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# Factors Influencing Producers' Marketing Decisions in the Louisiana Crawfish Industry

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Factors influencing farmer selection of a crawfish marketing outlet were analyzed using 2008 survey data from the Louisiana crawfish industry. Most farmers sell to wholesalers, followed by direct to consumer, direct to retailer, and finally to processors. A relatively high percentage of farmers grade crawfish prior to sale, with fewer washing, peeling, and purging crawfish. Probit results show farm size, farm income, household income, age, education, and pre-market grading and washing operations significantly affecting farmer selection of marketing outlet.

## Introduction

Farmers generally choose a market for their products considering a number of factors, with economic profit likely of greatest importance for most. Louisiana has a significant crawfish industry with crawfish being marketed using a variety of market outlets. Four of the main outlets through which farmers market crawfish are: processors, wholesalers, direct to consumers, and direct to retailers. Furthermore, some farmers conduct various combinations of value-added activities such as washing, peeling, purging, and grading crawfish prior to sale. Little information has been available regarding the extent of use of various marketing and value-added activities of crawfish farmers, limiting the ability of researchers, extension personnel, and agribusiness persons with an interest in the crawfish industry to adequately characterize the industry in terms of cost of production and potential for increased industry efficiencies. Characterization of these facets of the industry are particularly important today, considering recent significantly increased competition from abroad (Lee 2007), along with the need to accurately estimate cost of production (Boucher and Gillespie 2010) in years of significant loss from weather events such as hurricanes.

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In this study, we seek to characterize the marketing and value-added production activities of crawfish farmers by extent of use and farm type. The objectives are to determine: (1) the portions of farmers using each of the four main marketing outlets for crawfish, (2) the portions of farmers conducting each of four value-added activities in crawfish production, and (3) the types of farmers using each of the four main marketing outlets for crawfish. In accordance with the structure-conduct-performance paradigm, we focus on the first two phases, proceeding by providing background information on the structure of the industry, followed by a discussion of marketing practices (conduct), data and methods, results, and finally conclusions.

## *The United States Crawfish Industry*

Louisiana is the largest crawfish producer in the United States with almost 1,600 farms on more than 184,000 acres (LSU AgCenter 2008). Most of the state's production (70%) is consumed in Louisiana and neighboring states, with much of the remaining United States demand being supplied via imports, especially from China (Lee 2007). Crawfish farm sizes vary widely. In the survey from which the data for this study were collected, of 64 farms reporting crawfish acreage, 6 farmed  $\leq 20$  acres while 4 farmed  $> 950$ , for an average of 211 acres. Gillespie and Nyaupane (2010) show a variety of crawfish production systems, with 62% of farmers either double-cropping with rice or rotating crawfish

with a field crop. Furthermore, approximately 12% of the crawfish marketed in 2008 was wild-caught, rather than farm-raised and roughly equal numbers of producers were engaged in farm-raised and wild-caught production (LSU AgCenter 2008). Considering the range of operation sizes, competition from the wild-caught segment, and variety of production systems used, it is evident that scale economies are not forcing farmers into large-scale, homogeneous operations – the structure of the primary production segment remains quite heterogeneous in nature.

