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Freshwater Prawn Cost of Production

Results from a 2005 Multistate Freshwater Prawn Grower Survey

MAFES

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INTRODUCTION

In 2004, the U.S. Freshwater Prawn and Shrimp Growers Association (USFPSGA) encouraged researchers to study the cost involved in producing freshwater prawns (FWP). Agricultural economists collected the names of freshwater prawn producers throughout the country, including names provided by the USFSPGA, Shawnee Shrimp Growers Association, and other sources. These producers were contacted via a mail survey, which requested cost, marketing, and sales-related information related to their FWP operation for the 2005 production year. Twenty-seven useable responses were analyzed.

The inputs of stocking, feed (used as an organic fertilizer), fuel, and electricity comprised the majority of variable costs for prawn operations and varied by state. Each respondent who completed the fixed cost section of the survey indicated that they used aeration equipment in their ponds, but a wide range of other equipment was also utilized, affecting the total fixed costs for each operation. The average respondent spent a similar proportion of funds on variable and fixed cost categories, such as stocking, fertilizer (including feed as fertilizer), machinery, and interest on investment. Estimated cost results from this survey were comparable to previously reported economic analyses using experimental results, providing support to the assumption that FWP experimental work reflects the costs spent in commercial settings.

Postharvest costs varied among states due to some regional operations selling the majority of their harvest to markets that were different from those of producers in other regions. Sixty-seven percent of respondents who provided variable cost information realized a positive income above variable costs. When the average fixed cost of all survey respondents was added to the regional variable and postharvest costs, the net returns were positive for 41% of the operations. Producers who were able to produce more than 500 pounds or more than 650 pounds of FWP per acre were more likely to meet all variable costs or have a positive net return, respectively.

Regional differences in costs were principally linked to variations in feed and stocking costs, while regional differences in price per pound received were highly influenced by the market outlet type into which the FWP was sold and the percent of FWP harvest that was sold. Producers can improve their net returns by increasing the price received per pound harvested and decreasing the costs of production. The price received per pound harvested can be increased by (1) selling 100% of the FWP harvested, (2) identifying FWP as a unique product, (3) developing niche markets that will purchase FWP at a preferred price, (4) locating specific market outlets before stocking the FWP into ponds, and (5) determining whether the costs associated with additional processing of the FWP (e.g., deheading) will be less than the increase in price expected for a more processed product. Producers can decrease their costs per pound of FWP produced by improving yields (survival and increased mean individual harvest weight), decreasing stocking costs, controlling fuel and electricity needs more efficiently, finding less expensive organic fertilizer substitutes for manufactured animal feeds and/or decreasing feed costs, and finding multiple income-generating uses for equipment used to produce FWP.

Introduction and Background

On a national level, production of U.S. freshwater prawn (FWP), *Macrobrachium rosenbergi*, has decreased in recent years from a high of more than 400,000 pounds in 1991 to an estimated 83,000 pounds in 2004 (Figure 1) (FAO 2004). In a survey of consumer attitudes towards FWP, respondents identified lack of availability as one of the primary reasons why they did not consume or did not consume more of the product (Hanson et al. 2005). Most consumers indicated that they have had limited exposure to FWP as a food item.

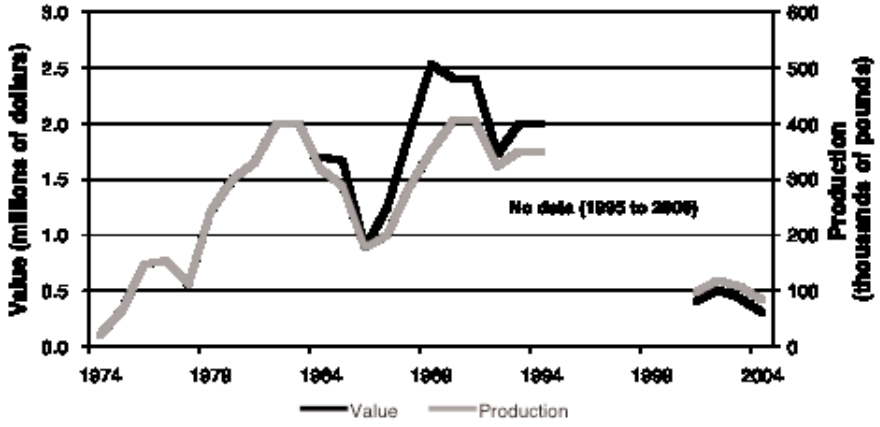

Figure 1. U.S. production of freshwater prawns, 1974 to 2004 (FAO 2004).

U.S. FWP aquaculture primarily consists of small operations that are widely distributed geographically. Production requires at least 90 days of water temperature at 68°F or more to grow out a market-sized prawn (D'Abramo et al. 2003). In 2005, prawn grow-out operations were located in Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Ohio, Tennessee, and Virginia (Dasgupta 2005, Fratesi 2005). Grow-out operations use juveniles that are supplied by FWP hatcheries, which, in 2003, were located in Mississippi, Florida, Kentucky, Tennessee, and Texas (D'Abramo et al. 2003).

The FWP grow-out period in ponds is approximately 4 months, with FWP generally stocked in ponds from late May to early June and harvested in mid-September to mid-October (Dasgupta 2005). Because larger FWP often receive a higher price, most producers aim to grow the larger size class, which requires more time for the FWP to feed in the pond or a lower stocking density (D'Abramo et al. 2003). The first cold weather front of the fall may result in substantial or complete losses of FWP, requiring producers to balance keeping the prawns growing in the pond as long as possible and not keeping them in too long. Prawns are harvested before morning water temperatures drop below 60°F, and the harvest process can be labor-intensive if the pond is not designed properly for drain harvest (D'Abramo et al. 2003).

The level of production is affected by stocking density and survival. As the production levels increase, so do the inputs and expenses, resulting in additional pounds of FWP harvested and increased revenues. Recommended juvenile stocking rates for prawn grow-out ponds are 8,000 to 24,000 FWP per acre, which are expected to lead to a yield of 600 to 1,200 pounds per acre, depending on management practices employed (D'Abramo et al. 2003). Dasgupta (2005) suggested that a stocking density of 8,000 to 30,000 FWP juveniles per acre would result in a harvest of 200 to 2,000 pounds per acre in a commercial setting and 800 to 3,000 pounds per acre in an experimental setting. The use of additional substrate such as polyvinylchloride (PVC) barrier fence provides an opportunity for more intensive production and acts as a strategy to reduce cannibalism among the FWP. The use of substrate increases the weight of FWP at harvest and also increases survival (Dasgupta 2005).

Regardless of the intensity level of the pond production system, FWP culture requires several management strategies related to maintaining an adequate environment to encourage prawn growth. One- to 5-acre ponds are preferable for FWP grow-out to aid in applying inputs and managing the pond (D'Abramo et al. 2003). Producers may add several or all of the following inputs to the pond before or during the grow-out cycle:

- lime to the pond bottom to reduce pH fluctuations;
- rotenone to kill fish in the pond 2 to 3 weeks before stocking FWP;
- inorganic fertilizer to shade out nuisance weeds 1 to 2 weeks before stocking FWP;
- inorganic fertilizer to promote phytoplankton growth;

- catfish feed or meal used as organic fertilizers to stimulate growth of FWP food sources;
- additional forms of organic matter to further stimulate growth of FWP food sources and to control pH;
- a safe herbicide to control algae growth once FWP are in the pond (D'Abramo et al. 2003, D'Abramo 2006).

In addition to the use of multiple inputs, prawn production requires several pieces of equipment. Often the equipment can be shared among other farm operations so that 100% of the equipment use will not be required for growing out FWP. Equipment can include tractors, mowers, water pumps, pickup trucks, artificial substrate, feed storage bins, water quality kits, and harvest equipment (i.e., seines, buckets, boots, and tanks) (D'Abramo et al. 2003, Dasgupta 2005). Because prawn growth is best at dissolved oxygen levels above 3 ppm, oxygen meters or test kits are required, and electric and PTO aerators are often used to maintain proper oxygen levels in the ponds (D'Abramo et al. 2003).

Due to the various inputs and equipment used to grow out FWP, it is important for producers to understand their costs. D'Abramo and others (2003) used a hypothetical 50-water-acre FWP operation with a stocking density of 8,500 FWP per acre to estimate the cost of producing prawns that were 12 count in size (12 prawns per pound). The expected cost to produce the prawns was $2.90 per pound, with $2.17 per pound spent on variable costs and $0.74 per pound spent on fixed costs. The expected farm-gate price was $3 per pound, which would indicate that all costs were covered (D'Abramo et al. 2003). This work also suggested percentages of variable costs for common expenses: stocking juveniles (36%), feed (15%), labor (13%), and repair and maintenance (9%). Dasgupta (2005) estimated the cost of stocking juveniles to be 20% to 40% of the variable costs; he estimated that depreciation (56%) and interest on investment (37%) make up the majority of fixed costs.

Research suggests that geographical and farm size differences may contribute to cost and price discrepancies. In most instances, FWP production is a secondary activity. Dasgupta (2005) suggested that labor costs might be less in Mississippi than in Kentucky because diversified Mississippi farms tend to be larger, and economies of scale will play a role in labor costs. Dasgupta (2005) also stated that other input costs, such as catfish feed, are less expensive in Mississippi than in Kentucky due to the nearby catfish industry feed mills. These factors may suggest that it is less expensive to produce FWP in one state or region versus another.

