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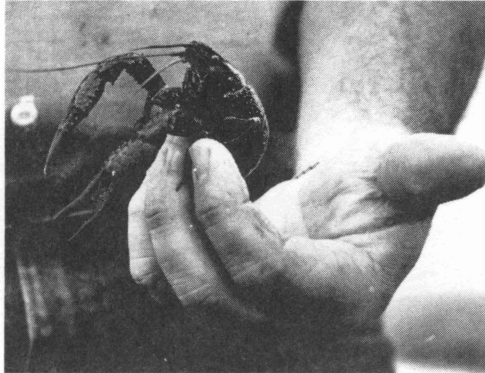
Texas Agricultural  Extension Service



## TEXAS CRAWFISH AQUACULTURE

**An Analysis of A Producer Survey Focusing  
on Current Industry Practices,  
Conditions, Marketing Plans  
and Ideas for the Future**

Texas Agricultural Extension Service • The Texas A&M University System  
Zerle L. Carpenter, Director • College Station, Texas



(clockwise from right)

**Crawfish are harvested by periodic trapping. In this scene crawfish harvesting equipment is used to traverse the pond.**

**Crawfish traps stand vertically in the water with bait placed inside.**

**Texas farm-raised crawfish are available in a variety of sizes and are a high quality product. Purging helps the animals live longer.**



# Texas Crawfish Aquaculture

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## EXECUTIVE SUMMARY

Information on crawfish production, acreage, marketing plans and producer opinions was collected via a mail survey distributed in January 1989. The data collected pertained to the November 1987 to June 1988 crawfish production season. The cumulative response rate from the survey was 46.9 percent; however, only 45 percent of the respondents (26 of 58) were actually involved in crawfish production in 1987-88. Since no comparative base exists, there is no way to determine the level of coverage which this survey made of the Texas crawfish industry. As a result, many of the percentage values may provide more insight to true industry intent than do the raw data.

Crawfish aquaculturists are relative newcomers to the business, with 42 percent of producers indicating at most a 1-year tenure. Cumulatively, 80 percent have been in the crawfish business for no more than 3 years.

The current production base was reported as 1,610 acres, 81 percent of which is located in Chambers, Jefferson, Liberty and Orange counties. When asked about planned changes in crawfish acreage, three in ten producers indicated that total crawfish acreage in Texas would be increased 30 percent over the next 2 years. However, two operators' expansion plans account for 62 percent of this expected increase, indicating that expansion plans are not widespread. Just over 600,000 pounds of crawfish were produced in 1987-88, with 84 percent coming from the same four-county area mentioned above.

Most producers (71 percent) funded facility construction through internal means. Similarly, 74 percent fund their own operational needs (forage, bait, utilities, harvest labor and marketing), with commer-

cial lenders providing operating funds to 22 percent of respondents.

Crawfish farmers typically oversee other on-farm enterprises and off-farm endeavors in addition to managing a crawfish operation. According to survey data, crawfish aquaculture currently makes a negligible contribution to total livelihood, with 72 percent of the respondents indicating a contribution of 0 to 1 percent. Considering their short tenure in the business, their means of financing (often on an incremental basis determined by availability of existing, internal sources), and the lack of distribution systems for live crawfish, this low contribution indicates a young industry whose managers must divide management time among crawfish production and other endeavors to make their livelihood.

Two elements combine to place large time requirements on crawfish producers: a) the fact that production is determined by periodic trapping, thereby necessitating multiple sales efforts throughout the season; and b) the lack of existing distribution systems for live crawfish. As a result, producers reported distributing 42 percent (208,960 pounds) of their total marketings in 1987-88. Of this 208,960 pounds requiring off-farm delivery, 73 percent (152,541 pounds) was distributed to retail outlets (food service establishments, food retailers and specialty shops) in numerous metro areas.

Serving a retail account base requires periodic cycling through a delivery zone to make frequent, small shipments. This type of delivery requires intensive management and the collection and use of timely information related to competition, account turnover, receivables management, etc. We believe that the ab-

sence of a marketing system has been largely responsible for the frustration among crawfish producers because they have had no choice but to become their own distribution system. Managing this distribution function requires skills much different from production acumen.

Producers noted that seasonal oversupply, i.e., saturation of local markets, was the most pressing marketing obstacle. This suggests the need to expand the market for crawfish. In terms of market development, the two options are: a) the diversification of the local customer base; and b) the creation of new business in areas where crawfish are not currently sold. In moving from local diversification to development of new markets a number of considerations must be weighed. These include the increased costs, risks and potential returns of developing new business in regions distant from production areas. Also, the need for formalized, objective quality control protocols increases when market development activities focus on building demand in distant areas. Therefore, group commitment must also increase.

Currently, at least 58 percent of crawfish sales are made at the local level--the farm. Until production increases, producers interested in developing new markets must remove product from the local market to meet volume needs in distant markets.

Producers ranked the need for enforceable product standards unimportant in their marketing plans. However, to serve new markets with current production volumes, pooling of producer output probably will be required. As a result, some formal, objective means of insuring that participating producers adhere to the demands of these new

markets will be necessary. Development and use of such quality control standards is the only way to provide objective, equitable treatment of participants and insure that consistent quality products enter the market.

To summarize the opinion rankings, Texas crawfish producers indicated that establishment of individual profitability was a top priority. The more uncertain, longer term development of public policies designed to benefit the crawfish aquaculture industry was ranked less important. However, several issues currently in the public arena will require industry attention to highlight legitimate industry positions, needs and concerns. These include insuring product safety and quality via mandatory inspection and the use, allocation, regulation and cost of water resources.

Beginning in January 1989, some Texas producers began distributing substantial quantities of farm-raised crawfish into the retail food sector at a fixed price throughout the season. This event was not captured via the mail survey, since the time period for surveying industry conditions was November 1987 through June 1988. It represents a departure from traditional marketing practices for live crawfish in that 1) a new outlet was developed (sales to retail food stores accounted for only 2 percent of total marketings in 1987-88), 2) forward contracting enabled producers to increase their annual weighted average selling prices, 3) producers and retailers agreed upon size standards for live crawfish as a condition of sale and acceptance, and 4) participants in this pooling program, i.e., individual crawfish farmers, did not have to distribute their product to the contracting food retailing firm.

## INTRODUCTION

Crawfish aquaculture in Texas began at least 20 years ago in the southeastern part of the state. Though not documented, this alternative enterprise grew rapidly in the early 1980s. However, as certain grain prices began to increase, and as aquaculturists experienced the difficulties of marketing live crawfish periodically throughout the harvest season, often by vertical integration into delivery services, some producers gave up crawfish production to pursue more traditional agricultural ventures.

To obtain information on the size, characteristics, conditions and future growth potential of the industry, a mail survey was distributed in January 1989. A complete survey is included as an appendix. This effort was supported through the Sea Grant College

Program's Marine Advisory Service at Texas A&M University. The survey was initiated in September 1988. The survey was reviewed by the Board of Directors of the Texas Crawfish Farmers Association, 15 professionals working in agricultural or marine economics, aquaculture, food distribution, and appropriate Texas Agricultural Extension Service / Marine Advisory Service staff. The specific purposes of conducting this survey were as follows:

1. to obtain current, baseline data on key industry measures such as acreage, production and the importance of crawfish aquaculture as an on-farm enterprise;

2. to evaluate the current marketing plans of producers, including the types of customers served, the marketing services provided and whether or not the crawfish (sold for direct human consumption) are purged; and

3. to provide a means of collecting industry members' opinions and concerns about future needs of the industry.

Since no "clearinghouse" exists for obtaining current producer data, the following steps were required to obtain a complete listing of possible crawfish producers.

1. A recent version of the Texas Crawfish Farmers Association Directory was obtained and producer data were incorporated into a master file.

2. Mailing lists were requested (and received) from every county Extension agent-marine. These data were checked for duplication and entered into the master file.

3. Since crawfish aquaculture is not necessarily coastal in nature, county Extension agents-agriculture in the eastern half of Texas were asked for the names of crawfish producers in their respective areas. More than 75 percent of the agents responded to this request (both positively and negatively). Five producers who would otherwise have been excluded from the survey were incorporated into the master file.

4. A request was made to the Texas Department of Agriculture for similar listings of crawfish producers. This agency provided a list of persons who had requested information on various types of aquaculture, and those who had expressed an interest in crawfish were incorporated into the master file.

5. At the Texas Crawfish Farmers Association Annual meeting held in Houston, an announcement was made about the upcoming survey. A composite listing was circulated among participants to obtain corrected mailing information.

Individuals receiving the questionnaire were either currently engaged in crawfish aquaculture, had previously been in the business, or had expressed some degree of interest in establishing a crawfish facility. The questionnaire was sent to 130 individuals. Because the initial question categorized respondents as to whether or not they were currently involved in producing farm-raised crawfish in Texas, this survey was able to use a diverse list of possible producers as its universe.

Survey protocol used methods detailed in Dillman (1976), whereby a discrete timetable was used for the initial mailout and subsequent, written communication with respondents. Sixty-one surveys were

returned (46.9 percent response rate). Two surveys reflected data for the same aquaculture operation (a joint venture) and one survey was obtained from a Louisiana culturist. These data were not included in the composite dataset used in the analysis. Surveys which indicated that the respondent was not currently involved with crawfish production were separated, and all subsequent data (if present) were set to missing values. Missing data are not used in any analysis.

## Limitations Of This Work

This survey is an initial step toward exploring various characteristics of the Texas crawfish industry. Two types of limitations exist in this study: sampling error concerns; and the fact that many in the business have completed so few production cycles. The first type of limitation is inherent in the sampling approach to obtaining information. The second limitation affects the usefulness and interpretation of reported industry performance information.