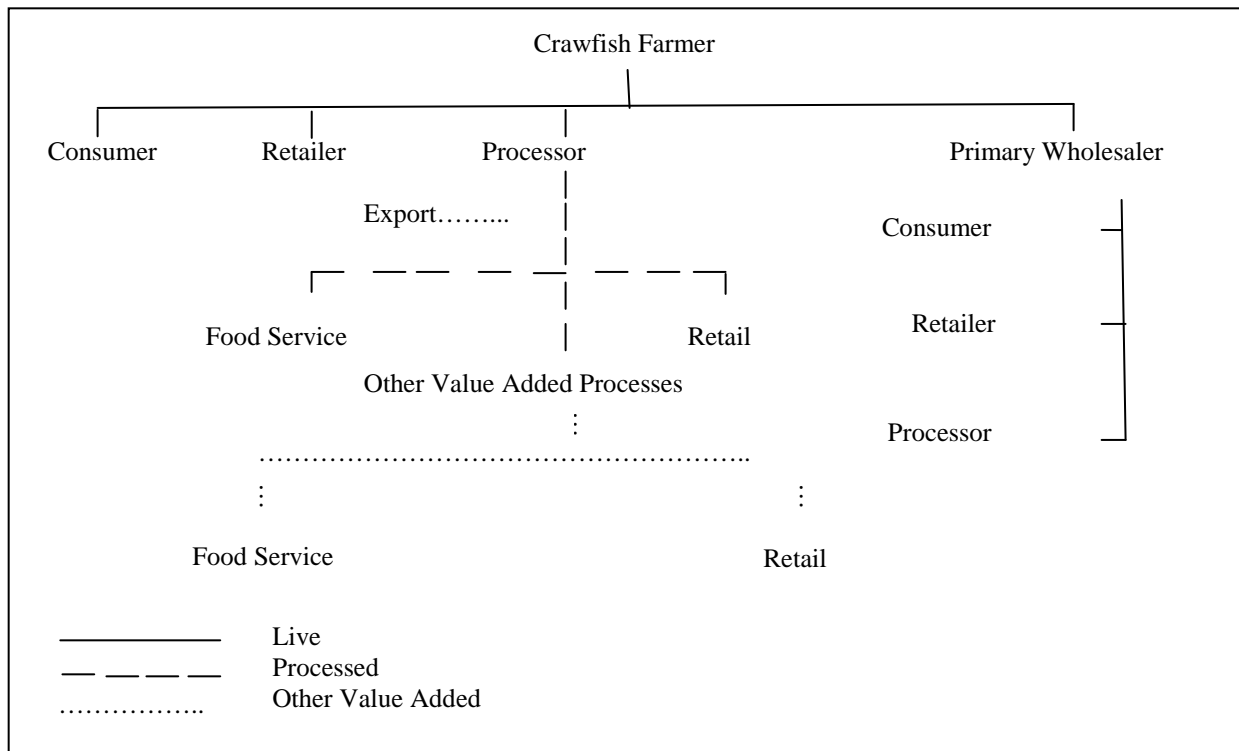
In 2002, Louisiana per capita consumption was higher (10.4 lbs) than that of the rest of the United States (0.25 lbs) (Lee 2007). Crawfish is sold in the United States in two main forms: live or as cooked, peeled tail-meat. Live crawfish are sold primarily for crawfish boils in the spring, particularly around Easter, and peeled tail meat is used in various Cajun dishes such as crawfish etouffee and crawfish pie, which are consumed year-round. In addition to limited demand for crawfish outside southern Louisiana, restricted geographical production areas, seasonal production, and unstable prices are among the reasons for the limited national supply of crawfish

meat from China, which is priced lower than the domestic product (Lewis and Gillespie 2008). (McClain et al. 2007). Moreover, the U.S. crawfish industry must compete with peeled tail-

Peeled tail-meat can be sold in fresh or frozen form. The harvesting schedule and market distribution of live crawfish is highly influenced by its short shelf life (Romaine et al. 2005). All of the whole and live crawfish and most of the fresh tail-meat are provided by domestic producers while China is the major supplier of frozen tail-meat, allowing the domestic product to be somewhat differentiated from the imported product. In addition, the domestic product generally contains the yellow “fat” or hepatopancreas, which adds flavor, while the imported product does not.

*Value-added Production Practices and Methods of Crawfish Marketing*

A farmer may sell crawfish directly to a consumer, processor, primary wholesaler, and/or retailer depending upon access to the market and production practices used (McClain et al. 2007). Figure 1 provides a chart depicting the marketing conduct of crawfish. Some farmers market crawfish directly to consumers and/or retailers.



**Figure 1. Marketing Outlets for Louisiana Crawfish**  
Source: Romaine et al., 2005

In some cases, consumers go directly to the farm to purchase crawfish, though this is unlikely to occur to a great extent for larger-scale farmers high transactions costs, as discussed by Coase (1937) and later by Williamson (1990), for the large-scale farmer. Producers may sell directly to retailers, with retailers having an interest in dealing with farmers who can guarantee a consistently high quality product.