Breakeven prices were calculated for different yield levels by researchers in Kentucky. Breakeven prices were $6.32 per pound for FWP yields of 800 pounds per acre, $5.62 per pound for 900 pounds per acre, and $5.06 per pound for 1,000 pounds per acre (Tidwell et al. 2002).

One of the greatest challenges facing FWP producers is marketing their annual harvest. Producers must find outlets for their products locally or through wholesalers because a centralized FWP production region does not exist. The lack of infrastructure in the form of prawn harvest crews, processors, and distributors makes it necessary for the farmer/producer to market his prawn harvest. This additional challenge and associated expense make it critical for producers to know their cost of producing prawns to identify profitable selling prices. In addition, by examining costs associated with production, producers may be able to recognize expenses that can potentially be reduced.

The United States Freshwater Prawn and Shrimp Growers Association (USFPSGA) identified a need to collect FWP cost of production data and requested that the authors conduct a research effort. The USFPSGA and the Shawnee Freshwater Prawn Growers Association (SFPGA) were instrumental in initiating this work. See the reference section for links to their respective websites.

The purpose of this project was to gather baseline cost of production and related postharvest costs directly from FWP producers and assist them in improving their profits. Past efforts have estimated the cost of producing FWP based on either experimental or theoretical data, or on a survey of a limited number of producers. This research project's aim was regional in scope, and the goal was to collect the actual costs producers incurred during the 2005 FWP production year. This would help to develop a better understanding of the FWP production cost structure and provide an opportunity to verify the theoretical cost of production estimates. It also presented an opportunity to generate customized cost of production reports for each producer who responded to the survey. Each producer could then analyze his costs and compare them with state and regional averages. The cost of production report also provides the price that would be required for the producer to cover variable and/or fixed costs of production, thereby enabling producers to identify the minimum asking price for their product in order to cover all costs.

Finally, an added benefit of this project was the comparison of prices received by producers. Prices vary by FWP size, product form, market outlet, and location. Therefore, the collection of these data provides a more in-depth examination of the range of prices that producers can expect to receive for their FWP.

Materials and Methods

A FWP cost of production survey was developed (Appendix I) based on grow-out management strategies described in the "Culture of Freshwater Prawns in Temperate Climates: Management Practices and Economics" (D'Abramo et al. 2003). The survey was revised based on discussions with FWP researchers, producers, and industry association members. Questions asked in the survey related to general farm characteristics (location and farm size), production practices (stocking sizes of juveniles and rates, pounds of production, size classes harvested), inputs (feed, nonfeed fertilizers, chemical applications, fuel, electricity, vegetation control), fixed costs (equipment and machinery), labor, and insurance. The survey also addressed topics such as postharvesting costs (processing, marketing, transport, and storage), market outlet types, and price received per pound of FWP produced. The prawn cost of production survey did not include costs related to FWP pond building or pond repair/maintenance.

Names of FWP producers were provided by the USFPSGA and SFPGA. In addition, Web-based searches were conducted to identify additional individuals who had reared FWP in 2004. Surveys were sent to prospective producers in the fall of 2005 after the FWP had been harvested. Reminder cards were sent to nonrespondents after 2 weeks. Individuals who did not respond after the reminder cards were mailed were sent a second copy of the survey.

Completed survey responses were entered into a Microsoft® Excel spreadsheet, and responses that were incomplete or indicated that the individual did not produce FWP in 2005 were noted and not used in this analysis. Individuals who had attempted to farm FWP but had limited production (e.g., 5 pounds of FWP harvested) or complete losses were not included in the analysis. All responses were standardized for comparison by calculating costs and receipts on a dollar per pound of FWP produced basis.

Data were collected on the grow-out and postharvest costs related to FWP production. Respondents reported their variable costs based on the total money spent on each input item for the 2005 prawn grow-out season (Appendix I). The exception was if a producer provided the number of hours the aerator(s) operated during the year in lieu of electricity costs. In this case, the number and size of aerators on the farm were calculated, and then the regional electrical rate was applied to estimate the electricity cost for that farm.

Respondents who completed the fixed cost section of the survey indicated the number of machinery and equipment units, the model year, and the percent usage of the equipment for FWP production. The table in Appendix II provides details on the assumptions that were used to calculate fixed costs. When a specific year and model truck was identified, the value of the vehicle was determined using the Kelley Blue Book rate based on the zip code of the respondent and assumed the default vehicle features, mileage, and condition provided by the Website (Kelley Blue Book 2006).

Responses were examined on a state level to capture nuances in operating costs between different regions. State averages for each line item were calculated when there were more than three responses from one state and no single observation represented more than 60% of the annual FWP production of that state. This rule was used to ensure confidentiality and anonymity. State averages were based on the total dollar amount for a given line item in the state divided by the total pounds of FWP produced for that state. This procedure provided dollar receipt and FWP production costs on a per-pound basis. The composite production cost for a state does not represent any one farm's expenses but instead represents the average receipt or line item cost for that state. If a respondent did not complete or partially completed the fixed cost section of the survey, his information on fixed costs was not included, and his observation was removed from the fixed cost state averages.

Gross receipts were calculated based on the price received per pound as provided by the respondent multiplied by the pounds sold at that price. In many cases, the same producer indicated that he received different prices depending on the FWP size class or market outlet. Producers provided the percent of their production that they sold to each outlet type, as well as the percent of produced prawns that were not sold. When multiple prices were provided by the same respondent for different size classes, a weighted average of the prices was calculated for that outlet. Total revenue was calculated using the pounds of product the respondent sold to each outlet and the average price the respondent received at each outlet. This was then divided by the total pounds of FWP produced. The following equation describes the calculation:

$$P = (x_1p_1 + x_2p_2 + \ldots + x_np_n) / H$$

where: P is the weighted average price per pound of FWP harvested (gross receipts on a price per pound produced basis), x_i is the pounds sold at a given outlet, p_i is

the producer's average price per pound of FWP sold at a specific outlet, and H is the total pounds of FWP harvested (i.e., the sum of $x_1, x_2,\ldots, x_n$).

The price per pound includes all pounds produced. Therefore, the weighted average price may be lower than the actual FWP selling price because not all of the pounds produced were necessarily sold. For example, if a producer produced 200 pounds of FWP and sold 100 pounds of FWP at $10 per pound but was unable to sell the remaining 100 pounds, then the value for this respondent's gross receipts would be $5 per pound ($1,000 sold divided by 200 pounds produced).

Gross receipts and costs for all respondents were calculated by adding all costs for each line item and dividing the sum by the total pounds produced by all survey respondents, thus providing a weighted cost in dollars per pound of prawn produced. All values in this report are presented in terms of price or cost per pound of prawn produced unless otherwise noted.

Results and Discussion

Production and Farm Characteristics

Surveys were sent to 128 individuals who were identified as probable FWP producers. Thirty-five percent of those contacted responded to the survey. Twenty-seven respondents submitted useable surveys (21% of those contacted), while 12 responses were considered unusable (9%). Unusable responses consisted of incomplete surveys, individuals who indicated that they did not produce FWP in 2005, and producers who indicated they sustained substantial or complete losses during the 2005 season and therefore did not complete the annual FWP production cycle in 2005. Producers submitted usable surveys from 10 of the 16 states that were sent surveys, with useable responses coming primarily from the Southeast and Midwest of the U.S. (Figure 2). The number of responses from Kentucky, Mississippi, and Tennessee satisfied the confidentiality criteria; therefore, these states were examined individually. Responses from the remaining states did not meet the confidentiality criteria. Responses from Alabama, Arkansas, Georgia, Illinois, Indiana, Missouri, and Virginia were aggregated and reported in the "Other" states category. Figure 3 demonstrates the regional response rates.

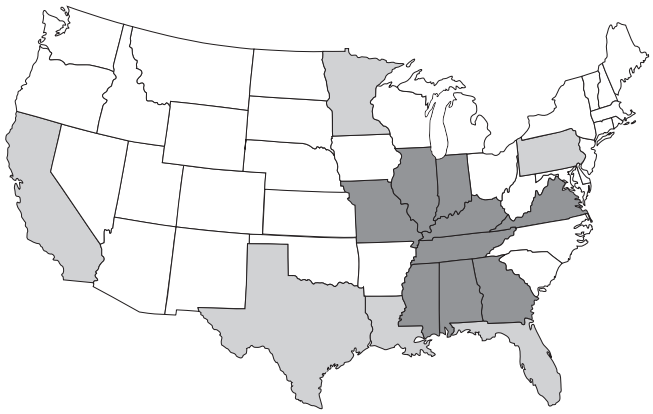

Figure 2. States that received the 2005 freshwater prawn cost of production survey ☐ and those that participated ■.

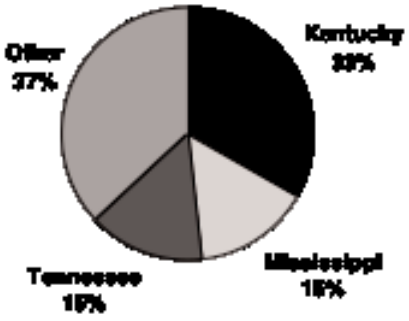

Figure 3. Distribution of freshwater prawn survey responses by state. "Other" states include Alabama, Arkansas, Georgia, Illinois, Indiana, Missouri, and Virginia.