*Sampling Error Considerations.* Typically, survey data provide descriptive and causative information. Through survey results, the significance of the industry (i.e., acres in production, quantities produced, etc.) and current characteristics of facilities which comprise the industry can be assessed. These data often are used as the basis for planning future activities.

Industry data generally are collected through the sampling procedure. However, the collection of baseline data in emerging industries with few participants is often done via census due to the small number of operations. While this exercise sought to achieve a census of producers, it did not. Of the surveys returned, fewer than half were completed by current crawfish aquaculturists (Table 1).

**Table 1. Number of Respondents Currently Involved With Crawfish Aquaculture.**

	Number of respondents	Percent
Who do produce crawfish	26	44.8
Who do not produce crawfish	32	55.2
<b>Total</b>	<b>58</b>	<b>100.0</b>

Judging whether or not a survey's results are meaningful is sometimes done by comparing the survey data with existing baseline information. This comparison would show whether the survey captured all elements of the industry, or whether only a small subset was sampled which would provide a distorted image of the entire industry. Insofar as Texas crawfish aquaculture is concerned, such a judgment is difficult to make since no data are collected through permits or licenses, or by the industry which identify either the number of commercial operators in Texas, the amount of dedicated acreage or total production. As a result, there is no objective way to determine the level of coverage which this survey has made of the Texas crawfish production sector.

Because of this shortcoming, it is important to realize that where industry totals are concerned (number of people engaged in the business, acreage dedicated to crawfish production, total industry production, etc.) the discussion is strictly reflective of respondent information. The totals reported may be understated because a) some producers did not return the survey; b) some information was missing from several of the surveys returned; or c) some producers might not have received the survey.

Survey results can be used to provide a statistically verifiable test to determine whether enterprises in dif-

ferent geographic regions or with different operating characteristics (the independent variables) perform or behave differently than those in other areas. For example, do they earn greater profit margins or are their marketing plans materially different, etc.? Because of the small sample size, these relationships were not explored.<sup>1</sup>

As a consequence, while these survey data do explain selected components of the crawfish industry, they do so with no mention of specific differences in location, facility size, production intensity or producer experience, which may combine to influence certain performance measures such as production costs, marketings and expansion plans.

*Industry-related Limitations.* Forty-two percent of the respondents noted that they had been in the crawfish business for only 1 year. Having completed only one cycle, these respondents are generally in a learning/research mode, and many of the performance measures may appear weak. However, it should be remembered that while effectiveness and efficiency in production management are typically low with limited experience in a new enterprise, they improve with repeated trials and the adoption of research findings. As a result, the current, reported performance data do not indicate the long-term expectations for Texas crawfish aquaculture.

## CURRENT INDUSTRY CONDITIONS

### Length of Time in Business

For most respondents, crawfish aquaculture is a relatively new enterprise. About 80 percent of the respondents said they had been involved with crawfish aquaculture for 3 years or less (Table 2). This condition alone is quite significant, and is certain to influence other response data because of the 3- to 4-year lead time required to obtain a large, consistent crop.

Table 2. Number of Years Involved With Commercial Crawfish Aquaculture.

Years in business	Number of Respondents	Percent
1	10	41.7
2	5	20.8
3	4	16.7
5	1	4.2
6	1	4.2
8	2	8.3
20	1	4.2

Mean years in business: 3.29 years

## Membership in Seafood or Aquaculture Trade Associations

Most Texas crawfish producers (71 percent of respondents) are members of at least one trade association which focuses on aquacultural issues. All Texas crawfish farmers who are members of a trade association belong to the Texas Crawfish Farmers Association. Several are also members of the Louisiana Crawfish Farmers Association and the Texas Aquaculture Association. Trade association membership is reflective of the producers' desire to have a common voice in issues affecting their industry and to participate in an exchange of information beneficial to aquacultural growth and development.

## Existing Acreage, Current Production and Planned Expansion

Crawfish aquaculture was reported in 13 Texas counties, with a cumulative production base of 1,610 acres (Table 3). Eighty-one percent of this acreage is located in four counties in extreme southeast Texas (Jefferson, Chambers, Orange and Liberty counties), suggesting that the combination of existing levees, fresh water availability and the historic infrastructure for moving and managing water for agricultural use is a key consideration in selecting this enterprise.

Statewide, slightly more than 600,000 pounds of crawfish were produced in the November 1987 to June 1988 season (Table 4)<sup>2</sup>. Southeast Texas (Jefferson, Chambers, Orange and Liberty counties) accounted for 503,518 pounds or 84 percent of total production.

**Table 3. Reported Distribution of Crawfish Aquacultural Acreage by County or Counties.**

County	Reported acreage	Percent of total
Jefferson	768	47.7
Chambers	202	12.5
Matagorda/Wharton/ Colorado	87	5.4
All others <sup>a</sup>	553	34.3
<b>Total</b>	<b>1,610</b>	

<sup>a</sup> Other counties (including some with no county specification or counties with only one observation) are: Caldwell, Houston, Leon, Liberty, Live Oak, Orange, Refugio and Waller.

**Table 4. Computed 1987-88 Crawfish Production by County or Counties.**

County	Acreage	Total production <sup>a</sup>	Percent of total
Jefferson	768	255,738	42.5
Chambers	202	71,480	11.9
Matagorda/Wharton/ Colorado	87	61,275	10.2
All others <sup>a</sup>	553	212,639	35.4
<b>Total</b>	<b>1,610</b>	<b>601,132</b>	

<sup>a</sup> Total production was computed by multiplying acreage by per acre production. Since there were missing data in the multiplicands, total production is slightly understated. Furthermore, if the average per acre production value is computed from this table, it will be understated as a result of missing data.

<sup>b</sup> Other counties (including some with no county specification or counties with only one observation) are: Caldwell, Houston, Leon, Liberty, Live Oak, Orange, Refugio and Waller.

Average per acre production for the 1987-88 season was 409 pounds + or - 226 pounds with production ranging from 19 pounds per acre to 780 pounds per acre.<sup>3</sup> These per acre production data did not correlate well with acreage ( $r = .037$ ), suggesting that there are different levels of production intensity not considered.

When asked about plans for changing the acreage of their crawfish operation, 40 percent of the reporting producers indicated that they would be making a change. Eight out of ten producers contemplating a change indicated that they plan to increase acreage, while two expect to redirect their acreage to other uses within the next 2 years. These plans will lead to a net increase of 484 acres over the next 2 years. This planned expansion represents a 30 percent increase over current, reported, statewide acreage. This percentage figure may be more relevant in evaluating the industry's intent, since total crawfish acreage in Texas cannot be determined through this survey.

## Purging Operations

Allowing crawfish to cleanse themselves naturally has been a major contributor to repeat sales and consumer loyalty to the Texas farm raised product. While purging is specified in the by-laws of the Texas Crawfish Farmers Association there is no means for the association to determine individual compliance with the procedure. However, 84 percent of the respondents indicated that they did operate a purging facility in

conjunction with their aquaculture operation.

The size of purging facilities should be proportional to daily production in the Spring. Capacity in purging operations ranged from 30 pounds to 6,000 pounds. Forty-three percent of respondents noted that their animals were purged for 24 hours. On average, purging was completed in 27 hours + or - 11.3 hours.

Purging may be done for a number of reasons (Table 5), but enhancing taste and texture and maintaining product vitality are ranked as the two most important. Since Texas crawfish are generally marketed live, purging provides obvious advantages in reducing death loss.

**Table 5. Producer Opinions of Purging Importance.**

Importance of function to producer	Mean score <sup>a</sup>	Number	Preference index <sup>b</sup>	Rank
Enhance taste, texture	3.29	21	69.09	1
Extend life of animal	2.86	21	60.06	2
Warehousing	2.57	21	53.97	3
Effective display	1.65	20	33.00	4

<sup>a</sup> Respondents were requested to rank each function from most important (1) to least important (4). Through a recoding procedure, these values were changed so that most important = 4 and least important = 1.

<sup>b</sup> The preference index provides a way to weight the mean scores by number of responses. It is computed by multiplying mean score by number.

## Costs of Producing and Marketing Crawfish

Respondents were asked to provide cost data for the 1987-88 season dealing for production, harvest, marketing/distribution and management. The types of expenses to include in each category were described in the survey instrument. Complete data were provided by only 10 of 26 producers. These producers managed facilities ranging from 7 acres to 500 acres. From an investigation of these data (total, reported dollar cost and computed total cost per acre), only total cost correlates with acreage ( $r = .839$ ). Other computed costs would be expected to correlate with acreage (i.e., as acreage increases the cost per acre should decrease as certain central fixtures such as pumps, canals, levees, harvesting equipment, etc. are shared among more units of production). However, this is not the case.

Total costs per acre for the 1987-88 season ranged from \$101 (7 acres) to \$555 (180 acres). Costs are influenced by the intensity of management. For example, a farm with 180 acres in production reported a total cost of \$100,000, just \$12,000 less than that reported for a facility of 500 acres. Comparing these two operations in terms of total computed production shows that the larger facility produced 150,000 pounds of product whereas the smaller crawfish operation produced 125,100 pounds. Clearly, production management is more intense in the smaller facility. Because of such obvious differences in management strategy and outlook, no other discussion of cost data is made. To do so would be misleading because so few responses comprise the data set and varying levels of management exist which are independent of acreage.<sup>4</sup>

## Sources of Financing

Separate questions requested information on the source of funds for capital construction needs and for meeting annual operating expenses (Tables 6 and 7, respectively). As is typical for enterprises with no identifiable "track record," 71 percent of the respondents indicated that personal resources were the major source for funds for developing crawfish aquaculture facilities. Commercial banks were mentioned as a major funding source by 19 percent of the respondents.