Farmers may sell to processors, who in turn sell to food service and/or retail firms. Processors often peel some (generally smaller) crawfish and sell it as cooked, peeled tail meat. Partially because of the lower priced tail-meat imports from China, a reduction of licensed processors has resulted; in 1996, Gillespie and Capdeboscq (1996) identified 80 processors for surveying, but by 2004, just over 30 processors were identified for surveying by Gillespie and Lewis (2005); thus, the peeling capacity of the industry has decreased (McClain et al. 2007). Primary wholesalers have docks throughout the major crawfish production area of southern Louisiana. Farmers may sell crawfish to these wholesalers or, in some cases, wholesalers arrive at the farm to purchase crawfish. Wholesalers, in turn, re-sell the product to retailers, processors, and/or consumers. The wholesaler is an additional firm in the supply chain, introducing an additional transaction (and thus transaction cost) before the product reaches the final consumer. However, from the farmer's perspective, transaction costs may be reduced since the entire day's catch can be marketed to these local buyers rather than perhaps sell to multiple firms that may be located further away (increased transportation costs) and may require additional value-added activities. Likewise, the processor or retailer may incur lower transaction costs if he or she can purchase in bulk from the wholesaler rather than from a greater number of individual producers. Though this study is not designed to fully compare the net transaction and other costs associated with each of the marketing alternatives, it is important that these costs be recognized.

When there is market saturation, size grading is a commonly used practice, allowing uniform-sized crawfish to be distributed to the target marketing unit. Larger crawfish have greater appeal for use in crawfish boils, so consumers

generally purchase large crawfish live, whether directly from the farmer or from a primary wholesaler. Smaller-sized crawfish are generally peeled by processors for sale as tail-meat. Usually, grading is done in wholesaler or processing units by using modified vegetable graders or custom-made graders (Romaine et al. 2005). To enhance the appearance and, thus, market value of the product, external wash with ascorbic or citric acid is sometimes done.

The practice of confining crawfish in water without food supplements for one or two days, termed "purging", is one of the ways to increase the market value of live crawfish. It helps to clean external mud, debris and excretory products from the intestine. An additional cost of 15-25% is expected for purging crawfish (Romaine et al. 2005). Value is added, but increased mortality risk is associated with purging (McClain et al. 2007).

In areas where live crawfish is available, there are generally a number of small retail outlets and restaurants specializing in serving boiled crawfish. When the live crawfish market is saturated, smaller-sized crawfish are processed for tail-meat production or sold to the processing industry, leaving large crawfish for the live market. Some firms cater boiled crawfish to parties and festivals using custom boiling rigs (Romaine et al. 2005).

## **Data and Methods**

### *The Survey*

The types of marketing arrangements and value-added activities used in Louisiana crawfish production are assessed using crawfish producer responses obtained from a mail survey conducted during Fall, 2008, to 770 Louisiana crawfish producers. As discussed by Gillespie and Nyaupane (2010) and Nyaupane and Gillespie (2011), surveyed farmers were on the LSU Agricultural Center mailing list for crawfish newsletters. Dillman's (1978) Total Design Method was followed for implementing the survey, which was eight pages long. Producers were asked questions about marketing practices, general production practices, tenancy arrangements, adoption of best management practices and rec-

ord-keeping systems, demographics, and general farm information.

Four mailings were used. The first, in September 2008, included the questionnaire and a letter that was personally addressed and signed; first-class mail was used. Non-responders were sent a postcard reminder approximately 1 ½ weeks later. A second copy of the survey followed the postcard reminder 1 ½ weeks later. Finally, a second postcard reminder was sent to non-responders 1 ½ weeks after the second survey. Several area aquaculture extension agents and LSU Agricultural Center aquaculture faculty were consulted in developing the survey. All area aquaculture extension agents were informed when it was sent to producers. Announcements were made in the July, 2008, Crawfish News, a newsletter distributed to all known Louisiana crawfish farmers, and at the Louisiana Farm Bureau annual meeting in July. Of the 770 surveys sent, 75 were returned as completed, 185 were returned with the producer stating he or she did not produce crawfish during the 2007-2008 production season, and 79 were returned as non-deliverable, for an adjusted response rate of 15%. Though the response rate was lower than hoped for, individuals working closely with the industry were generally "enthusiastic" about the return rate, given past data collection experiences with the population. This population has been less likely to participate in government programs since there is no crawfish-specific program, so it has been surveyed less than other farm populations.