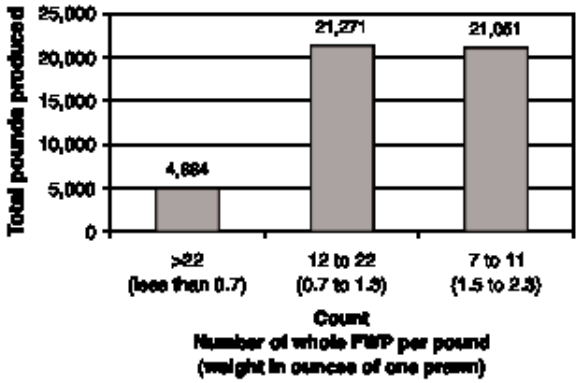

Figure 4. Size class distribution of freshwater prawn pounds produced by survey respondents.

Table 1. Farm characteristics and production values by state average and average of all respondents (standard deviation in parentheses).[1]

	Kentucky	Mississippi	Tennessee	Other	Average respondent
Water acres per farm	3.32 (2.58)	3.39 (2.66)	3.45 (2.42)	2.38 (3.24)	3.00 (2.72)
Number of ponds per farm	3.11 (1.62)	1.75 (1.50)	3.25 (2.50)	3.10 (3.70)	2.93 (2.60)
Average pond size (acres)	1.10 (0.77)	2.40 (2.46)	1.10 (0.27)	0.74 (0.48)	1.16 (1.13)
Stocking density (FWP/acre)	18,356 (6,402)	13,688 (6,005)	16,250 (1,258)	12,150 (8,069)	15,054 (6,857)
Production (pounds/acre)	680 (349)	638 (418)	514 (159)	545 (337)	599 (323)

[1]Based on the number of completed surveys returned from the given state, from other states, and for all respondents.

Table 1 presents the average farm characteristics and composite production values by state. Survey respondents used 81 total water acres in 2005 to produce a total of 47,206 pounds, which is 56% of the total U.S. production identified in 2004 (FAO 2004). Responses suggest an equal distribution of production between the two largest FWP size classes, indicating that production of larger-sized prawns is not a problem for the south- and mid-central regions of the U.S. (Figure 4). Survey respondents indicated that in 2005, they utilized one to 11 ponds totaling from 0.5 to 10 water acres per farm to culture FWP. The average producer who responded to the survey used three ponds totaling three water acres and produced approximately 600 pounds of FWP per acre. There was a wide variation in the production realized as related to pounds harvested and original stocking rate (Figure 5). The expected trend of higher production associated with higher initial stocking rates was generally true with notable exceptions such as those respondents who produced less than 400 pounds per acre while stocking anywhere from 5,000 to 25,000 prawns per acre.

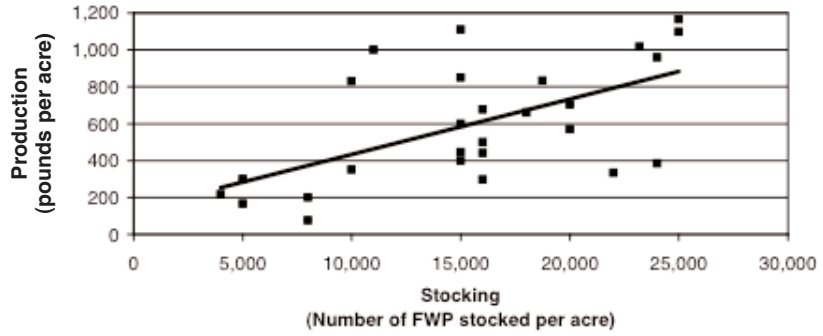

Figure 5. Freshwater prawn survey respondent's production versus stocking rate.

Variable Costs

Variable costs are the "cash" or operating costs incurred in raising prawns. Survey respondents provided detailed information about their variable costs. Therefore, the state averages are probably quite representative of the actual regional costs. Table 2 provides details about the variable FWP production costs by state and reflects costs by major categories. For example, Kentucky respondents used a combination of 32% and 28% protein catfish feed and "other" feed. Not every farmer used these three feeds in Kentucky, but the average expenditure of 9, 60, and 2 cents for the feed types, respectively, were summed to equal the average total feed cost (71 cents) per pound of prawn produced in Kentucky.

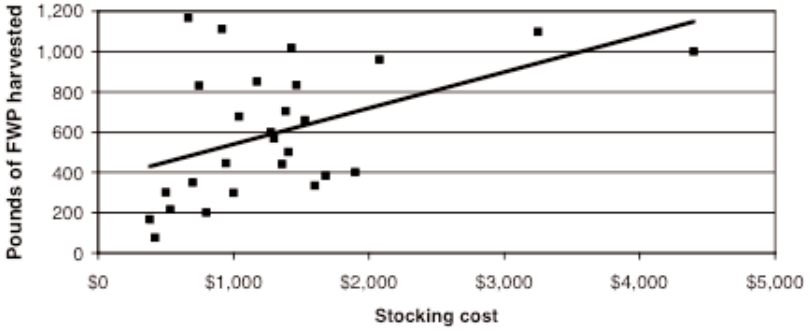

Figure 6. Relationship between production and stocking cost expressed on a per-acre basis.

As expected, the variable or cash costs associated with rearing FWP varied according to location, which may be a reflection of management practices, availability of inputs, and cost of inputs in a given location. Some producers have an apparent geographical advantage based on their proximity to the limited number of FWP support industries. The cost of stocking FWP was approximately half of the total variable costs that producers spent on the operation (Table 2). These costs were lower in Kentucky and Mississippi compared with the other locations. The lower stocking cost is most likely due to the presence of FWP hatcheries in these states. Producers closer to the hatcheries will be able to take advantage of lower shipping costs associated with transporting FWP juveniles. In Figure 6, the cost efficiency of stocking cost related to production is shown. Most FWP producers paid less than $2,000 per acre to stock, but only 48% of producers had production rates greater than or equal to 600 pounds per acre.

Feed was commonly used as an organic fertilizer and applied at a cost per acre that was relatively higher than the other fertilizers and nutrient inputs. As previously mentioned, the use of catfish and "other" feeds are not applied for direct consumption by FWP but are used to promote the growth of pond-dwelling organisms (i.e., worms, insect larvae, mollusks) that serve as a food source for the FWP. The category of feed was separated from the organic fertilizer category because feed composed the majority of costs associated with organic inputs to the FWP ponds. Feed costs were less in

Table 2. Variable FWP production costs by state average and average of all respondents (in dollars per pound of FWP produced).[1]

	Kentucky	Mississippi	Tennessee	Other	Average respondent
	$	*$*	*$*	*$*	*$*
Stocking	1.65	1.62	2.41	2.59	1.99
Feed	0.71	0.63	0.67	0.91	0.74
Organic fertilizer	0.01	0.04	0.03	0.04	0.02
Inorganic fertilizer	—	0.02	0.02	0.05	0.02
Other nutrient inputs	0.01	—	0.01	—	0.01
Water quality inputs	0.03	0.05	0.05	0.07	0.04
Fuel costs	0.07	0.23	0.14	0.05	0.10
Electricity	0.48	0.27	0.49	0.74	0.51
Labor, paid only	0.11	0.24	0.36	0.58	0.28
Vegetation/algae control	0.13	0.05	—	—	0.06
Insurance	0.04	0.01	0.16	0.04	0.05
Subtotal variable costs	**3.24**	**3.16**	**4.34**	**5.07**	**3.82**

[1]A "—" in a column means no respondent in the state used that item.

Mississippi and Tennessee, which is most likely due to the quality of feed used. Prawn producers principally used 28% and 32% crude protein sinking catfish feed. Feed mills in the central Southeast produce the majority of catfish feed, which is reflected in the lower priced feed in Mississippi and Tennessee. Interestingly, those who produced FWP in "Other" states spent 48% of their feed costs on alternatives to catfish feed and had overall higher feed costs. Figure 7 shows that most FWP producers spent less than $600 per acre in feed costs, and as expected, there was a general trend that higher production of FWP per acre required higher feed input costs per acre.

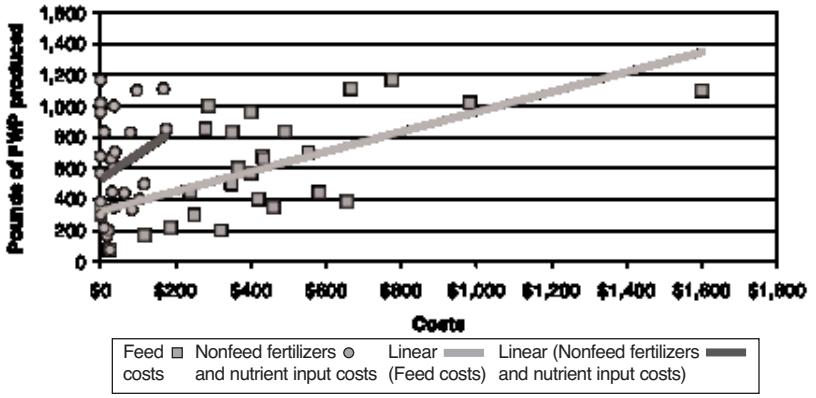

Figure 7. Respondent's production versus feed and nonfeed fertilizers and nutrient input costs expressed on a per-acre basis.