Personal resources also were the source of operating funds for 74 percent of the respondents, with commercial banks providing operating funds to 22 percent of the crawfish producers.

**Table 6. Major Sources of Capital Construction Funds.**

Source of capital	Number	Percent
Production credit associations	1	4.8
Commercial banks	4	19.0
Outside investors	1	4.8
Personal resources	15	71.4

**Table 7. Major Sources of Operating Funds.**

Source of capital	Number	Percent
Commercial banks	5	21.7
Outside investors	1	4.3
Personal resources	17	73.9



## Sources of Livelihood

Respondents were asked what percentage of their livelihood came from the following sources: a) crawfish aquaculture; b) other on-farm agricultural endeavors; and c) off-farm, non-agricultural endeavors (could also be on-farm royalties from oil and gas production). Each questionnaire was checked to insure that the sum of the three categories equaled 100 percent. If the sum of the three categories was zero, then each of the three percentage contributions to total family livelihood was set to missing and was excluded from subsequent evaluation and analysis. As a result of this validation procedure, any contributions of zero are the actual responses as indicated by participants.

Initially, it was expected that acreage should influence the percentage contribution which crawfish aquaculture makes to the respondent's total livelihood (i.e., large crawfish enterprises should contribute a greater percentage toward total livelihood). However, correlation coefficients between acreage and percentage contribution to total livelihood from crawfish aquaculture ( $r = -.083$ ) suggest that there is no relationship between the two.

Crawfish culture currently makes a negligible contribution to most producers' total livelihood (Table 8). Almost half (48 percent) of the producers reported that the crawfish production enterprise made no contribution to total livelihood. Cumulatively, 72 percent of the operators indicated that crawfish production contributed 1 percent or less to total livelihood. In only one instance was crawfish aquaculture contributing to most of the respondent's livelihood.

**Table 8. Percent Contribution to Total Livelihood from Crawfish Aquaculture.**

Percentage contribution	Number	Percent
0.00 - 1.00	18	72.0
5.00 - 8.00	3	12.0
10.00	2	8.0
30.00	1	4.0
60.00	1	4.0

As a contributor to total livelihood, other on-farm agricultural enterprises were bimodal in nature, with 48 percent of the respondents indicating that at most 20 percent was contributed to total family living requirements while 48 percent earn at least 84 percent

of their total livelihood from other on-farm agricultural enterprises (Table 9).

**Table 9. Percent Contribution to Total Livelihood from Other On-Farm Agricultural Enterprises.**

Percentage contribution	Number	Percent
0.00	8	32.0
10.00 - 20.00	4	16.0
40.00	1	4.0
84.00 - 100.00	12	48.0
90.00 - 100.00	11	44.0

As expected with a bimodal distribution of livelihood earned from other on-farm agricultural enterprises, there is an offsetting bimodal distribution of off-farm earnings. Specifically, 48 percent of the producers earn at most 10 percent of their total livelihood off the farm, while 48 percent earn no less than 50 percent (Table 10).

**Table 10. Percent Contribution to Total Livelihood from Off-Farm (non-agricultural) Endeavors.**

Percentage contribution	Number	Percent
0.00	7	28.0
1.00 - 5.00	4	16.0
10.00 - 20.00	2	8.0
50.00	2	8.0
80.00 - 100.00	10	40.0

From these data it may seem that crawfish aquaculture is an unprofitable enterprise, or that revenues just offset production costs with no profit. However, closer analysis of other components of the survey may indicate that the type of financing used to establish and operate a facility, the length of time one has been in the business, and unique marketing conditions interact to produce the results in Table 8.

The type of financing used to construct and operate the facility, typically from internal sources, may have created a sense of urgency in re-establishing personal equity levels. Therefore, any initial net returns generated may not have been construed as a contribution to livelihood but instead as "internal" repayment of a loan. Additionally, without external sources from which to fund necessary costs (bait and payroll), some producers may have been constrained

by the cash flow which can be generated from operations. Another constraint could be competition from other concurrently managed enterprises. Some of these respondents may not have made much effort to harvest crawfish if they lacked the time, manpower or cash to do so.

It is also important to realize that the sample is skewed in favor of recent entrants in crawfish aquaculture. These new entrants typically operate under a number of limitations, many of which are eliminated by experience. Almost half (42 percent) of the respondents reported being in the crawfish aquaculture business for only 1 year. Having gone through only one production cycle, it is not surprising that these culturists may be operating below their breakeven point either because of high initial expenditures and/or low production which could be tied to inexperience or the reproductive capacity of the animal. Forty-seven percent have cultured crawfish for only 2 or 3 years. While this group has completed more production cycles, more time may be required to learn and adopt proper aquacultural production management and marketing techniques.

Two circumstances differentiate crawfish production from other aquacultural ventures: a) the occurrence of multiple sales opportunities throughout the season as a result of periodic trapping; and b) a non-existent or relatively weak distribution system for live crawfish. Since producers typically rely on a combination of other on-farm enterprises and off-farm endeavors for their livelihood and usually fund their own capital and operating budget needs, they may lack the time and/or funds to adequately harvest and distribute crawfish. As a result, some producers may rely strictly on local, drop-in/call-in customers for sales, even though their facilities are capable of greater production.

With a weak distribution system, some producers have had to provide delivery services. This could have been an unforeseen cost, or a larger cost than previously expected, thereby influencing contribution to total livelihood. A limitation such as an undeveloped marketing system implies that crawfish aquaculture is a young industry in Texas, and that time may correct this inadequacy.

## CRAWFISH MARKETING ACTIVITIES

### Background Information

Marketing of live crawfish continues to be problematic for many aquaculturists. With production determined by periodic trapping, crawfish farmers have numerous opportunities to market a portion of their total, annual output. This is perhaps beneficial from a risk management perspective, but potentially quite time consuming as a result of the lack of a developed distribution system for live crawfish. Because of these two situations, most producers have been required to "become" the distribution system. Many have discovered that establishing and servicing an account base is a separate enterprise requiring skills different from those needed to produce the product. It also requires tremendous time, especially in the initial stages. That time requirement, in addition to the time necessary for managing the production enterprise, has perhaps been the main limiting factor in crawfish aquaculture for many producers. Many producers have been forced to conduct both enterprises simultaneously, both of which require specialized skills.

### Current Marketing Practices

This section focuses on three components of crawfish marketing:

- 1) an analysis of the current customer base for Texas farmed crawfish and the extent of producer delivery services required to make sales;<sup>5</sup>
- 2) an outline of current producer opinions concerning the obstacles involved with marketing crawfish, both from an individual perspective and as an industry; and
- 3) a discussion relating current marketing activities with expressed obstacles to suggest some areas for future emphasis, both individually and industry-wide.

### Delivery Services Provided by Producers

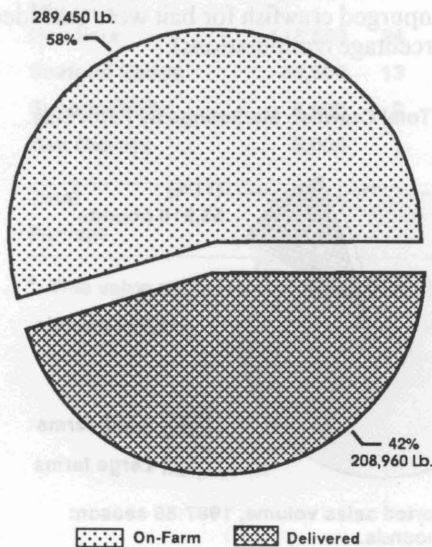
Post-harvest transportation of farm output to gins, elevators or auction houses is a common practice among farmers and ranchers. This type of transportation typically requires traveling to one destination

point and then returning. It is important to distinguish between infrequent delivery to one terminal and establishing a delivery route (or routes) whereby farm output is distributed periodically to numerous accounts, often in different geographic areas. The major distinction lies in the amount of managerial oversight required to complete each type of delivery. Cash flow needs are another distinguishing consideration.

With limited distribution options available for live crawfish, most producers have been forced to provide delivery services to a variety of interests (food service establishments, specialty seafood shops, supermarkets, processors and mid-level handlers). Total reported marketings for the 1987-88 season amounted to 498,410 pounds. Fifty-eight percent (289,450 pounds) of Texas crawfish was sold from the farm, while deliveries were required for 42 percent (208,960 pounds) (Figure 1). Of the sales requiring deliveries, 73 percent were made to retail interests (food service establishments, food retailers and specialty shops). Deliveries to these customers are characterized by frequent drop shipments of small quantities due to a combination of a) the animal's short life span once removed from the water, b) the lack of storage space in most retail establishments, and c) the difficulty retail interests often have in estimating demand for selected menu items.

The time requirements for initiating and managing this type of delivery service are intense. The producer must obtain orders from existing accounts, develop new accounts, handle customer complaints, continuously analyze route profitability, and make the frequent deliveries.

Figure 1. Most Common Distribution Method.



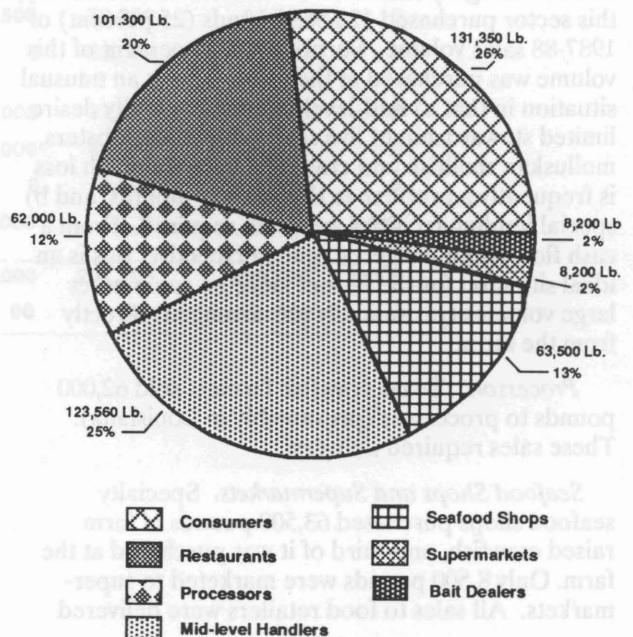
Total, Reported Sales Volume, 1987-88 Season: 498,410 pounds.