To determine sample representativeness, statistics are first compared with those of the 2005 Census of Aquaculture, which reports 605 Louisiana crawfish farms, 433 of which utilized cropland for production. The average acreage of those utilizing cropland was 176 acres, which is 35 acres less than our survey average of 211 acres. In contrast, *Louisiana Summary, 2008*, estimated that, for Louisiana, there were 139 acres of crawfish per farm on 1,320 farms. Louisiana Cooperative Extension Service agents were used to estimate numbers of farms and acreage on a parish-by-parish basis for *Louisiana Summary, 2008*. The difference in our sample farm size with the estimated population farm size depends upon whether *Louisiana Summary, 2008* or Census numbers are used.

Examining the Census of Aquaculture's 738 Louisiana freshwater aquaculture farms, of which 605 would be crawfish, 49% of the farmers leased land and 54% of the land was leased. Our sample suggests 63% leased land, while 42% of the land was leased. Partially because crawfish is often double-cropped or rotated with rice, land leasing arrangements in crawfish are generally more common than with most aquaculture enterprises. Thus, the higher percentage of producers leasing land in our sample versus the non-crawfish-specific Census sample is as expected. According to the 2007 Census of Agriculture, approximately 42% of all Louisiana farmers had farming as their primary occupation, compared with 56% of crawfish farms from our sample. Our survey average age of crawfish farmers is 54; the 2007 Census average age of all Louisiana farmers was 57. An overall comparison of our survey sample with Census numbers suggests our surveyed crawfish farms to be more likely to lease land and 20% larger than the average crawfish farm. Assuming crawfish farmers are typical of all Louisiana farmers, our sample is younger and more likely to list farming as their primary occupation. A number of studies have found farm respondents to mail surveys to be somewhat larger than non-respondents (e.g., Gillespie et al. 2007).

Farmers were asked to choose any of the four marketing outlets applicable to their scenario. The choices include: "I sell to a processor," "I sell to a wholesaler," "I sell to a retailer," and "I sell directly to consumers". Following this, they were asked, "Do you, at least sometimes": "Grade your crawfish prior to selling them?", "Wash your crawfish prior to selling them?", "Purge your crawfish prior to selling them?", and "Own or run a commercial crawfish peeling operation?" The survey also included information on other crawfish production practices, farm characteristics, and farmer characteristics.

#### *Econometric Model*

Probit models are used to analyze factors influencing crawfish producers' choice of marketing outlet. Marketing outlets (dependent variables) include whether the farmer markets crawfish via processors, wholesalers, retailers, and/or consumers. Using the probit model, which assumes

a normal distribution, the probability of adoption is modeled as shown in Greene (2000):

$$(1) \quad \Pr(Y = 1) = \int_{-\infty}^{\beta'x} \phi(t) dt = \Phi(\beta'x)$$

where  $\phi(\cdot)$  denotes the standard normal distribution,  $(Y=1)$  suggests the marketing outlet was adopted, and  $x$  represents independent variables expected to influence adoption. Marginal effects for continuous variables are estimated as:

$$(2) \quad \frac{\partial E[Y|x]}{\partial x} = \phi(\beta'x)\beta$$

Marginal effects for dummy variables,  $d$ , are estimated as:

$$(3) \quad \Pr[Y = 1|\bar{x}_*, d = 1] - \Pr[Y = 1|\bar{x}_*, d = 0]$$

where  $\bar{x}_*$  refers to all variables other than  $d$  held at their mean values. Though we originally considered using the multivariate probit model to examine market choice among the four marketing outlets, similar to Fu et al. (1988) and assuming correlated error terms for each of the equations, several runs using the model suggested that the sample size was insufficient to support this framework. Since farmers may market their crawfish via multiple outlets, the multinomial logit would be infeasible due to the resultant very large number of possible choices: 16.

