|
| | | ALL DEALERS | WHOLESALERS | COMBO/OTHER | RETAILERS |
| Size | x-large (16-25 tails/lb) | 0.485 | 0.661 | 0.903 | 0.255 |
| | large (26-35 tails/lb) | 0.279 | 0.336 | 0.069 | 0.335 |
| | medium (36-50 tails/lb) | -0.764* | -0.997* | -0.972* | -0.590* |
| State | fresh, never frozen | 0.060 | -0.140 | 0.068 | 0.142 |
| | frozen | -0.060* | 0.140* | -0.068* | -0.142* |
| Form | whole, head on | -0.921 | -0.872 | -0.868 | -1.031 |
| | tails, head off | 1.510 | 1.364 | 1.403 | 1.656 |
| | peeled & deveined | -0.589* | -0.492* | -0.535* | -0.625* |
| Price | $3.00/lb | 0.664 | 0.994 | 1.090 | 0.536 |
| | $5.50/lb | 0.234 | 0.193 | 0.653 | 0.203 |
| | $8.00/lb | -0.898* | -1.187* | -1.743* | -0.739* |

* Calculated utility.

Table 7. Relative Importance of Shrimp Product Features to Seafood Dealers

| Attribute | Relative Importance* | | | |
|---|---|---|---|---|
| | ALL DEALERS | WHOLESALERS | COMBO/OTHER | RETAILERS |
| Size | 23.3 | 26.1 | 26.4 | 17.9 |
| State | 2.2 | 4.4 | 1.9 | 5.5 |
| Form | 45.3 | 35.2 | 31.9 | 52.0 |
| Price | 29.1 | 34.3 | 39.8 | 24.7 |

* Relative Importance does not sum to 100% due to rounding.

Product form is the most important shrimp product feature for dealers, contributing almost 50% to the rating decision. Tails are strongly preferred, and contributed more to the product utility value than any other feature or feature level. Price contributed almost 30% to the decision and is slightly more important than size. As expected, the highest preference was for the lowest price and the largest size. State (fresh or frozen) has no significant effect on the product rating, suggesting that dealers are completely indifferent to the shrimp refrigeration state in their shrimp purchasing decisions. Results were fairly consistent between all dealers combined and the wholesaler and retailer groups, except that form is more important and size is less important to retailers.

The model can be validated by comparing the actual mean dealer ratings with the ratings predicted by the model for the "holdout" product #10 (large, fresh, whole shrimp for $5.50/lb). The buyer utility for the product is the sum of the base utility level plus the sum of the utility values for each selected product feature. The predicted utility for the "holdout" product #10 was calculated as 3.481. The actual dealer mean rating for product #10 was 3.08 with a standard deviation of 4.08. Thus the model's predicted rating is quite accurate.

## Conclusions

The demand for seafood in the U.S far exceeds the amount produced by U.S. commercial fishermen and aquaculture producers. The U.S. shrimp farming industry has been expanding rapidly in the southern U.S. in response to the excess market demand for shrimp. Shrimp farmers wish to harvest and market their products as quickly as possible, at the lowest possible costs, so the usual shrimp product forms leaving the farm are generally live shrimp or fresh, head-on shrimp. One marketing alternative, especially during the early stages of industry development, is for shrimp farmers to market their products directly to seafood dealers. This research was designed to identify and characterize the shrimp purchasing behavior of seafood dealers (wholesale and retail) in the southeastern U.S., and identify challenges and opportunities associated with the seafood dealer market.

The results of the seafood dealer (wholesale and retail) survey and conjoint analysis of dealer product ratings suggest that the shrimp dealer market is not an especially good candidate for direct sales of whole, farm-raised shrimp. The large majority of dealers are willing to buy farm-raised shrimp direct from the farmer but dealers revealed a strong preference for shrimp tails, rather than whole shrimp. The small percentage of dealers willing to purchase whole shrimp

would only be able to support a small volume of shrimp products in a niche market, during the early stages of industry development.

Other potential marketing problems with the dealer market are associated with price and refrigeration state. Price is extremely important to dealers, contributing 30% to the shrimp purchase decision. Shrimp dealers may be unwilling to pay higher prices for domestic farm-raised shrimp, compared with shrimp from other sources. Dealers are also completely indifferent to the shrimp refrigeration state (fresh vs. frozen) in their shrimp purchasing decision, suggesting that domestic shrimp farmers cannot obtain any competitive advantage or product differentiation by selling fresh, never frozen, shrimp, which is the farmers' preferred refrigeration state for marketing purposes.

Overall, the results of this study indicate a strong potential market for fresh, farm-raised shrimp in a variety of sizes, but there is considerable resistance to the whole or live, head-on shrimp form. The mail survey and conjoint experiment results suggest that shrimp farmers interested in successfully marketing to seafood dealers may be required to process their product in order to offer shrimp tails, rather than whole shrimp. Each shrimp farmer will have to compare his own costs versus returns for both whole shrimp and shrimp tails before choosing the product form and outlet that yields the highest profit margin.

## References


Adams, Chuck. "Selected Factors Affecting Seafood Markets in the United States." *Journal of Food Distribution Research* 29, no. 1 (1998):8-17.

Dore, Ian. *SHRIMP Supply, Products and Marketing in the Aquaculture Age*. Toms River, New Jersey: Urner Barry Publications, Inc., 2000.

Golz, Theresa K. and William C. Nelson. "Markets for Northern Plains Aquaculture – Case Study of Tilapia." Agricultural Economics Report No. 429, Department of Agricultural Economics, North Dakota State University, October 1999.

Green, P.E. "On the Design of Choice Experiments Involving Multifactor Alternatives." *Journal of Consumer Research* 1 (1974):61-68.

Green, P.E. and V. Srinivasan. "Conjoint Analysis in Consumer Research: Issues and Outlook." *Journal of Consumer Research* 5 (1978):103-123.

Green, P.E. and Y. Wind. "New Ways to Measure Consumers' Judgments." *Harvard Business Review*, July-August 1975, pp 89 -108.

Harrison, R. Wes, Aylin Ozayan, and Samuel P. Meyers. "A Conjoint Analysis of New Food Products Processed from Underutilized Small Crawfish." *Journal of Agricultural and Applied Economics* 30, no. 2 (December 1998):257-265.

Harvey, David J. "Aquaculture Outlook." Washington DC: U.S. Department of Agriculture, LDP-AQS-15, March 2002.

Herman, Steven. "Software for Full Profile Conjoint Analysis." Proceedings of the Second Sawtooth Software Conference. Sun Valley, Idaho, April 1988.

National Fisheries Institute (NFI). "Seafood's Top Ten". http://www.nfi.org/news/topten.php.

National Marine Fisheries Service (NMFS). "Fisheries of the United States, 2001." http://www.st.nmfs.gov/st1/fus/fus01/

Schumann, Don. Indian River Aquaculture. Personal Communication, 2000.

Shang, Y.C. *Aquaculture Economic Analysis: An Introduction. Advances in World Aquaculture, Volume 2*. The World Aquaculture Society, Baton Rouge, LA, 1990.

Wirth, F.F., C.K. Halbrendt, and G.F. Vaughn. "Conjoint Analysis of the Mid-Atlantic Food-Fish Market for Farm-Raised Hybrid Striped Bass." University of Delaware, College of Agricultural Sciences, Agricultural Experiment Station Bulletin No. 488, November 1990.

Yokoyama, K.M., S.T. Nakamoto, and K. Wanitprapha. “Shrimp Economic Fact Sheet.” Department of Agricultural and Resource Economics, University of Hawaii, July 1989.