The profitability of the delivery enterprise is generally sensitive to minor changes in the cost of goods sold (i.e., production costs and/or purchases of other producers' output), since the difference between sales revenues and cost of goods sold is typically low. Out of this difference must come variable vehicular expense, variable expense for driver travel and delivery, the fixed expenses of vehicle ownership, telecommunications expense, management costs and profit. Profitability of individual routes is sensitive to quantities sold and the variable costs required to deliver in that region. The level of management required to complete this delivery function successfully can become burdensome if other enterprises also require managerial oversight.

### Marketing Highlights by Type of Customer

Industry wide, crawfish farmers marketed 71 percent of their production to three customer types: ultimate consumers (26 percent); mid-level handlers (25 percent); and food service establishments (20 percent) (Table 11, Figure 2). Sales to specialty seafood shops accounted for 13 percent of season totals, and sales to processors were 12 percent of reported totals. Sales volumes to supermarkets and bait dealers were minimal--2 percent each. No sales were made to caterers, although some food service establishments may perform catering functions upon request.

Figure 2. Total Crawfish Marketings by Customer Type.



Total, Reported Sales Volume, 1987-88 Season: 498,410 pounds.

**Table 11. Total Crawfish Marketings By Type of Customer Served (1987-88 Season).**

Customer type	Total sales		On-farm sales		Off-farm sales	
	pounds	percent	pounds	percent	pounds	percent
Consumers	131,350	26	131,350	100	0	0
Food service	101,300	20	27,500	27	73,800	73
Processors	62,000	12	0	0	62,000	100
Mid-level handlers	123,560	25	104,000	84	19,560	16
Seafood shops	63,500	13	20,000	32	43,500	68
Supermarkets	8,500	2	0	0	8,500	100
Bait dealers	8,200	2	6,600	80	1,600	20
<b>Total</b>	<b>498,410</b>		<b>289,450</b>		<b>208,960</b>	
<b>Percent</b>				<b>58</b>		<b>42</b>

*Ultimate Consumers.* In most aquacultural enterprises, farm sales directly to end users account for the smallest volumes. This situation does not hold for crawfish aquaculturists, who collectively sold 131,350 pounds (26 percent of reported marketings) to consumers at the crawfish facility.

*Food Service.* Direct marketing to food service establishments accounted for about 20 percent of reported sales volumes (101,300 pounds). Approximately 27 percent of these sales were made at the farm, implying that the food service operator provided transportation.

*Mid-Level Handlers.* Because there were no definitions in the survey instrument to differentiate brokers from distributors, these two categories are merged into the category of mid-level handlers. Cumulatively, this sector purchased 123,560 pounds (25 percent) of 1987-88 sales volume. Surprisingly, 85 percent of this volume was purchased at the farm. This is an unusual situation in that a) mid-level interests typically desire limited stewardship of live seafoods (crabs, lobsters, molluscan shellfish and crawfish) because death loss is frequently a problem in the warmer months, and b) special holding facilities are often required. From a cash flow and managerial time perspective, this is an ideal situation for the farmer since he can market large volumes (presumably pre-arranged) directly from the farm.

*Processors.* Texas crawfish farmers sold 62,000 pounds to processors (presumably in Louisiana). These sales required delivery.

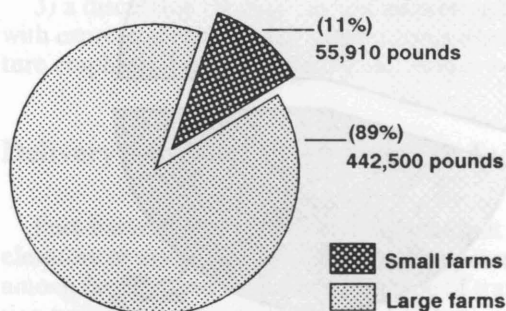
*Seafood Shops and Supermarkets.* Specialty seafood shops purchased 63,500 pounds of farm raised crawfish, one-third of it was purchased at the farm. Only 8,500 pounds were marketed to supermarkets. All sales to food retailers were delivered

(presumably direct to the outlets rather than the distribution center).

### Marketing Highlights by Farm Size

Cumulatively, small operators marketed 55,910 pounds or 11.2 percent of total sales volume (Figure 3). Through cross referencing it was determined that this volume was generated from 178.5 acres. Eighty-five percent of all marketing transactions by this subset were completed at the farm (Table 12). On-farm sales to ultimate consumers accounted for 69 percent of total marketings by this group. The operators of smaller facilities must often rely on local demand and sell from the pond bank because the time or money to initiate delivery services are limited or unavailable. Approximately 12,800 pounds (24 percent) sold for direct human consumption were unpurged (marketings of unpurged crawfish for bait were excluded from these percentage computations).

**Figure 3. Total Crawfish Marketings by Farm Size.**



**Total reported sales volume, 1987-88 season: 498,410 pounds.**

Table 12. Total Crawfish Marketings, By Type of Customer Served, for Farms 30 Acres or Smaller.

	Pounds sold	Percent	Pounds picked up	Pounds delivered	Pounds purged	Pounds unpurged
Consumers	38,850	69	38,850	0	33,850	5,000
Food service	4,800	9	0	4,800	0	4,800
Mid-level handlers	9,060	16	7,000	2,060	6,060	3,000
Bait dealers <sup>a</sup>	3,200	6	1,600	1,600	0	3,200
<b>Total</b>	<b>55,910</b>		<b>47,450</b>	<b>8,460</b>	<b>39,910</b>	<b>12,800</b>
<b>Percent</b>			<b>85</b>	<b>15</b>	<b>76</b>	<b>24<sup>b</sup></b>

<sup>a</sup> Data not provided on whether product was delivered or picked up; assumed 50 percent delivered and 50 percent picked up.

<sup>b</sup> Pounds sold for bait deducted from total.

Farms larger than 30 acres accounted for sales of 442,500 pounds (89 percent of crawfish sold in Texas). Cumulative response by this group indicates that marketings originated from 1,180 acres. In contrast to the smaller facilities, operators of larger farms reported a more balanced customer base, with 21 percent marketed to ultimate consumers and the rest

divided among mid-level handlers (26 percent), food service establishments (22 percent) and retail interests (14 percent) (Table 13). Approximately 60 percent of marketings by large farmers occurred at the farm, while 40 percent were delivered. All crawfish sold for human consumption by this group were purged.

Table 13. Total Crawfish Marketings, By Type of Customer Served, for Farms Larger than 30 Acres.

	Pounds sold	Percent	Pounds picked up	Pounds delivered	Pounds purged	Pounds unpurged
Consumers	143,500	29	143,500	0	143,500	0
Food Service	97,700	20	27,500	70,200	97,700	0
Processors	62,000	12	0	62,000	62,000	0
Mid-level Handlers	118,500	24	101,000	17,500	118,500	0
Seafood Shops	63,500	13	20,000	43,500	63,500	0
Supermarkets	8,500	2	0	8,500	8,500	0
Bait Dealers	5,000	1	5,000	0	0	5,000
<b>Total</b>	<b>498,700</b>		<b>297,000</b>	<b>201,700</b>	<b>493,700<sup>a</sup></b>	<b>5,000</b>
<b>Percent</b>			<b>60</b>	<b>40</b>	<b>100</b>	

<sup>a</sup> This value excludes crawfish sold for bait.

## Producer Opinions of Current Marketing Obstacles

Respondents were asked to rank six potential marketing obstacles based on how important each was to the success of their crawfish operation.<sup>6</sup> The three most pressing marketing obstacles, in order of importance, are: a) seasonal oversupply, b) underdeveloped marketing opportunities; and c) inadequate promotion of aquacultured crawfish (Table 14). These three issues are sequentially and logically linked. For example, the correction of an oversupply situation necessitates seeking new outlets (markets). However, potential new users of the product (including distributors, food service establishments, food retailers and consumers) must learn more about this food item, typically through directed promotional efforts. While these issues affect producers on a daily basis, reducing their impact typically requires a long-term plan.

**Table 14. Producer Opinions of Current Marketing Obstacles That Affect Aquaculturists.**

Issue / Obstacle	Mean score <sup>a</sup>	Number	Preference index <sup>b</sup>	Rank
Seasonal oversupply of crawfish	4.82	22	106.04	1
Underdeveloped marketing opportunities	4.43	23	101.89	2
Inadequate promotion of crawfish	3.91	23	89.93	3
Lack of suitable in-state processing	3.68	22	80.96	4
Inefficient or inadequate distribution	3.05	22	67.10	5
Lack of enforceable quality standards	3.10	20	62.00	6

<sup>a</sup> Respondents were requested to rank each function from most important (1) to least important (6). Through a recoding procedure, these values were changed so that most important = 6 and least important = 1.

<sup>b</sup> The preference index provides a way to weight the mean scores by number of responses. It is computed by multiplying mean score by number.

The top ranked obstacles to profitability are, naturally, those of immediate concern. Obstacles ranked four through six focus on long-range needs and suggest the infrastructure and policy changes required if market development activities are to be successful. For example, to differentiate farm-raised crawfish from those caught in the wild, product standards may be important. The existence of such standards would also insure consistency in the supply of product provided to new trade areas.