We proceed by discussing independent variables included in the models. Our “expectations” for variable effects are based primarily on economic theory, industry observations, and previous research. Though observations have been made over a number of years working with the crawfish industry, this represents the first attempt we are aware of to quantify portions of producers using various marketing practices and the types of farmers using them; thus our “expectations” are tested as hypotheses.

### Independent Variables

*Farm Size and Diversification.* Independent variables include *Acres* of land used in crawfish production (divided by 1,000 in the regression for computational purposes), a measure of craw-

fish production. Greater production is expected to be associated with sales to the wholesaler and processor market because of buyers' capacity to purchase in bulk. This lowers transaction costs to the producer as he or she need not enter into separate transactions with multiple buyers. Moreover, processors and wholesalers generally also have grading facilities in cases of oversupply.

Percent of farm income from crawfish production (*%FarmCF*) shows the degree of specialization of a farm. Percent of household income from the farming operation (*%HHFarm*) allows for analysis of the influence of the farmer's financial dependence from farm operations on choice of market outlet. Though diversification is sometimes used in marketing studies as a measure of the risk faced by a producer (e.g., Gillespie et al. 2004), in our case, there is no known or hypothesized difference in price risk among the alternatives. However, since marketing direct to consumers or retailers is likely to require additional management on the part of the producer (scheduling, dealing with specific requirements, etc.), it is expected that producers who are more highly specialized in crawfish production will more likely market via those outlets. A farmer who is more economically dependent on agriculture is expected to use more innovative production and marketing practices. Fu et al. (1988) showed a relationship between the number of farm enterprises in which a peanut farmer was involved and market choice. Gillespie et al. (2004) and Davis and Gillespie (2007) found farm size and diversification variables to influence farmer choice of cattle marketing and hog market outlets, respectively.

*Demographic.* Previous marketing studies for other agricultural enterprises (i.e., Gillespie et al. (2004) for beef and Davis and Gillespie (2007) for pork) have examined the influence of producer *Age* and education on the adoption of a market outlet. We divide producer education into two categories, one without a high-school degree (*NoHighSch*), the other having at least a four-year *College* degree. Though additional education categories were available, they were not included due to statistical non-significance and limited observations for the entire sample. The base category, which includes high school graduates and those with some college, repre-

sents 63% of the sample. The number of *Years* a farmer has been farming crawfish is a continuous variable in increments of seven years, as defined in Table 1. This variable allows for examination of the impact of experience on market selection.

*Production Practices.* Two dummy variables, whether the producer *Grades* and/or *Washes* crawfish prior to selling, were included to determine the impact of premarketing practices on the selection of marketing outlets. Farmers who grade and/or wash crawfish prior to selling are expected to be more likely to sell directly to consumers; most processors have their own grading facilities (Gillespie and Lewis 2005), so grading would not be as important in selling to them. Peeling and purging variables were not included in the model due to there being too few farmers using each for inclusion in the model. The number of *Months* crawfish are produced annually is also likely to influence marketing

options available to farmers. Generally, the early

harvesting season runs from November-January when most of the crawfish are immature, mid-season is February-May, an late season is June-July. The price is generally highest early in the production season (winter and early spring) when the demand is highest, while it decreases in the peak and late seasons when the supplies of other seafood products such as shrimp and crabs increase (Romaine et al. 2005).

**Results**

*General Overview of the Louisiana Crawfish Industry*

Table 1 provides a general overview of the Louisiana crawfish industry, as provided by the survey responses. The average crawfish farm size is 211 acres of crawfish. Although the mean percentage of farm income from crawfish and percentage of household income from farming were found to be in the 20-39% and 40-59% ranges,