Nonfeed fertilizers and other nutrient inputs were also used to promote prawn growth. There were several different organic inputs, including hay, cracked corn, and soybean meal. Additional organic fertilizers, such as distillers' dried grains and cottonseed meal, were used in all regions except Kentucky, which spent a minimal amount on "Other" organic fertilizers such as alfalfa. The "Other" states spent the most money on nonfeed organic and inorganic fertilizers in addition to the relatively large amount of money spent on feed, even though the average stocking density of FWP was less. This result may suggest that more inputs were not added, but rather producers paid a higher price for the inputs than producers in Kentucky, Mississippi, and Tennessee. A lower survival of FWP in the "Other" states may also be the explanation.

The increase in money spent on nonfeed inputs, such as other organic fertilizers, inorganic fertilizers, and other nutrient inputs, was low at approximately 1.3% of total input costs and often returned a higher harvest yield in pounds per acre (Figure 7). This condition may be reflective of a variety of factors, including low cost of inputs and efficient use of inputs. Producers may have added unnecessary inputs for the lower production levels. When the feed cost was plotted versus production, a slightly stronger relationship was apparent between cost of inputs per acre and production — as defined by pounds of FWP produced per acre (Figure 7). Producers appeared to spend more on feed to drive production compared with other fertilizer expenditures. Alternatively, the prawn may have been more efficient at utilizing the benefits of added catfish feed versus other fertilizer inputs. Recent work has suggested that replacing all of the feed with lower priced cattle feed supplements, such as range cubes and corn gluten pellets, may stabilize production levels while decreasing the cost of inputs (D'Abramo 2006). This finding should be of interest to all prawn producers, especially those in regions where catfish feed costs are relatively high.

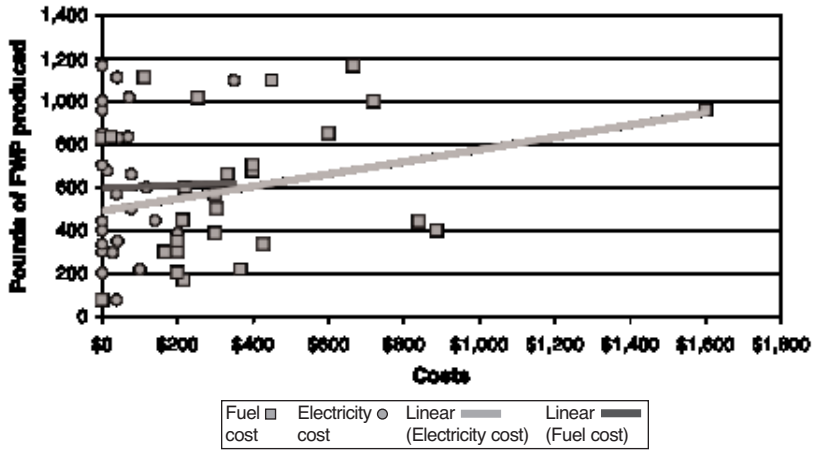

Figure 8. Gas/diesel fuel and electricity costs versus the pounds of FWP produced expressed on a per-acre basis.

A minimal number of water quality control inputs were used to farm FWP, and those inputs varied by location. Within all regions, at least one producer used lime. Other pond preparation inputs used by respondents included rotenone, copper sul-

fate, pond colorants, and aquatic herbicides. Additional inputs included triple superphosphate, sugar, salt, and soda.

Fuel, electricity, and labor costs also varied greatly among states (Table 2). Despite having the lowest electricity costs, Mississippi had the greatest fuel costs, suggesting a greater reliance on PTO aeration than producers experienced in other states. The average electricity cost in the "Other" states was almost three times the cost in Mississippi. Figure 8 presents the relationships between electricity and gas/diesel costs on FWP production. Higher electricity costs per acre appeared to be related to higher production levels, which may reflect a greater need to operate electrical aerators in ponds containing more prawns. Electricity costs are typically higher than gas/diesel fuel costs. The gas/diesel costs per acre were not as high as electricity costs, nor were they as strongly correlated to production per acre. The next highest variable cost was labor. Labor was variable with producers in the "Other" states paying two, three, and five times more than producers in Mississippi, Tennessee, and Kentucky, respectively.

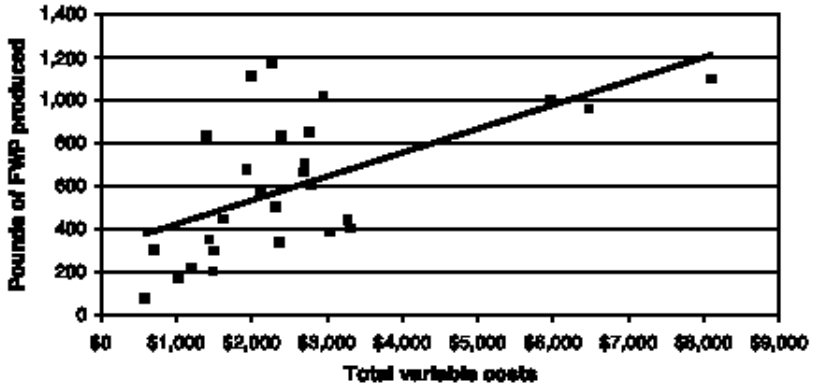

Figure 9. Total variable costs versus pounds of FWP produced presented on a per-acre basis.

Only respondents in Kentucky and Mississippi indicated that they stocked their ponds with fish to aid in vegetation and algae control. Kentucky producers spent almost three times the amount Mississippi producers spent on this expense.

The variable (cash) cost subtotal varied greatly among states (Table 2). As expected, the two states with the lowest stocking costs also had the lowest cash costs because stocking costs constitute a large proportion of total variable costs. Those in "Other" states paid a premium on variable costs, primarily due to spending almost twice the amount for stocking, labor, and electricity compared with Kentucky or Mississippi. Figure 9 presents total variable costs relative to production, with the majority of producers spending between $1,500 and $3,000 per acre to produce approximately 300 to 800 pounds of prawns per acre.

When line item variable costs were compared regionally as a percent of the total variable costs, they appeared very similar, especially relative to high cost line items (Table 3). Stocking costs ranged from 51% to 56%, while feed costs ranged from 15% to 22%. When

Table 3. Percent of total variable costs by input item by state, group of states (other), all respondents, and the estimated FWP production costs from D'Abramo et al. (2003).

	Kentucky	Mississippi	Tennessee	Other respondents	All	Estimated[1]
	%	%	%	%	%	%
Stocking	51	51	56	51	52	45
Feed	22	20	15	18	19	18
Organic fertilizer	0	1	1	1	1	
Inorganic fertilizer		1	0	1	1	
Chemical inputs	0		0		0	5
Water quality inputs	1	2	1	1	1	
Fuel costs	2	7	3	1	3	6
Electricity	15	9	11	15	13	6
Labor, paid only	3	8	8	11	7	16
Vegetation/algae control	4	2			2	
Insurance	1	0	4	1	1	
Other costs						3
Subtotal variable costs	100	100	100	100	100	100

[1]Based on a 50 water-acre, single-enterprise pond production system in Mississippi in 2002; column adapted from Table 7.

fuel and electricity costs were combined, they ranged from 14% to 17% of the variable costs. The largest difference was in labor costs, which varied from 3% in Kentucky to 11% in "Other" states. This finding may be a reflection of the labor market in which the FWP were produced. These results are closely aligned with estimates previously reported by D'Abramo et al. (2003). The variable costs in D'Abramo's study were based on stocking 20,000 juveniles per acre, producing 1,150 pounds per acre, and selling the entire FWP harvest at $3 per pound.

Fixed Costs

Twenty-two respondents provided useable information in the fixed cost section of the survey. Not all survey respondents completed the fixed cost section of the survey, and some provided only partial information. Accordingly, their responses were excluded from the fixed cost calculations by removing their pounds of production when the fixed cost averages were computed. This procedure still allowed estimation of fixed costs based on a per-pound production for each state.

Table 4 presents the percentage of respondents who indicated use of specific equipment during the 2005 grow-out season. The most notable findings were that every respondent used aeration, and 82% of them used an oxygen-monitoring device. Most of the different types of equipment were used by less than half of the producers, which reflects various management practices used to raise FWP or incomplete reporting of equipment used. Approximately 36% of the respondents used substrates in their production, a practice recommended for low- and high-density production.

Only 19% of producers were able to harvest more than 1,000 pounds of FWP per water acre, and the majority (55%) of respondents harvested less than 600 pounds per acre (Figure 5). Therefore, many of the reported commercial-scale levels of production in pounds per acre are lower when compared with experimental results of 800 to 3,000 pounds per acre (Dasgupta 2005) and commercial estimates of 600 to 1,200 pounds per acre (D'Abramo et al. 2003).

Table 4. Percent of respondents who used specified equipment in the pond grow-out of FWP in 2005.

Equipment	Percent who reported use
Aerators	100
1 hp	45
2 hp	36
10 hp	9
5 hp	9
3 hp	5
0.75 hp	5
Oxygen monitoring device	82
Trucks	77
Baskets	68
Water pumps	50
Chemical test kit	50
Building/shed	41
Tractor	36
Mower	36
Substrate	36
Seine net	36
Boots	32
Feed storage bin	27
Traps	23
Boat, motor & trailer	14
Computer/office equipment	14
Miscellaneous[1]	<10

[1]Miscellaneous includes collection tubs, dip nets, feeders, feed blowers, gloves, John Deere gators, live tanks, PTO aerators, scales, and wash tubs.