## Seasonal Oversupply of Crawfish

The phenomenon of seasonal oversupply in aquaculture typically creates hardship, since only "real time" sales opportunities exist (i.e., no futures market and very little forward contracting). Since most crawfish are sold live, seasonal oversupply in the Spring (March through June) typically leads to significant reductions in open market prices. With such a significant proportion of annual harvests (and catches) occurring within this 3-month interval, producers' annual weighted average selling price for the entire season often approaches the open market price paid in the Spring. Since other crawfish producing regions have exactly the same season, much of their excess supply often ends up in Texas' metro markets. Furthermore, the oversupply situation significantly affects Texas producers since 84 percent of Texas production occurs no more than 60 miles from Houston, and approximately 90 percent of all crawfish produced in the U.S. is harvested within a 300-mile radius of the greater Houston area.

## Underdeveloped Marketing Opportunities

In the short term little can be done either individually or as an industry to change the problem of oversupply and its effect on local demand. However, one way to combat its effect is to explore markets not typically influenced by local production, or to explore arrangements such as contract sales. Not surprisingly, producers cumulatively ranked underdeveloped marketing opportunities as a close second to the seasonal oversupply problem.

## Inadequate Promotion of Farm-Raised Crawfish

With the difficulty in arranging for other than open market sales, many producers have suggested that developing additional marketing opportunities is the

most appropriate approach to take. However, to explore and develop new business ventures requires time and money. One component of new business creation is promotion of the product to potential users. Producers indicated that inadequate promotion of farm-raised crawfish was the third most pressing issue confronting them.

### **Lack of Suitable In-State Processing**

Farmers ranked processing limitations as the fourth most important issue they face. Through processing, the product is preserved and can be sold throughout the year. Although no particular types of processing were mentioned in survey questions, it is important to note that a peeling facility alone may not provide producers with a profitable outlet for crawfish because of low meat yields. Crawfish typically yield about 16 percent edible meat from relatively small animals. (Yield decreases in larger crawfish.) Therefore, for every \$.10 increase in the price paid for live crawfish, the direct meat cost will increase by \$.63 (\$.10/.16). As a result of this cost magnification in the final product, processors often pay producers the minimum price. Even with numerous plants in Louisiana competing for producer output, the prices paid have been quite low. For example, prices reported in the Aquaculture Situation and Outlook Report (1988) indicated that during the 1987-88 harvest season, Louisiana crawfish producers were receiving \$.25 to \$.40 per pound for crawfish to be peeled. However, with the current live markets placing more emphasis on the larger crawfish for boiling, a peeling facility may be the only outlet for crawfish not large enough to sell live.

It is important to realize that there are other processing options besides peeling. For example, some facilities in Louisiana are freezing whole crawfish destined for the European market.

### **Inefficient or Inadequate Product Distribution**

With 58 percent of the crawfish produced in Texas sold from the farm, it is not surprising that producers did not perceive distribution to be a pressing issue. However, as production increases and local markets become saturated, efficient, planned methods of distributing farm output will become more crucial.

When asked what issues the trade association should focus on, producers listed "development of crawfish farmer cooperatives dealing with either purchasing or marketing" first. This may indicate that

having to "be" the distribution system is a difficult enterprise to conduct in conjunction with a production operation. Producers may be suggesting that some specialization of duties within the Texas crawfish industry would be beneficial. Such an arrangement (i.e., a marketing cooperative or a producer-owned marketing company) would allow producers to specialize their production skills, thereby providing more opportunity to build a competitive advantage.

### **Lack of Enforceable Quality Standards**

Producers do not perceive the need for enforceable product quality standards. While compliance with purging is high (84 percent for farms smaller than 30 acres and 100 percent for farms larger than 30 acres), perhaps producers feel that no other standards are required. However, crawfish size is becoming an issue in the market (Aquaculture Situation and Outlook Report 1988). Besides product quality issues, the federal government is currently in the initial stages of developing prototype seafood oversight and inspection protocols coincidental with consumer concern over seafood quality and safety. Current estimations are that within the next 5 years a mandatory seafood inspection and oversight program will be in place.

### **Opinions of Current Marketing Obstacles Requiring Industry Intervention**

Besides ranking issues which affect producers personally, producers commented on three issues which the industry (through the Texas Crawfish Farmers Association) could address. These options were presented as a way for producers to express their opinions about which items should be priority considerations for industry involvement. The results are not surprising, since promotion of Texas farm-raised crawfish has been repeatedly mentioned as the key to future industry success (Table 15). The issue of developing a crawfish farming reporting system which could be used to track industry status received a less than enthusiastic reception. This ranking may be due to producer perceptions that required reporting could be linked to direct or indirect government control. However, this lack of documentation may create difficulty in demonstrating the importance of the crawfish farming industry to policy makers and others who could influence industry development.

**Table 15. Producer Opinions of Current Marketing Obstacles That The Industry Should Address.**

Issue / Obstacle	Mean score <sup>a</sup>	Number	Preference index <sup>b</sup>	Rank
Development of a comprehensive product promotion plan	2.40	25	60.00	1
Development of product standards which are supported by crawfish farmers	2.04	25	51.00	2
Development of a standardized reporting system to assess the current status of the crawfish industry by lenders, policy makers, etc.	1.76	25	44.00	3

<sup>a</sup> Respondents were requested to rank each function from most important (1) to least important (3). Through a recoding procedure, these values were changed so that most important = 3 and least important = 1.

<sup>b</sup> The preference index provides a way to weight the mean scores by number of responses. It is computed by multiplying mean score by number.

## Relating Current Situations and Obstacles to Future Direction: A Discussion

The opinions of seasonal oversupply, underdeveloped marketing opportunities and inadequate promotion of farmed crawfish represent the frustrations typical of entrants into enterprises which do not have well established marketing/distribution systems in place. These obstacles collectively suggest that developing additional crawfish demand is essential to future producer profitability and industry growth. However, the real issue is not developing new markets per se, but determining which markets are profitable to serve.

An assessment of the options for developing additional demand for crawfish requires an evaluation of potential costs, returns and risks, just as with any other decision. Developing additional, profitable marketing opportunities can take many forms, with some approaches requiring little investigation, time and money and others a lot. Also, some market development activities can be conducted by individuals while others require group support and commitment. Two major avenues for developing new marketing opportunities are diversifying the customer

base within existing market areas and seeking business in new areas.

## Diversifying The Customer Base in Existing Markets

Diversification of the local customer base is typically the least risky, least costly approach to market development. It may also provide the least returns, depending on the extent of saturation and competitive pressure. This approach to market development often can be completed by an individual producer. *Based on survey data, the current customer base for Texas crawfish appears diversified in terms of customer type served, although there may be some unsatisfied demand on the part of food retailers.* Consumers appear to be well served, but the percentage of urban vs. rural consumers served directly by crawfish aquaculturists is unknown. Therefore, a segment of metropolitan consumers may currently have limited access to crawfish. Data on in-state vs. out-of-state sales were not collected, nor was there information available on the location of ultimate sales within Texas.

One means of diversifying a customer base in a specific region may be the use of existing farmers' or terminal markets.<sup>7</sup> Selective use of existing terminal markets may be an appropriate component of a marketing strategy if the following conditions exist: a) traffic through the facility is steady, b) local health regulations do not prohibit the sale of live products in the farmers'/terminal market; c) someone qualified or accountable is available to manage the booth space, typically a family member; d) the distance from crawfish farm to market is not excessive; e) all farm output cannot be sold on the farm; f) realistic expectations are formulated about the total volume of business achievable through such outlets and the seasonal distribution of these sales; and g) delivery, advertising and market development costs are reduced by using an existing outlet.<sup>8</sup>

Some Texas crawfish farmers should explore the use of farmers'/terminal markets, based on the following observations. First, 25 percent of farm-raised crawfish was purchased by ultimate consumers who traveled to the farm. This suggests that local demand for live crawfish is high enough for buyers to travel some distance to purchase the product. Second, 84 percent of reported Texas crawfish production exists within 60 miles of Houston, site of one of the oldest farmers' markets in the state. Third, without constant evaluation of route profitability and sales efforts, producers who vertically integrate into delivery ser-



vices may find that they are only meeting their cash flow needs but not their profit objectives.

The farmers'/terminal market provides a point from which to market crawfish direct to metropolitan customers without the significant time and expense of planning and carrying out a delivery enterprise. While untested, this idea should be investigated by those living in proximity to such facilities. Pro forma measures such as direct costs of marketing a portion of output from farmer'/terminal markets (i.e., wage of booth/manager, transportation costs and product costs) and the quantities required to initiate such a venture (total seasonal output, daily/weekly product requirements and the computed breakeven price per pound) should all be used to evaluate the net margins available.

### **Development of Additional Marketing Opportunities**

At the other end of the spectrum is development of a strategic plan designed to target other regions of the country as markets for Texas farm-raised crawfish. Such a plan should estimate the quantity required and determine whether the problems of a short season can be overcome, what product attributes should be promoted, how this promotional effort will be funded, who will assemble and distribute orders, and whether appropriate quality assurance measures are in place to guard against poor or inconsistent quality products entering new trading areas.

A number of issues must be addressed if market development activities are to be successful. Since some lead time is required to build demand in new markets, the benefits of developing new markets are long term. In fact, such a plan may initially lose money due to low volumes sold and losses from spoilage or death.

One of the first issues to be considered is whether production is adequate to serve new markets. According to the survey data, the local market supports at least 58 percent of the reported sales volume (the percentage of sales made at the farm). Therefore, focusing on new markets in lieu of existing ones may not be prudent until production increases.