**Table 1. Variables, Descriptions, and Means**

Independent Variables	Description	Mean
<i>Acres</i>	Cts: Number of crawfish acres on the farm, divided by 1,000	0.211
<i>%FarmCF</i>	Cts: Percent of farm income from the crawfish operation; 1: 1-19%; 2: 20-39%; 3: 40-59%; 4: 60-79%; 5: 80-100%	2.15
<i>%HHFarm</i>	Cts: Percent of household income from the farming operation; 1: 1-19%; 2: 20-39%; 3: 40-59%; 4: 60-79%; 5: 80-100%	3.03
<i>Age</i>	Cts: Farmer's age; 1: ≤30 years; 2: 31-45 years; 3: 46-60 years; 4: 61-75 years; 5: ≥76 years	3.07
<i>College</i>	Dummy: Producer holds a college bachelor's degree or more = 1	0.30
<i>NoHighSch</i>	Dummy: Producer without a high school degree = 1	0.07
<i>Years</i>	Cts: Number of years a producer has been farming crawfish; 1: 1-7; 2: 8-14; 3: 15-21; 4: 22-28; 5: 29-35; 6: 36-42; 7: ≥43	3.26
<i>Grade</i>	Dummy: Producer grading crawfish prior to selling = 1	0.63
<i>Wash</i>	Dummy: Producer washing crawfish prior to selling = 1	0.32
<i>Months</i>	Cts: Number of months a producer harvests crawfish	5.60

Note: Two other education categories were (1) High School Diploma / GED and (2) Some College or Technical School. Means for these categories were 0.34 and 0.29, respectively.

respectively, half of the population responded that their farm income generated from crawfish was <20%, while a range of percentage of household income from farming suggested wide diversity in that measure among farms. It is common for producers to rotate crawfish, rice and soybeans, or double-crop rice with crawfish. Furthermore, a typical producer harvests crawfish for 5-6 months during the year (mean=5.6 months), leaving time for other production activities during the remaining portion of the year. Of the respondents, 29.3% held college degrees, while only 6.6% did not hold a high school diploma. The modal range of age of producers was 46-60 years. The modal years of farming experience was 15-21 years.

*Farmer Premarketing Operations and Selection of Marketing Outlets*

Table 2 provides framers' premarketing practices conducted before selling. Most of the

respondents (62.5%) grade their crawfish prior to selling. As mentioned earlier, smaller crawfish are more often used in tail-meat production, and thus have a possible route to processors. Compared to grading, the percentages of farmers washing (31.8%), purging (4.8%), or peeling (7.7%) prior to selling are lower. The lower inclination towards purging could be partly due to associated mortality risks and higher fixed cost. A peeling operation is generally conducted manually and would usually be considered a labor-intensive separate enterprise with extensive specific associated equipment.

Farmer selection of marketing outlets and their proportions are provided in Table 3. Most of the farmers (64.2%) sold crawfish via wholesale markets. Percentages of producers selling crawfish directly to consumers, retailers, and processors were 30.3%, 22.7%, and 17.9%, respectively.

**Table 2. Farmer Use of Value-added Production Practices.**

<b>Grade:</b> Do you, at least sometimes, grade your crawfish prior to selling them?		
<i>Categories</i>	<i>Frequency</i>	<i>Percentage</i>
Yes	45	62.5
No	27	37.5
Total	72	100.0
<b>Wash:</b> Do you, at least sometimes, wash your crawfish prior to selling them?		
Yes	21	31.8
No	45	68.2
Total	66	100.0
<b>Purge:</b> Do you, at least sometimes, purge your crawfish prior to selling them?		
Yes	3	4.8
No	60	95.2
Total	63	100.0
<b>Peel:</b> Do you, at least sometimes, own or run a commercial crawfish peeling operation?		
Yes	5	7.7
No	60	92.3
Total	65	100.0



**Table 3. Farmer Selection of Crawfish Marketing Outlets.**

Categories	Total Responses	Frequency	Percentage
I sell to a processor	67	12	17.9
I sell to a wholesaler	67	43	64.2
I sell to a retailer	66	15	22.7
I sell directly to consumers	66	20	30.3

Note: A farmer may choose to market in more than one outlet during a production season, thus the sum of these percentages is >100%.