The state-by-state calculated fixed costs are presented in Table 5. Fixed costs include noncash depreciation costs and estimated cash costs for insurance, loan interest, and repairs and maintenance for equipment. Overall, there was wide variation in total fixed costs. Survey respondents in Kentucky reported the use of more equipment, thus their fixed costs were higher. Kentucky producers may be purchasing equipment solely for prawn production. In contrast, producers in the remaining states may be able to share specialized equipment for pond aquaculture on other parts of their farms. The average of all respondents may be the best estimate of fixed costs because it compensates for

Table 5. Fixed costs of survey respondents by state average and average of all respondents (in dollars per pound of FWP produced).

	Kentucky	Mississippi	Tennessee	Other	All respondents
	$	*$*	*$*	*$*	*$*
Depreciation on machinery & equipment	2.48	0.36	1.22	0.89	0.69
Interest on M&E investment	0.51	0.14	0.53	0.36	0.29
Insurance, general liability	0.01	0.01	0.01	0.01	0.01
Repairs & maintenance	0.20	0.15	0.49	0.36	0.28
Subtotal fixed costs	**3.20**	**0.66**	**2.25**	**1.62**	**1.27**

Table 6. Percent of total fixed costs for each line item by state, group of states (other), all respondents, and the estimated costs from D'Abramo et al. (2003).

	Kentucky	Mississippi	Tennessee	Other	All respondents	Estimated cost[1]
	%	%	%	%	%	%
Depreciation on machinery & equipment	78	55	54	54	54	44
Interest on M&E investment	16	21	24	22	23	29
Insurance, general liability	0	2	0	1	1	5
Repairs & maintenance	6	23	22	22	22	22
Subtotal fixed costs	100	100	100	100	100	100

[1]Based on a 50 water-acre, single-enterprise pond production system in Mississippi in 2002. Column modified from tables 6 and 7.

overreported or underreported usage of equipment.

When line item fixed costs were compared regionally as a percent of the total fixed costs (Table 6), more variation was observed between Kentucky and each of the other states and regions. This disparity may be attributed to the less consistent completion and valuation of the fixed costs compared with the variable costs. The estimates of costs reported previously (D'Abramo et al. 2003) were similar to all states and regions with the exception of Kentucky. These differences may reaffirm that the fixed cost percentages reported from Kentucky respondents may be inherently different from those of other regions, or they may demonstrate discrepancies in fixed cost responses.

Postharvest Costs

Postharvest costs are incurred after the prawns are removed from the pond(s) (Table 7). Disparities in postharvest production costs occurred mainly because of the diverse outlets to which producers sold their FWP. Obviously, sales at the pond bank required lower costs than those needed to sell and ship a heads-off product to a restaurant. It appears that producers in one state favored certain market outlets more than producers in other states. Additional information about market outlet diversity will be provided in the *Gross Receipts* section of this bulletin.

Producers in Mississippi sold both deheaded and heads-on FWP to grocers, at the pond bank, and from home. The added cost of processing headless FWP most likely contributed to an increase in postharvest costs in this state. Tennessee producers, who had the second highest postharvest costs, sold headless product to restaurants and from home, as well as heads-on product to wholesalers and from the pond bank. Kentucky respondents sold heads-on FWP to grocers, wholesalers, and pond bank customers. Only one respondent from Kentucky indicated sale of a headless product and that was from his home. The low level of processing of prawns by Kentucky farmers accounts for this state's low postharvest costs. Finally, survey respondents from "Other" states indicated sale of headless FWP from home and to restaurants and grocers. Heads-on FWP were sold to grocers and pond bank customers.

Table 7. Postharvest costs of survey respondents by state average and average of all respondents (in dollars per pound of FWP produced).[1]

	Kentucky	Mississippi	Tennessee	Other	All respondents
	$	*$*	*$*	*$*	*$*
Crushed ice	0.09	0.14	0.19	0.08	0.11
Processing	0.01	0.09	0.01	0.05	0.04
Packaging	0.01	0.04	0.05	0.01	0.02
Storage	0.01	0.33	0.08	0.01	0.07
Transportation	0.04	0.03	0.06	0.02	0.03
Marketing	0.00	0.07	0.19	0.10	0.07
Insurance	—	0.06	—	—	0.01
Post harvest labor	0.03	0.15	0.04	0.06	0.06
Other post harvest expenses	—	0.05	—	0.04	0.02
Subtotal postharvest costs	**0.19**	**0.96**	**0.62**	**0.37**	**0.43**

[1]A "—" in a column means no respondent in the state used that item; when a "0.00" appears in a column, the average was less than 0.005 per pound produced for that line item but is reported to indicate use, though at a very low level.

Total Costs

Figure 10 presents the summation of variable, fixed, and postharvest costs versus pounds of production per acre. Some respondents did not indicate their fixed costs, so fewer points were included in this scatter plot. The general trend reveals that as more money is spent per acre, higher production per acre is realized. However, this is not as strong a relationship as expected. Some producers who spent approximately $4,000 per acre achieved production as good as or better than producers who spent $8,000 to $10,000 per acre.

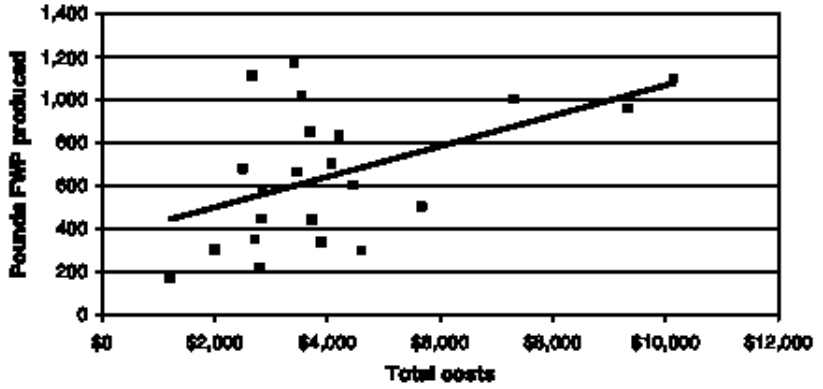

Figure 10. Total variable, fixed, and postharvest costs versus pounds of FWP produced presented on a per-acre basis.

Gross Receipts for Freshwater Prawn Sales

The price received for the product by state reflects the form of the FWP sold (heads-on or headless), market outlet type, and the percent of harvest sold at each venue. The first row of Table 8 provides the weighted average price received per pound of prawn harvested in each state. Many of the pounds of production sold in Kentucky went to wholesalers who offered a lower price than other market outlets; therefore, the average price received is relatively low for this state (Figure 11). In addition, most prawns produced in Tennessee were also sold to wholesalers, contributing to a lower price received. No Mississippi respondents indicated sales to wholesalers, and the absence of this outlet might partially explain why they received higher prices per pound sold. Mississippi respondents reported receiving $4.50 to $10 per pound of heads-on FWP and $7.20 to $15 per pound of heads-off FWP — amounts before adjustment

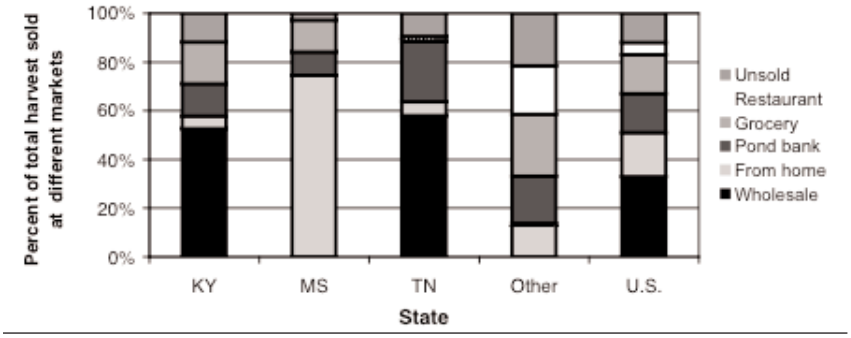

Figure 11. Percent of FWP pounds harvested that were sold to specific markets.

Table 8. Summary of cost of production by state average and average of all respondents (in dollars per pound of FWP produced).

	Kentucky	Mississippi	Tennessee	Other	All respondents
	$	*$*	*$*	*$*	*$*
Receipts (per pound)	4.97	8.87	5.65	7.50	6.30
Variable costs	3.24	3.16	4.34	5.07	3.82
Income above variable costs	1.73	5.71	1.31	2.43	2.48
Fixed costs	3.20	0.66	2.25	1.62	1.27
Postharvest costs	0.19	0.96	0.62	0.37	0.43
Total costs	6.63	4.78	7.21	7.06	5.52
Net return	**(1.66)**	**4.09**	**(1.56)**	**0.44**	**0.78**

for price per pound harvested. The price per pound harvested is less because many producers were unable to sell all of their harvest.