Two other issues of market development also relate to sales volume: the seasonality of volumes; and the need for pooling of output. Currently, most crawfish are harvested in the Spring, even though some producers begin harvesting in the Fall. Therefore, volumes may not exceed local demand until production is well underway in the Spring. The seasonal na-

ture of crawfish production may (or may not) be problematic in these new markets.

With the economics of shipping dependent upon volume, presumably some pooling of output from various farms would be required. Obviously, area farmers have to be committed to such a plan, but beyond commitment, farmers expect, and should be given, objective treatment concerning pack style, adherence to specifications, etc. A strategic market development plan should also include the development of acceptable, enforceable product standards which can be used for the purposes of: a) insulating new customers from poor or inconsistent quality; b) establishing an objective means of identifying sources of output and determining whether a producer's output meets minimum market requirements; and c) developing themes for promotional messages in new markets.

Industry sponsored product quality programs are currently in a growth mode. These programs have begun because of a negative consumer perception of product integrity, safety, wholesomeness, etc. For example, market research on farm-raised catfish, conducted in regions outside of traditional catfish consuming areas, identified two issues that limited greater use of the product: a) concern over the life history of the animal, i.e., that it was a scavenger; and b) that catfish typically had to be served fried. To counter these perceived issues, the industry has adopted a voluntary program which oversees processing activities and monitors plant output. This program provides a guarantee to customers that products originating from credentialed (voluntarily inspected) plants are free of off-odors, off-flavors and processing defects such as improperly trimmed fillets, etc. This quality assurance program can be considered the substance behind the message. The message, funded through a producer checkoff program, focuses on the controlled environment under which the catfish are produced, the high quality feeds used and the versatility which catfish offers in menu planning.

It is interesting to note that crawfish producers responding to the survey felt that lack of enforceable product standards (either through in-house means or the public sector) was their least important marketing issue. The by-laws of the Texas Crawfish Farmers Association require that crawfish be purged before sale, but there is no mechanism for ensuring compliance. Some reports indicate that sorting crawfish by size also is becoming a prerequisite for live sales (Aquaculture Situation and Outlook Report, 1988).

Many approaches can be used to develop new markets for farm-raised crawfish. Some of these approaches can be conducted by individuals or small groups who share common goals. These activities can

be as simple as hiring a route salesman to create new business in local areas, or pooling financial resources and output to save money in distribution.

Market expansion activities also can be as sophisticated as developing a strategic, marketing plan for the entire industry. However, such a plan requires producer commitment. If producers collectively feel that a strategic market development plan is needed,

then funds will have to be generated for market research, development of a quality assurance program and promotional activities. The approach that actually works to correct oversupply conditions, and therefore returns higher profits to aquaculturists, is the program that is planned around realistic assessments of current industry conditions and has the support of individual producers.

## PRODUCER THOUGHTS ABOUT ISSUES CONFRONTING THE TEXAS CRAWFISH INDUSTRY

Respondents were asked to rank each of a set of statements which may reflect obstacles encountered in producing and marketing crawfish.<sup>10</sup> The categories were water use and management, and production management practices. In a different question, producers were asked to rank various issues which the industry (presumably through a trade association or associations) should address.

Such collective opinions are important sources of information which can be used to guide industrial development. They provide a framework for research, developmental and educational projects which will provide long-term benefits to crawfish producers. As well, an opinion about a particular issue may raise questions about other, seemingly unrelated management practices.

### Issues Confronting Individuals

*Water Use and Management.* Producers felt that the rising cost of water was the most pressing issue in this category (Table 16). From a production management stance, when the cost of an input, such as water, increases, production is typically intensified to spread the cost over a larger production base. For example, the approach used in Taiwanese shrimp culture operations, where land suitable for aquaculture costs \$100,000 per acre, is to increase production through aggressive, intensive management practices.

Producers ranked government regulation and allocation of water the least important issue they face in water use and management. Some have argued that eminent domain has already been applied to the state's surface and ground water resources, thus providing the public sector with the means of deciding priority uses of that resource (Wallis, 1988). But Wallis forewarns that in some cases the development of regulations, an appropriate use of governments'

police power, is all that is needed to redirect uses of water. With this approach no compensation need be paid since taking the resource is an appropriate use of police power.

**Table 16. Producer Ratings of Issues Related to On-Farm Water Use and Management.**

	Mean score <sup>a</sup>	Number	Preference index <sup>b</sup>	Rank
Rising costs of obtaining water	3.32	25	83.00	1
Control of water quality	2.52	25	63.00	2
On-farm water use management	2.32	25	58.00	3
Govt. regulation & allocation of water	2.00	20	40.00	4

<sup>a</sup> Respondents were requested to rank each function from most important (1) to least important (4). Through a recoding procedure, these values were changed so that most important = 4 and least important = 1.

<sup>b</sup> The preference index provides a way to weight the mean scores by number of responses. It is computed by multiplying mean score by number.

Specific changes are currently underway in the management structure of Texas' fresh water resources (Lower Colorado River Authority, 1989). For example, local, regional and statewide efforts are shifting control and/or ownership of groundwater from the private landowner to the public domain. Management of these resources is being conducted by water or utility districts. As well, the Texas Water Commission has directed certain river authorities to incorporate groundwater management into their comprehensive water plans that are being developed for Commission approval.

As water issues such as availability, use, distribution and quality become more critical, efforts to establish government controls will become stronger. As a water dependent industry, crawfish aquaculturists may find that control and allocation of water is their most important issue.

*Production Management Practices.* The top three concerns of respondents seem related to intensification of production systems and profitability. Specifically, crawfish nutrition, a cost efficient harvesting technology (such as drain harvesting, which is common in shrimp culture) and predator and disease control were rated one through three, respectively (Table 17). This implies that producers are interested in more intensive production (i.e., perhaps supplemental feeding and a way to reduce harvest costs). However, the impact of drain harvest technology on

crawfish marketing could be detrimental to producers if the season for crawfish is constricted, with most annual production entering marketing channels within 2 or 3 months. Under this scenario, the shortened season could make it difficult to move a majority of the harvest live. The effect on profitability would have to be weighed carefully against the potential cost saving which drain harvesting would offer.

Interestingly, inadequate financing for expansion or development was ranked fourth in importance. Without market development activities, many producers may feel that expansion of crawfish facilities is premature. Also, with the extensive system currently used, input costs are low. This may suggest no pressing need for financing. With greater intensification, however, costs will increase. This should increase the need for external financing.

Table 17. Producer Ratings of Production Management Practices.

	Mean score <sup>a</sup>	Number	Preference index <sup>b</sup>	Rank
Poor understanding of crawfish nutritional needs	4.74	23	109.02	1
The need for a more cost efficient harvesting technology (drain harvest vs. trapping)	4.77	22	104.94	2
Predator/disease control	4.39	23	100.97	3
Inadequate financing for expansion or development of crawfish enterprises	3.81	21	80.01	4
Regulatory issues such as licensing and permitting	2.65	20	53.00	5
Limited availability of seed stock or breeding stock	2.16	19	41.04	6

<sup>a</sup> Respondents were requested to rank each function from most important (1) to least important (6). Through a recoding procedure, these values were changed so that most important = 6 and least important = 1.

<sup>b</sup> The preference index provides a way to weight the mean scores by number of responses. It is computed by multiplying mean score by number.

## Issues Confronting The Crawfish Industry

*Trade Association Issues.* Producers indicated that the development of supply and/or marketing cooperatives was the most important issue which the industry should address (Table 18). They felt that the crawfish industry should have more input into research and producer education programs carried out by agencies within USDA and the state university system. Producers suggested that the least important issue facing the industry as a whole was industry interaction with those responsible for developing policies and regulations which affect aquacultural production and marketing issues.

Ranking issues indicates priorities. It is not surprising that producers' priorities are skewed toward the immediate concerns of profitability and survival and less toward the long-term, uncertain benefits of interaction with regulatory and policy groups.

In the long run, regulation and control of private activities which affect public safety or the quality of life will occur with or without the input or involvement of affected industries. It is important, therefore, to begin thinking about ways the industry can become more of a partner in the architecture of these regulations.

Perhaps a good example of the need for pro-active involvement with policy makers is regulation of processing and marketing. Seafood (including crawfish) is, for the most part, not subjected to the same type of inspection and oversight as are the red meat and poultry industries. This appears to be changing. Over the past 18 months issues related to the lack of inspection within the seafood complex, and erosion of consumer confidence in seafood quality and safety, have been raised by various advocacy groups. This

has led many in the U.S. Congress to suggest that the seafood utilization and marketing sectors should come under similar regulations as other meat industries. It is thought that within the next 5 years some type of mandatory oversight process will be applied to seafoods.

**Table 18. Producer Ratings of Issues Which the Trade Association Should Address**

	Mean score <sup>a</sup>	Number	Preference index <sup>b</sup>	Rank
Formation of crawfish farmer cooperatives that deal with purchasing or marketing	3.16	25	79.00	1
Greater input into research and/or producer education programs carried out by public institutions	2.84	25	71.00	2
Developing alliances with other relevant trade associations & interest groups	2.48	25	62.00	3
Greater, more timely input into governmental policies & regulations that affect aquacultural production & marketing	1.67	24	40.08	4

<sup>a</sup> Respondents were requested to rank each function from most important (1) to least important (4). Through a recoding procedure, these values were changed so that most important = 4 and least important = 1.

<sup>b</sup> The preference index provides a way to weight the mean scores by number of responses. It is computed by multiplying mean score by number.

Regulations can be dictated by policy makers who may have little understanding of the industry (this can present sizable problems to producers and marketers), or they can be developed with input from producer groups. One way an industry can influence proposed policies is to have its own "in house" standards in place. (These standards need to address substantive issues of quality and safety which are of concern to the market.) Often such "in house" regulations and standards can be adopted by policy makers, or at least used as a starting point from which compromises can be made.