#### *Probit Results of Farmers' Choosing a Marketing Outlet*

Appendix Table 4 shows the factors affecting farmer choice of a crawfish marketing outlet. Larger farmers were found to be more likely to market via retail outlets, likely the result of their ability to guarantee significant volume to supply those markets, reducing transaction costs to the retailer. An additional 1,000 acres of crawfish increased the probability of the farmer marketing via retailer by 0.34. As initially expected, farmers with higher portions of their farm income from crawfish were more likely to market crawfish direct to consumers: a 20% increase in the percent of farm income derived from crawfish increased the probability of marketing direct to consumers by 0.10. This specialization in crawfish production affords them the opportunity to market crawfish via an outlet that likely involves higher transaction costs, but potentially higher return if customers are willing to pay higher prices to a farmer whose product is perceived to be of higher quality. On the other hand, as expected, those with greater percentages of income coming from off-farm sources were more likely to market via wholesalers: a 20% increase in the percent of household income derived from the farm increased the probability of marketing via wholesalers by 0.14.

Farmer age was positively associated with selling crawfish to processors, while negatively related to selling to wholesalers: an additional 15 years of age increased the probability of marketing via processors by 0.13 and decreased the probability of marketing via wholesalers by 0.16. The reduction in the number of processors over a number of years may partially explain

this result, as older farmers continue to market to processors with whom they have built business relationships over a longer time frame. Farmers with college degrees were more likely to sell their product via wholesalers and less likely to market via processors. Holding a college degree increased the probability of marketing via wholesalers by 0.19, but the marginal effect for processors was non-significant. Those without high school diplomas were inclined towards processors and direct to consumers rather than through the wholesale market.

Producer grading of crawfish also had a positive relationship with the wholesale market, while producers washing crawfish were less likely to sell their product to wholesalers and more likely direct to consumers. Producers who graded their crawfish prior to sale had a 0.34 higher probability of marketing via a wholesaler than producers who did not grade their crawfish. Producers who washed their crawfish prior to sale had a 0.63 higher probability of marketing direct to consumers and a 0.66 lower probability of marketing via wholesalers than producers who did not wash their crawfish. Washing crawfish just after harvesting not only removes external debris, but also improves quality by providing a cleaner looking product, so it is not surprising that washing would be done when marketing direct to the consumer. The wholesaler can sell crawfish to processors, retailers, or direct to consumers, so they may conduct grading and/or washing if not already done by the producers.

## **Summary and Conclusions**

This paper deals with factors associated with crawfish farmers' use of alternative marketing outlets. We use 2008 survey data from a survey of Louisiana crawfish farmers. Four types of marketing outlets commonly used in the industry are analyzed using probit models. Although a farmer can choose a single outlet or a combination of outlets during a production season, the wholesale market was the most commonly used in the industry. A total of 64.2% of the survey sample was found to sell to wholesalers, 30.3% sold directly to consumers, 22.7% to retailers, and 17.9% to processors; given these numbers do not sum to 100%, we see that 35.1% of farmers sold via more than one market type. Understanding how crawfish are marketed is of importance when examining the ways in which an industry can regain its competitiveness in an international market. From an international competitiveness standpoint, one would need to take this the next step and examine the transaction costs and market efficiency associated primarily with the wholesale market to determine whether appreciable increases in efficiency (reductions in the cost of getting crawfish to the final consumer) could be gained.

It was found that 62.5% of producers grade and 31.8% wash crawfish prior to selling. Purging is not frequently done by producers, and few producers are involved in the peeling segment. Increased mortality in purging and high costs associated with peeling operation are likely to be two major reasons for lower adoption of those value-added activities.

Younger farmers with higher percentages of household income from farming, with a college degree, and those who grade and do not wash crawfish are more likely to choose the wholesale market. Scale of operation was the major determinant of whether farmers would sell directly to retailers, as larger farmers are the ones who have

the volume required to sell directly to the retail market. Farmers who wash crawfish before selling and have higher percentages of their farm income coming from crawfish are the more likely farmers to market direct to consumers. Older, less highly educated farmers were more likely to market direct to processors. As expected, demographics, farm characteristics, and pre-market activities significant impacted on market choice.