A factor that contributed to the discrepancy in price per pound received is the amount of product that producers were actually able to sell. When the total calculated revenue was divided by total pounds of prawn harvested, producers who were unable to sell all of their harvested FWP experienced a relatively lower price per pound sold. Fifty percent of producers sold all of the FWP they harvested. Some producers may have actually planned not to sell their entire harvest. In fact, 78% of Kentucky respondents were unable to sell — or possibly chose not to sell — all of their harvest, resulting in a decrease in the overall price per pound produced (Figure 12).

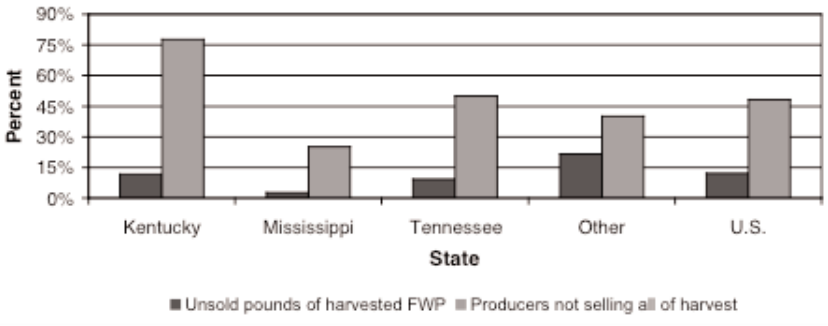

Figure 12. Mean percent of unsold prawn production and percent of producers who were unable to sell entire harvest.

Income Above Variable Costs

Income above variable costs is an important measure of short-term operational viability. If income above variable cost is negative, then the operation should shut down immediately as cash costs of production are not being covered. If income above variable costs is positive, then the operation is doing well in the short-run. Long-run viability of the operation will need to cover both the variable plus fixed costs.

Sixty-seven percent of respondents who provided variable cost information realized a positive income above variable costs. Seventy-three percent of respondents who fully completed the survey (variable and fixed cost sections) had positive incomes above variable costs. The average income above variable costs for all state categories was positive (row 3 of Table 8). Therefore, the average respondent was able to cover cash costs to produce FWP (Table 8). Figure 13 presents the relationship between income above variable costs (not including fixed or postharvest costs) and the production level expressed as pounds of FWP produced per acre. With the exception of one observation, all producers who produced more than 500 pounds per acre realized a positive income above variable costs. Actually, some producers who harvested less than 500 pounds per acre were also able to have a positive income above variable costs. The trend line of the plot crosses zero income above variable costs at 500 pounds per acre, suggesting that producers who exceeded this level were more likely to realize a positive income after variable costs were covered.

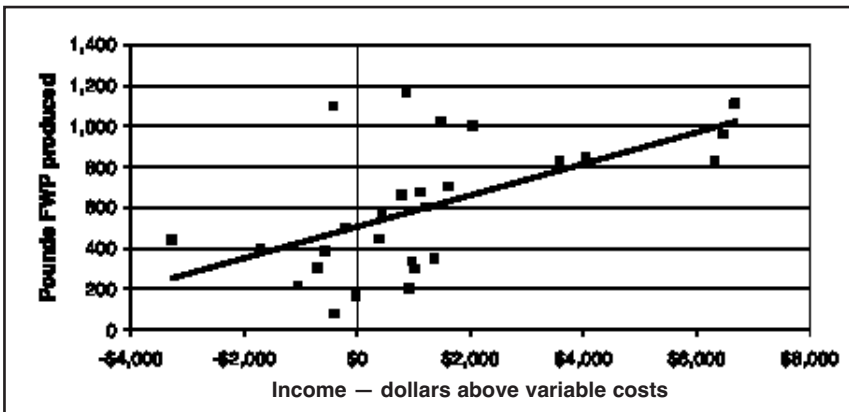

Figure 13. Income above variable costs versus pounds of FWP produced presented on a per-acre basis.

The calculated net return above all costs captures variable, fixed, and postharvest costs. It was calculated by using the price received per pound harvested minus the sum of variable, fixed, and postharvest costs (row 7 of Table 8). If the net return was positive, then all cash and fixed factors of production were covered, and the remaining positive value was "economic" profit. Forty-one percent of respondents had a positive net return above all costs (Figure 14). In addition, with the exception of one case, no producer who produced at levels below 650 pounds per acre had a positive net return.

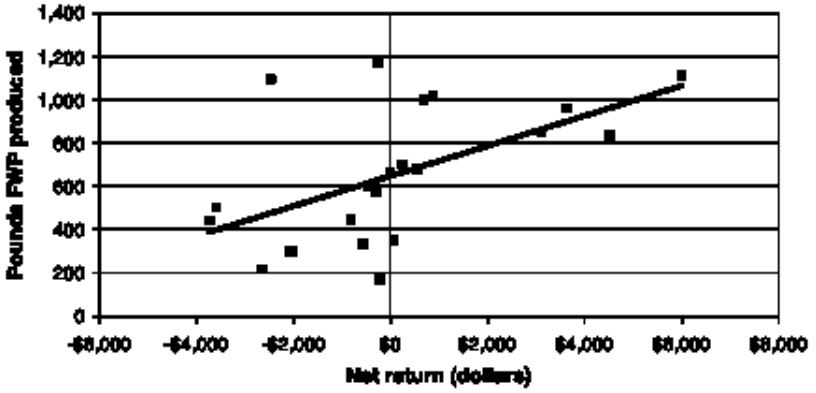

Figure 14. The relationship of net returns to level of production presented on a per-acre basis.

The average net return was not positive for all states (Table 8). Kentucky's negative net return was primarily attributed to two factors: (1) high fixed costs and (2) the relatively low price received per pound produced, which is linked to the inability to sell all of the FWP that were harvested. Tennessee respondents also received a relatively low price per pound harvested. This low price was due to their inability to sell all of the prawn harvest, as well as high variable costs — mainly stocking costs. In addition, the relatively high fixed costs in Tennessee resulted in a negative bottom line. Conversely, Mississippi respondents received the highest price per pound, partially by selling a large portion of their production and by locating higher paying market outlets. Producers in Mississippi also benefited from having the lowest variable and fixed costs. Most likely, the fixed costs for Mississippi in this analysis were artificially low, so the true average net return for this state may be lower than what was reported. Finally, producers in "Other" states also were able to realize a net profit despite having the highest average variable cost and approximately 22% of their harvest pounds unsold.

The inability to sell 100% of the harvest appeared to be linked to whether a positive net return was realized. Therefore, an additional plot was created to examine this relationship (Figure 15). This scatter plot supports the belief that as the amount of unsold harvest increases, the net return per acre decreases. There are also indications that producers were still able to have a positive net return even when not all of their harvest was sold.

Due to the wide variation in fixed costs from respondents in different states and some incomplete responses for fixed costs, the overall average respondent fixed cost ($1.27 per pound harvested, Table 5) was used to generate a modified *Summary of Cost of Production* table (Table 9). The fixed costs are standardized across states according to an estimate that was calculated based on overall survey responses. Net return results indicate that all states except Tennessee were able to cover all of their costs.

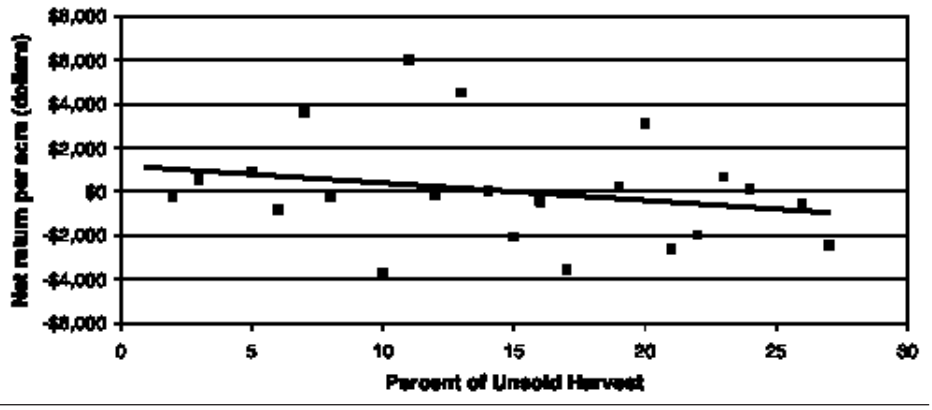

Figure 15. The relationship of net return to percent of harvest that is unsold presented on a per-acre basis.

Table 9. Summary of cost of production using the average fixed cost for all respondents (in dollars per pound of FWP produced).

	Kentucky	Mississippi	Tennessee	Other	All respondents
	$	*$*	*$*	*$*	*$*
Receipts (per pound)	4.97	8.87	5.65	7.50	6.30
Variable costs	3.24	3.16	4.34	5.07	3.82
Income above variable costs	1.73	5.71	1.31	2.43	2.48
Fixed costs (avg. respondent cost)	1.27	1.27	1.27	1.27	1.27
Postharvest costs	0.19	0.96	0.62	0.37	0.43
Total costs	4.70	5.39	6.23	6.71	5.52
Net return	**0.27**	**3.48**	**(0.58)**	**0.79**	**0.78**

CONCLUSIONS

Several regional effects can be identified in the cost of production tables. Gross receipts varied by state from $4.97 to $8.87 per pound produced. Prices were a function of the harvest proportion sold at different price levels to various market outlets and the percentage of FWP harvested that were sold. Variable costs, which ranged from $3.16 to $5.07, were influenced by the distance to hatcheries (stocking costs), distance to catfish feed manufacturers, and the amount of fuel and electricity used. In addition, specific management practices seem to have influenced the variable costs, with some producers spending a larger sum of money on additional inputs.