Another example of the need for industry involvement with policy makers is the desire producers expressed for more promotion to expand markets. Funding such promotion in a generic sense can often be done, at least in part, by the public sector. The public sector, like other entities, pays attention to groups representing an identifiable, common base. By developing information on current industry size and geographic distribution, the Texas Crawfish Farmers Association could document the significance of the industry.

Working within the public sector can be accomplished in a number of ways. The level of funding usually determines the approach, but not necessarily the outcome. Trade associations which are not well funded should strive to convey objective information about their industry to policy makers. By becoming an information source, such trade associations can initiate dialogue between their members and the various agencies or legislators with whom rests the capacity to control operations. Establishing the industry itself as the definitive information source can help ensure that policy decisions will not be based on misconceptions, perceptions or emotions.

## REVIEW AND CONCLUSIONS

### Current Conditions

All information reported in this survey is from the November 1987-June 1988 season. According to the survey, 80 percent of current crawfish producers have been in business 3 years or less. This short tenure is a major factor influencing all subsequent data, and suggests that the Texas crawfish industry is quite young.

Current producers cumulatively reported 1,610 acres in crawfish production, with 84 percent of the acreage in Chambers, Jefferson, Liberty and Orange counties. Despite limited tenure in crawfish aquaculture, these operators expect to add an additional 484 acres to crawfish production over the next 2 years, a 30 percent increase over current levels.

Entry into crawfish farming has primarily been funded through internal means. This financing pattern suggests the following: a) crawfish producers currently own or lease land which has some existing infrastructure for holding and moving water; b) crawfish aquaculture may have been initiated as a way to diversify the farming operation rather than as a stand alone enterprise; and c) the financing method has resulted in a segmented plan of development. While financing through internal means has reduced perceived financial risk, it *may* have created a tendency to focus on the cash flow significance of decisions rather than the economic returns of the enterprise.

Crawfish aquaculturists quickly became aware of two conditions within the marketing system unique to crawfish: a) the fact that crawfish production, unlike other aquacultural enterprises, requires periodic trapping over the season, thus necessitating persistent marketing of output; and b) the lack of existing systems with which to distribute live crawfish. These two limitations suggest that a significant investment of time is needed to market crawfish and that this necessary commitment may be in direct competition for the time needed for production activities or other enterprises.

In the 1987-88 season Texas crawfish farmers sold 58 percent of total marketings (498,910 pounds) to various types of customers who traveled to the farm. All consumer sales, and 84 percent of sales to mid-level handlers, were made at pond side. However, 42 percent of total marketings required that producers make deliveries. Seventy-three percent of sales requiring deliveries were made directly to retail interests (food service establishments, food retailers and specialty shop operators). Distribution of live crawfish to these customers requires frequent, periodic deliveries of small quantities, since retail interests have limited storage space and difficulty estimating demand for select items. Also, aquatic products have a relatively short life once removed from the water.

Once producers initiated delivery services they incurred a cost of goods sold (COGS) equal to their production cost. The difference between sales revenue and COGS must cover the variable expenses (determined by the vehicle characteristics and the delivery route) and contribute toward the fixed expenses of vehicle ownership, making sales calls and management time. To be profitable, a distribution enterprise requires careful planning so that delivery equipment size is appropriate to route demands and minimum prices and volumes for each route are determined. The dynamics of sales variation, customer inconsistencies and turnover, as well as downward pressure on crawfish price as the season progresses, require continual management to evaluate and maintain route profitability. Timely management informa-

tion and specialized management skills are required to succeed with physical distribution activities.

Based on the 1987-88 season, 72 percent of respondents indicated that crawfish aquaculture contributed 1 percent or less to their total livelihood. The aforementioned conditions (the incremental approach to financing with apparent emphasis on cash flow rather than economic performance, the implication that crawfish aquaculture was one of several enterprises all requiring management time, a weak or nonexistent distribution system, and relatively inexperienced producers) collectively suggest the reasons for the negligible contribution to livelihood.

## Marketing Considerations

At least 58 percent of Texas crawfish is purchased at the farm by a mix of consumers, various retail interests and mid-level handlers. Based on this rough distinction between local vs. distant demand, Texas crawfish farmers produce more than can be sold locally. As a result, producers have vertically integrated into physical distribution of crawfish which cannot be sold at the farm.

Respondents indicated that market development activities were the most pressing obstacle. Regardless of the approaches taken to develop new outlets (i.e., diversification of a customer base in existing markets or creating demand in distant areas) two changes in the way business is conducted will be required. These changes are: a) the need for enforceable product standards; and b) the need for more efficient distribution systems. These changes are logically linked to the goal of market expansion.

Developing new markets in distant areas will require group commitment, with the level of commitment proportionate to the size of the market being explored. This arrangement will be necessary until enough operations have production capable of individually satisfying marketplace requirements. Opting for this approach raises a number of other related issues, each of which needs to be addressed if market development activities are to be successful. Furthermore, implementation of a strategic plan will only result in long-term benefits. In fact, the execution of such a plan may initially cost more than it earns due to low volumes distributed and losses from spoilage or death. The uncertainties of producer commitment to cooperative ventures may also be a factor in the economic success of product pooling arrangements.

Market development requires the application of specialized skills. That is, producers will focus on production, and marketing and distribution will be

completed by a marketing firm, perhaps one which is producer owned. Once some level of specialization occurs, more formalized, objective means of insuring quality will be required. The only way this can occur is through the application of standards which reflect minimum market requirements. Once these standards are agreed upon, they will be the basis for acceptance of the product. Through this approach, new markets will be insulated from inconsistent or unacceptable quality and will become loyal to Texas farm-raised crawfish.

With expansion of crawfish demand, products will move greater distances. This will necessitate the pooling of farm output (through the application of objective product quality standards) and the use of distribution equipment capable of handling larger gross weights. Producers may use common carriers or perhaps their own trucks. Specialized skills will be required to manage this distribution function.

## Outlook

The rising cost of water was perceived as the most critical water use obstacle, while government control and allocation of water generally was not considered a problem. Rankings in the production management

section suggest that producers are interested in intensifying production, since crawfish nutrition and drain harvest technology were the top ranked interests. The concern over rising water costs bears this out, since intensification is usually the management strategy implemented when fixed costs increase.

In terms of trade association issues, producers highlighted the formation of purchasing and/or supply cooperatives as the most important concern. This could be viewed as a desire for specialization on the part of industry. As a group, producers would also like more input into research and educational activities undertaken on their behalf. Working with the public sector to guide policy development was rated significantly lower than other trade association issues, perhaps suggesting an urgency in generating individual profits from crawfish aquaculture before other, long-term issues are addressed.

The establishment of individual, short-term profit goals, followed by the more long-term objectives associated with helping to formulate public policies, appears to be the path the industry wishes to take. While these strategies seem mutually exclusive, both can be approached simultaneously either by individual producers or collectively through trade association(s).

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## EPILOGUE

In the interval between the initial mailout of this survey and the completed analysis of the responses received, several events took place which have changed the industry from the way it is pictured in this report. These changes involve: a) cooperative marketing ventures among a fairly large number of Texas growers; and b) a contractual commitment by a large grocery chain to purchase notable quantities of Texas farm-raised crawfish on a consistent basis at a constant price throughout the growing season. Although neither joint marketing nor retail food store sales are new occurrences, the number of independent producers involved and the volume delivered at a constant price throughout the growing season is indicative of an important trend. By integrating production, supply agreements, product standards, brokerage and delivery, this emerging industry has

made important strides toward the mainstream of seafood marketing and distribution.

These steps will likely lead to expanded opportunities for Texas crawfish farmers and food retailers. And consumers will enjoy the advantages of price stability and crawfish availability at major metropolitan grocery outlets. With such pre-season agreements, farmers can be less concerned with where and at what price they can sell their crawfish, and have time to concentrate on production profitability.

Admittedly, this marketing strategy possesses inherent risks and may not benefit all producers or producer/marketers. However, it may be a viable option for those seeking to establish predictable cash flows and/or solid markets for their crawfish.

## End Notes

<sup>1</sup> There are two benefits of such a test. First, in subsetting the data according to the rules of hypothesis testing, certain factors which affect performance can be distinguished. An example of such a factor could be location (i.e., regions which have surplus surface water at low cost, or are near feed mills, processing facilities, retail centers, etc.) Studying these independent variables may indicate corridors along which industry growth could occur. The second benefit of subsetting into more homogeneous clusters is that variation in the subsetted data may be reduced. This relatively low variation in sample data allows more accurate predictions with a more focused range.

<sup>2</sup> Statewide production was computed by multiplying reported average per acre production by acres in production.

<sup>3</sup> In most other aquacultural enterprises, production per acre is a key measure of effectiveness and a precursor of economic performance. Other aquacultural enterprises usually harvest by draining or seining ponds, thus removing most, if not all, inventory in a short time (usually 2 or 3 days). However, crawfish are harvested by periodic trapping. Because harvesting cost can be a large percentage of total production cost in crawfish aquaculture, harvesting can be influenced by numerous physical, economic and market conditions. For example, if the market price drops below the producer's perceived breakeven point, he will probably curtail harvesting, thereby reducing production. Likewise, in the early season cold weather restricts crawfish production even though trapping occurs. Finally, since crawfish ponds are typically self replenishing from one year to the next, some producers may curtail harvests to insure adequate production in subsequent years. Therefore, in the crawfish industry per acre production may not be an accurate measure of production management effectiveness. Perhaps a better measure would be catch per unit of effort, similar to that used in the commercial fishing industry.

<sup>4</sup> Capital expenses and operating budget needs for crawfish can be determined using "Aquacost," a coded program (requiring a personal computer) distributed through the Texas Agricultural Extension Service.