From working with the crawfish industry over a number of years, we have identified a number of issues that have prevented its growth into a larger, national industry, though the industry has had an interest in advancing it as such. Many of these issues are structural, such as seasonal production, limited production during the season, lack of extensive mechanization in the peeling sector, and the lack of vertical and/or horizontal coordination through either formal contracting or looser strategic alliances. If, however, the industry is to expand significantly beyond Louisiana's borders, close attention must be paid to development of an industry structure that can perform such that sufficient volume of consistent quality product can be produced year-round and distributed efficiently outside Louisiana. For this to occur, significant attention must be paid to marketing – the existing wholesaler and direct-to-processor outlets are likely to be the best places to begin in sourcing these markets. However, significant attention will need to be paid to increasing market efficiency, such as by lowering transaction costs, as the product will need to compete with other seafood products – what must be exported from Louisiana to other United States regions is peeled tail meat, which China currently dominates due to lower prices. Lower-cost domestic production of that product, which currently benefits from its product differentiation (fresh, contains “fat,” and “local”), will also be needed. We see determination of an optimal marketing structure for crawfish industry expansion as a fruitful area of future research.

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**Appendix**  
**Table 4: Probit Results of Marketing Outlet Analysis.**

	Processors			Wholesalers			Retailers			Consumers		
	Coefficient (Robust Error)	Std.	Marg. Effect	Coefficient (Robust Error)	Std.	Marg. Effect	Coefficient (Robust Error)	Std.	Marg. Effect	Coefficient (Robust Error)	Std.	Marg. Effect
<i>Acres</i>	-0.2498 (0.9455)		-0.0254	-0.3986 (0.9745)		-0.0789	1.1965 (0.6242)	*	0.3385	*	0.1028 (0.5158)	0.0319
<i>%FarmCF</i>	0.1004 (0.2754)		0.0102	0.0860 (0.2154)		0.0170	-0.2642 (0.1918)		-0.0748		0.3067 (0.1752)	* 0.0951
<i>%HHFarm</i>	0.2312 (0.1674)		0.0235	0.6900 (0.1960)	***	0.1365	-0.3029 (0.2080)	***	-0.0857		-0.1461 (0.1514)	-0.0453
<i>Age</i>	1.2420 (0.5234)	**	0.1264	-0.8132 (0.4563)	*	-0.1609	0.2508 (0.3844)	*	0.0710		0.2535 (0.3662)	0.0786
<i>College</i>	-1.0519 (0.6145)	*	-0.0904	1.1558 (0.5863)	**	0.1925	0.0623 (0.5765)	*	0.0177		-0.1647 (0.5205)	-0.0502
<i>NoHighSch</i>	1.8391 (1.0811)	*	0.5018	-2.4214 (0.8589)	***	-0.7727		***			1.8646 (0.9475)	** 0.6439
<i>Years</i>	-0.0801 (0.1428)		-0.0082	0.0887 (0.1622)		0.0176	0.0348 (0.1569)		0.0099		0.0377 (0.1338)	0.0117
<i>Grade</i>	-0.9328 (0.6333)		-0.1132	1.4759 (0.5736)	***	0.3373	0.3782 (0.3998)	**	0.1042		-0.4690 (0.5073)	-0.1492
<i>Wash</i>	0.2365 (0.8045)		0.0262	-2.3827 (0.8879)	***	-0.6626	0.6413 (0.7982)	***	0.1974		1.9029 (0.6462)	*** 0.6336
<i>Months</i>	-0.0891 (0.2906)		-0.0091	0.2760 (0.2344)		0.0546	-0.1181 (0.2465)		-0.0334		-0.0946 (0.1833)	-0.0293
<i>Constant</i>	-4.6791 (1.5415)			-1.0142 (1.5761)			-0.1886 (1.5640)				-1.6056 (1.2969)	
Obs.	48			48			45				47	
Pseudo R <sup>2</sup>	0.2417			0.4033			0.1620				0.2921	

Notes: \*\*\* indicates the variable is significant at the 0.01 level; \*\* indicates the variable is significant at the 0.05 level; \* indicates the variable is significant at the 0.10 level.