Fixed costs were likely not as accurate or representative of each region. This result is probably due to several factors, including some producers not completing that portion of the survey or not including all of their fixed costs in their responses. In addition, estimating machinery and equipment costs is more difficult than reporting variable costs, which are more easily collected and recorded. The wide range of state level fixed costs ($0.66 to $3.20 per pound produced) contributed to the uncertainty in the accuracy, but factors such as different management practices most likely influence the degree of variation.

Postharvest costs appeared to be a reflection of the FWP market. As postharvest costs increased, so did the price received. A cost-benefit analysis could be a valuable study to assess the cost of providing a more processed product for an increased purchase price. Since the prawn head comprises approximately 55% of the FWP (D'Abramo 2003), the price for a pound of headless FWP should be at least twice that charged for a pound of heads-on FWP. This increased price does not include the added processing costs that should be applied to the final price. A recommended rule of thumb is for the break-even price per pound of frozen heads-off FWP to be twice the price of heads-on FWP plus $1 (Dasgupta 2005). However, sale of heads-on FWP at high prices per pound in white tablecloth restaurants would be a double plus (i.e., a high price that includes payment on the inedible head weight of the prawn).

Another factor that affected this analysis was the quantity of prawns produced. The cost per pound produced would be less if either more FWP survived to harvest or a higher individual final weight was achieved. Dasgupta and Tidwell (2003) found that commercial yields were 92% of experimental yields. However, responses for this survey indicated that commercial yields were lower than experimental yields based on similar stocking density, thus suggesting either a lower survival, less weight gain by individual prawns, or a combination of both. Another interesting point was the discrepancy between actual harvest yields reported by the respondents (average level of all respondents 599 ± 323 pounds per acre) and the yields obtained in experimental ponds (up to 3,000 pounds per acre, Dasgupta, 2005). Lower yields contribute to higher costs per pound produced, especially for the fixed costs, but if individual size is increased and high-valued outlets can be found, then the higher cost can be partially offset.

The relatively low yields reported by some producers suggested management practices might have been extensive in nature. This presumption was also reflected in the limited number of producers who used substrate in their ponds. Lack of adoption of this recommended management practice may be due to a lag between the time it takes for technology to be developed and incorporated. More likely, though, budgetary and cash flow constraints do not permit an increase in

capital expenses. Increased production will not always be reflected in increased profits because increased production intensity is often associated with increases in fixed and variable costs. In addition, if not all of the production is sold, it may be unwise to produce more product the following year unless the producer is confident of selling more of the product at a preferred price point.

The ability to market the FWP is a premier concern for producers. The inability to sell all harvested FWP affects the bottom line. Dasgupta and Tidwell (2003) reported that Kentucky producers were unable to sell all their production, and they suggested that producers must explore new markets. The results of this 2005 survey support this need. Producers should establish markets to sell their product before stocking the prawn in the spring. There is a trade-off based on ensuring complete sales of the FWP and determining which market to sell the product. Wholesalers typically purchased 100% of the harvest, but they offered the lowest price, thus ensuring sales security but at a reduced price. Dasgupta and Tidwell (2003) also suggested that wholesale markets are not a profitable option for many producers. Results from this survey indicated that prawn producers were able to attract higher prices by processing their product and selling directly to the consumer, but in many cases, producers were still unable to sell their entire harvest.

In addition to finding markets for the product, prawn producers should focus on increasing the public's awareness of FWP as a seafood product and determine the price point at which they can sell their product and cover all production costs. Hanson et al. (2005) found that those who did consume FWP were willing to pay $8.11 for 23-45 count (number of FWP per pound) heads off in a rural locale and $9.21 in an urban setting. A prawn producer examining these prices must keep in mind that the producer would not receive these prices unless sale is directly to the consumer. Also of interest in that study was that the rural locale did not indicate they would pay a significantly different price for 1 pound of deheaded FWP, large marine shrimp, or lobster. In the urban location, FWP consumers were willing to pay a significantly higher price for 1 pound of lobster but did not identify a difference in the amount they would pay for an equal amount of FWP or marine shrimp. Knowing the market is essential to variable pricing of the prawn product.

Table 10. Strategies and recommendations for FWP producers to improve their net return above all production costs.

Increase the price received per pound of FWP produced:
- Find markets for produced prawns early, even before stocking;
- Sell a greater percentage of prawns harvested;
- Distinguish FWP as a unique product;
- Developing markets that are willing to purchase prawn at a preferred price; and
- Examine whether more a processed product will earn a higher price, compared with the cost of processing, storing, and transporting the value-added product.

Decrease the cost per pound of FWP produced:
- Improve yields through
  - An increase in prawn survival
  - An increase weight gain of individuals, with limited additional inputs (i.e., keep FWP in ponds longer);
- Decrease stocking costs (if possible);
- Find organic fertilizer substitutes for expensive feed and/or decrease feed costs;
- Monitor fuel and electricity costs (e.g., do not overuse aerators); and
- Find multiple income-generating uses for equipment used to produce FWP.

The information derived from the survey suggests that prawn producers must be able to compete with marine shrimp prices. Fulton Fish Market prices in 2004 for Florida deheaded shrimp averaged $7.63, $6.91, and $6.04 for 15 or less count, 16 to 20 count, and 21 to 25 count, respectively (DOC 2005). Ex-vessel price for headless shrimp in 2005 for the Eastern Gulf (west coast of Florida) were $5.50, $4.35, and $3.40 for 15 to 20 count, 21 to 25 count, and 26 to 30 count, respectively (NOAA Fisheries 2006). The ex-vessel price would be equivalent to the pond bank price if the transport cost of the product from pond bank/vessel was equivalent. These marine shrimp prices suggest that some FWP producers may want to market FWP as an alternative product to marine shrimp and aim for a selling price that will cover all production costs.

FWP producers are faced with challenges of increasing yields, developing markets, and selling all the prawns they produce. However, these challenges can be overcome, and a positive net return can be realized. This study demonstrates that the majority of producers were able to cover their cash costs of producing prawns, but less than half were able to meet all of the additional fixed and postharvest costs. Price is not the only factor that contributes to a positive net return. Producers should monitor costs and expend extra effort to ensure that all of their harvest is sold. Table 10 provides strategies and recommendations to assist producers in improving their chances of obtaining a positive net return.

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APPENDIX I — SURVEY INSTRUMENT

2005 Freshwater Prawn Cost of Production Survey

United States Freshwater Prawn and Shrimp Growers Association
and
Mississippi State University
Department of Agricultural Economics

Instructions: Please complete this survey using figures from your 2005 freshwater prawn (FWP) production season from ordering supplies and preparing ponds through final harvest and sales of the FWP. If you have additional items to add for a specific question, use the line after "Other" to explain. This survey is confidential and only aggregate and average values will be reported. If your farm records are not complete, good estimates are acceptable. You do not have to answer questions you are not comfortable answering. Your cooperation will benefit you in evaluating your prawn enterprise and will contribute to directing future progress in the U.S. freshwater prawn industry.

1) Where is your FWP operation located?
   a. State: _____
   b. County: _____

2) Did you operate a FWP hatchery/nursery this year? (check one answer below)
   a. _____No----Follow-up question:
      How many miles away is the hatchery that supplies your Postlarvae (PLs) or juveniles? _____miles

   b. _____Yes----For the following questions please **provide information for the FWP grow-out to harvest size in ponds only**.

3) How much money did you spend purchasing FWP PLs and/or juveniles to stock in ponds this year? (If you answered yes to question #2 use the value of the PLs or juveniles that you stocked in ponds on your farm to answer this question.)

Size of FWP stocked into ponds	Amount of money spent
Post-larvae (PL)	$
Juvenile (30 day)	$
Juvenile (45 day)	$
Juvenile (60 day)	$
Other _____	$
Other _____	$

4) What was your stocking rate in FWP per acre? _____FWP/acre

5) How many ponds on your operation were used to grow-out FWP this year? _____ponds

6) How many water acres on your operation were used to grow-out FWP this year? _____acres

7) How many total pounds of FWP did you produce this year? _____pounds

8) What percent of the FWP harvested this year fell into each of the following size categories:

Size (in number per pound)	Percentage in category
7-11 per pound (heads-on)	%
12-22 per pound (heads-on)	%
Other _____per pound (heads-on)	%
Other _____per pound (heads-on)	%
Other _____per pound (heads-on)	%
Other _____per pound (heads-on)	%
Total	**100%**

9) How much money did you spend this year on inputs to manage ponds and promote FWP growth this year?

Item	Total Cost
Feed a. 28% protein catfish sinking feed b. 32% protein catfish sinking feed c. Other (identify) _____	 a. $_____ b. $_____ c. $_____
Organic fertilizer a. Distiller dried grain b. Cottonseed meal c. Other (identify) _____	 a. $_____ b. $_____ c. $_____
Inorganic fertilizer a. 10-34-0 b. 13-38-0 c. Other (identify) _____	 a. $_____ b. $_____ c. $_____
Other (identify additional items used to promote growth but not mentioned above) a._____ b. _____ c. _____	 a. $_____ b. $_____ c. $_____

10) How much money did you spend on inputs to control water chemistry and pests? If you did not spend any money on the specific input, enter 0.

Input	Amount of money spent
Lime	$
Gypsum	$
Calcium chloride	$
Rotenone	$
Aquathol K	$
Hydrothol 191	$
Oil/diesel mix	$
Other _____	$
Other _____	$

11) Complete the following table of equipment used for FWP pond preparation, grow-out and harvest from November 2004 through October 2005. If equipment was used for several purposes (i.e. other farm or personal uses) enter the percent that it was used **only** for FWP production. If the equipment was used exclusively for FWP production, enter 100%. Don't forget to consider truck use to pick up PLs, feed and other errands related to FWP production.

Equipment	Quantity	Year purchased	% used for FWP production
Example: Truck (1995 Ford F-150)	**1**	**2000**	**10 %**
Tractor (Specify _____)			%
Truck a. Specify_____ b. Specify_____	 a. _____ b. _____	 a. _____ b. _____	 a. _____ % b. _____ %
Aerators a. 1 hp b. 2 hp c. 5 hp d. ___hp (specify size) e. ___hp (specify size)	 a. _____ b. _____ c. _____ d. _____ e. _____	 a. _____ b. _____ c. _____ d. _____ e. _____	 a. _____ % b. _____ % c. _____ % d. _____ % e. _____ %
PTO			%
Mower (Specify _____)			%
Boat (Specify_____)			%
Motor for boat (Specify_____)			%
Boat trailer			%
Water pumps			%
Substrate in the pond a. PVC barrier fence b. Bird netting c. Old seine nets d. Other _____ e. Other _____	(in linear feet) a. _____ b. _____ c. _____ d. _____ e. _____	 a. _____ b. _____ c. _____ d. _____ e. _____	 a. _____ % b. _____ % c. _____ % d. _____ % e. _____ %
Oxygen monitoring device			%
Chemical test kit			%
Feed storage bin			%
Building/Shed (Specify use _____)			%
Computer/Office equipment			%
Seine net			%
Traps for collecting prawns (Specify _____)			%
Baskets			%
Boots			%
Other_____			%
Other_____			%
Other_____			%
Other_____			%

12) How much money did you spend on fuel and electricity this year to raise FWP?

a. Gas $_____
b. Diesel $_____
c. Electricity (Answer 1. and/or 2.)
   1. $_____ (total annual cost used in FWP production)
   2. _____# of hours FWP aerators are run for the entire year
d. Other $ _____ (specify fuel type) _____

13) Did you stock fish to control vegetation in the FWP ponds this year? (check one answer below)

a. _____Yes----Follow-up question:
   How much money did you spend to stock algae-eating fish
   in FWP ponds this year? $_____
b. _____No

14) Please indicate the amount of money spent on insurance and the percentage of the insurance that covered FWP production? For example, take the amount of total farm liability you pay annually and prorate it for the percentage FWP production is of your entire farm's production.

Type of Insurance	Amount of money spent	Percentage of the insurance for FWP
General farm liability		%
Other _____		%

15) How many hours of paid and unpaid labor (by you and others) were used this year to raise FWP? Include labor used for all elements of production up **until the FWP are removed from the water** (planning, ordering equipment, preparing ponds, stocking ponds, feeding, monitoring ponds, harvesting, etc.) in your answer. If FWP were given as labor payment instead of dollars, count this as unpaid labor.

Number of hours of unpaid labor including your own labor _____hours
Number of hours of paid labor _____hours
Amount of money spent on paid labor $_____

16) How much money did you spend on activities **after** the FWP were removed from the water?

Activity/Item	Amount of money spent
Crushed ice	$
Processing	$
Packaging	$
Storage	$
Transportation	$
Marketing	$
Insurance	$
Labor after harvest occurred	$
Other _____	$
Other _____	$

17) Are there any other pre- or post-harvest FWP expenses that were not included in this survey? If so, please specify and identify cost.

a. ______________________ Cost $_________________
b. ______________________ Cost $_________________
c. ______________________ Cost $_________________
d. ______________________ Cost $_________________
e. ______________________ Cost $_________________

18) Have you sold or do you have contracts for over 50% of your 2005 FWP harvest? (check one answer below)

a. _____Yes----answer the next question for your **2005** harvest

b. ______No----answer the next question for your **2004** harvest, if you had one and note any change in water acreage between 2004 and 2005

19) Describe your sales outlets, percentage of your harvest sold to each outlet, FWP size, and price you sold to each outlet. Please do not identify the name of the outlet, only the type of outlet (i.e. local restaurants, pond bank sales, roadside stand, local grocery stores, out of home, etc.).

Sales Outlet Description	**Percent of total sales that were sold at outlet**	**Sold heads-on or heads-off?**	**Sizes sold (i.e. 7-11/lb, 12-22/lb, mixed sizes or not according to size)**	**Price received per pound**
	%	___on ___off	Size a. _________/lb Size b. _________/lb Size c. _________/lb Size d. _________/lb	a. $__________/lb b. $__________/lb c. $__________/lb d. $__________/lb
	%	___on ___off	Size a. _________/lb Size b. _________/lb Size c. _________/lb Size d. _________/lb	a. $__________/lb b. $__________/lb c. $__________/lb d. $__________/lb
	%	___on ___off	Size a. _________/lb Size b. _________/lb Size c. _________/lb Size d. _________/lb	a. $__________/lb b. $__________/lb c. $__________/lb d. $__________/lb
	%	___on ___off	Size a. _________/lb Size b. _________/lb Size c. _________/lb Size d. _________/lb	a. $__________/lb b. $__________/lb c. $__________/lb d. $__________/lb
	%	___on ___off	Size a. _________/lb Size b. _________/lb Size c. _________/lb Size d. _________/lb	a. $__________/lb b. $__________/lb c. $__________/lb d. $__________/lb
Percent of harvest that is/was unsold or not contracted	%			
Total	**100%**			

20) Did you use your farm records to answer this survey? (check one answer below)

a. ____ Yes

b. ____ No---Follow-up question:
Do you keep records of your FWP production inputs and sales? ___Yes ___No

21) How many years have you been producing FWP? _____years

22) What year were you born? _____year

23) What is the highest level of formal education you have completed? (check one)

- ☐ 1 - Less than high school
- ☐ 2 - High School diploma
- ☐ 3 - Some college
- ☐ 4 - Completed 2 – year degree (A.A. or A.S.)
- ☐ 5 - Completed 4 – year degree (B.A. or B.S.)
- ☐ 6 - Graduate school

24) What percentage of your anticipated household gross income for 2005 do you expect to come from your FWP operation? _____%

25) What is your anticipated household gross income for 2005? (check one)

- ☐ $0 to $25,000
- ☐ $25,001 to $50,000
- ☐ $50,001 to $75,000
- ☐ $75,001 to $100,000
- ☐ $100,001 to $150,000
- ☐ Over $150,000

26) How long did it take to complete the survey? _____minutes

27) Do you have any other comments? We would like to hear from you about additional costs items not covered in the survey or other FWP economic research areas or studies that would interest you.

Please return the completed survey in the enclosed pre-addressed and pre-stamped envelope. Thank you very much for your time and assistance in this study. Summarized results will be shared at the December 2005 meeting of the U.S. Freshwater Prawn and Shrimp Growers Association to be held December 9-10 at Tunica, MS (for more information on this meeting contact Dolores Fratesi at: usprawngrowers@yahoo.com or visit the Association website at http://freshwaterprawn.org/).

APPENDIX II

Matrix used to estimate value, depreciation, interest on investment, and repairs and maintenance of equipment used to grow out freshwater prawns.

Items listed in the survey	Cost	Useful life	Depreciation	Interest on investment	Repairs (pct. of annual depreciation)
	$	*years*	*$/year*	*%*	*%*
Tractor	18,725	14	1,338	9	75
Trucks[1]	variable	variable	variable	9	45
Aerators					
0.75 hp	750	10	54	9	50
1 hp	750	10	54	9	50
2 hp	1,400	10	100	9	50
3 hp	2,000	10	143	9	50
5 hp	3,135	10	224	9	50
10 hp	3,750	10	268	9	50
PTO aerator	3,300	10	236	9	25
Mower	3,700	10	264	9	20
Boat, motor & trailer	5,221	10	373	9	10
Water pumps	3,375	10	241	9	45
Substrate (PVC) (per foot)	0.24	10	0.02	9	20
Oxygen monitoring device	725	5	52	9	40
Chemical test kit	90	5	6	9	10
Feed storage bin	2,000	20	143	9	10
Building/shed	2,000	20	143	9	10
Computer/office equipment	1,350	5	96	9	10
Seine net	500	10	36	9	10
Traps	10	10	1	9	10
Baskets	25	10	2	9	10
Boots	25	5	2	9	10
Items not included in survey but identified as being used by one respondent					
John Deere Gator	6,260	10	447	9	20
Feed blower	5,967	10	426	9	20
Gloves	10	2	1	9	20
Live tank	1,200	10	86	9	20
Dip net	21	5	2	9	20
Wash tub	50	10	4	9	20
Scale	54	10	4	9	20
Collection tubs	50	10	4	9	20
Feeders & scales	5,967	10	426	9	20

[1]Kelley Blue Book Values were used to determine truck prices.

Mississippi State University

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