<sup>5</sup> Producers were asked the quantities of crawfish sold to various customer types, whether these sales were delivered by the producer or picked up at the farm by the buyer, and whether these sales were of purged or unpurged animals. This question was presented so that respondents could: a) list the quantities sold to each of nine different customer types; b) check the one most common distribution method for each customer type; and c) check the purged or unpurged category for each type of customer: These "check" marks became 0/1 variables for allocating quantity sold to each customer type by delivery and market form categories. Therefore, if a hypothetical producer reported selling 10,000 pounds to consumers and a check was placed in the buyer pick up category, then 10,000 pounds (10,000 x 1) were noted as being marketed with no distribution services to consumers and 0 pounds (10,000 x 0) were recorded as requiring delivery to consumers. If a respondent did not indicate the poundage sold to a particular customer type, then delivery method and market form variables became meaningless since poundage is the other multiplicand. Therefore, total marketings do not equal computed production for several reasons. First, some respondents omitted, or did not completely answer, the marketing questions. For example, marketing data from 252 acres is missing. Second, total production is computed by multiplying reported average production per acre by acres in production. This value may be different from the actual quantity marketed due to a preference in the market for a certain size of animal, the lack of a market for all production at certain times of the year, or a combination of these conditions.

<sup>6</sup> The most important obstacle was rated 1, and the least important was rated 6. Through recoding at the data validation step, these values were transposed so that the more important the obstacle the higher the value. Therefore, the most critical obstacle was recoded to a value of 6. Once the rankings were recoded, a preference index was computed whereby mean and number (frequency of response) would provide the weights to develop a composite score. In other words, this index was required to account for the situation where only 1 or 2 respondents ranked a particular obstacle very high, but other respondents left this issue blank. Without an index to reflect the importance of frequency of response, minority and majority positions would have equal footing, leading to erroneous conclusions.

<sup>7</sup> Often, the effect of supply on localized demand is not felt at all levels of the marketing system. For example, the concept of farmers' markets has been suggested as a means of circumventing more traditional marketing practices.

<sup>8</sup> Access to proper holding facilities may be of concern in controlling death loss and in protecting public health by selling live animals which remain viable until consumed. A holding facility which could simultaneously address both issues could be some type of portable purging facility capable of filtering and

sterilizing recirculated water which is continuously chilled and oxygenated.

<sup>9</sup> Many agricultural producers fund these activities through a checkoff program whereby a percentage of sales is retained for industry-wide promotional activities. Beef, milk, Scottish pen-raised salmon and Mississippi farm-raised catfish are examples of industries that combine quality assurance programs with promotional activities funded via producer check-off programs.

<sup>10</sup> The same procedure detailed in note 6 was used.

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## Appendix

### TEXAS CRAWFISH AQUACULTURE

#### Determining Current Industry Practices, Conditions, and Ideas for Future Growth

This survey is a step toward understanding more about crawfish aquaculture in Texas. The information which you provide will help in communicating the economic significance, operating characteristics, and needs of this industry to policy makers, educational groups, members of the financial community and others interested in crawfish aquaculture development. Please answer all questions. If you wish to comment on any question, or qualify your answers, please feel free to use the margins. Your comments will be read and taken into account.

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#### References

Please return this questionnaire to: Marine Advisory Service, P.O. Box 158, Port Aransas, Tx 78373.

Q-1 Are you currently involved in producing farm raised crawfish in Texas? (Circle one)

- 1 YES If YES, please answer the following questions.
- 2 NO If NO, please STOP. Since you do not produce crawfish in Texas you do not need to answer any more questions. However, please return this survey in the post paid envelope. Thanks!

Q-2 To be successful, the crawfish aquaculture enterprise requires land and water, efficient production management practices, and proper marketing. Various statements dealing with water, production practices and marketing are presented below. Some of these statements may represent genuine obstacles in your crawfish business while others may not be so troubling to you. Please rank these statements based on how you feel each impacts upon your crawfish business. Let 1 = the greatest obstacle, 2 = the second greatest obstacle, 3 = the third greatest obstacle, etc.

(NOTE: Please rank all of the statements in all three categories)

#### A. WATER USE AND MANAGEMENT

- \_\_\_ a. ON FARM WATER USE MANAGEMENT
- \_\_\_ b. GOVERNMENT REGULATION AND ALLOCATION OF WATER
- \_\_\_ c. CONTROL OF WATER QUALITY
- \_\_\_ d. RISING COSTS OF OBTAINING WATER

**B. PRODUCTION MANAGEMENT PRACTICES**

- a. PREDATOR/DISEASE CONTROL
- b. POOR UNDERSTANDING OF CRAWFISH NUTRITIONAL NEEDS
- c. LIMITED AVAILABILITY OF SEED STOCK OR BREEDING STOCK
- d. REGULATORY ISSUES SUCH AS LICENSING AND PERMITTING
- e. THE NEED FOR A MORE EFFECTIVE AND COST EFFICIENT HARVESTING TECHNOLOGY (drain harvest vs. trapping)
- f. INADEQUATE FINANCING FOR EXPANSION OR DEVELOPMENT OF CRAWFISH AQUACULTURAL VENTURES

**C. PRODUCT MARKETING**

- a. SEASONAL OVERSUPPLY OF CRAWFISH
- b. UNDERDEVELOPED MARKETING OPPORTUNITIES
- c. INADEQUATE PROMOTION OF FARM RAISED CRAWFISH
- d. LACK OF SUITABLE IN-STATE PROCESSING FACILITIES
- e. INEFFICIENT OR INADEQUATE PRODUCT DISTRIBUTION OPTIONS
- f. LACK OF "ENFORCEABLE" PRODUCT QUALITY STANDARDS BY EITHER THE PUBLIC SECTOR OR APPROPRIATE TRADE ASSOCIATIONS (i.e. purging, sizing, pack style, etc.)

Q-3 The crawfish farming industry can involve itself in a number of issues on behalf of its membership. Several options are outlined below. These are placed in two major groups: trade association issues and production and marketing issues. Some of these ideas may generate major improvements for firms in the industry while others may have limited positive impact upon industry growth and profitability.

Please rank each of these statements based on how you feel it would positively influence your individual profitability and continued business growth. Let 1 = most important, 2 = second most important, 3 = third most important, and 4 = least important.

(NOTE: Please rank all of the statements in both categories)

**A. TRADE ASSOCIATION ISSUES**

- a. GREATER INPUT INTO RESEARCH AND/OR PRODUCER EDUCATION PROGRAMS CARRIED OUT BY PUBLIC INSTITUTIONS (i.e., Texas Agricultural Extension Service, Texas Agricultural Experiment Station, Soil Conservation Service, etc.)
- b. GREATER, MORE TIMELY INPUT INTO GOVERNMENTAL POLICIES AND REGULATIONS THAT IMPACT AQUACULTURAL PRODUCTION AND MARKETING
- c. FORMATION OF CRAWFISH FARMER COOPERATIVES WHICH DEAL WITH EITHER PURCHASING OR MARKETING
- d. DEVELOPING ALLIANCES WITH OTHER RELEVANT TRADE ASSOCIATIONS AND INTEREST GROUPS

**B. CRAWFISH PRODUCTION AND MARKETING ISSUES**

- \_\_\_ a. DEVELOPMENT OF PRODUCT STANDARDS THAT ARE SUPPORTED BY CRAWFISH FARMERS (sizing, purging, grading, etc).
- \_\_\_ b. DEVELOPMENT OF A COMPREHENSIVE PRODUCT PROMOTION PLAN (which could include consumer publications, billboards, newspapers, radio and TV advertising, point-of-sale materials, media events, and tours, and would require the identification of funding strategies to implement the plan such as producer checkoffs, sponsorship of money generating events, etc.)
- \_\_\_ c. DEVELOPMENT OF A STANDARDIZED REPORTING SYSTEM TO ASSESS THE CURRENT STATUS OF THE CRAWFISH INDUSTRY FOR USE BY LENDERS, POLICY MAKERS, ETC. (This would require periodically collecting data on production, acreage, yields, market statistics, number of producers, etc.)

The next question addresses your crawfish marketing program. The types of customers you serve, whether you provide delivery services, and the market form of the crawfish which you sell to these customer types are all important information.

**Q-4** In column A, please indicate approximately the pounds of your **total crawfish harvest** that you marketed during the 1987 -- 1988 crawfish farming season (Nov. '87 -- June '88) to the various customer types listed below. Also, please place a check mark in the appropriate box of section B to indicate the **one** most commonly used distribution method used for each of your customer types and a check in the appropriate box of section C to indicate the **one** most common market form sold to that customer type, i.e., purged or unpurged.

(Note: Be sure to indicate the approximate poundage which each customer type purchased, the one most common distribution method used to serve that customer type, and whether you commonly sell them purged or unpurged animals.)

For Columns B & C, check the one appropriate category for each customer type you selected in Column A.

**A. POUNDS SOLD LAST YEAR 11/87--6/88**

**B. MOST COMMONLY USED DISTRIBUTION METHOD**

**C. MOST COMMON MARKET FORM**

		CUSTOMER PICKS UP	I DELIVER	PURGED	NOT PURGED
___ lbs.	a. CONSUMERS	_____	_____	_____	_____
___ lbs.	b. RESTAURANTS	_____	_____	_____	_____
___ lbs.	c. CATERERS	_____	_____	_____	_____
___ lbs.	d. PROCESSORS	_____	_____	_____	_____
___ lbs.	e. FOOD BROKERS	_____	_____	_____	_____
___ lbs.	f. WHOLESALERS	_____	_____	_____	_____
___ lbs.	g. SEAFOOD SHOPS	_____	_____	_____	_____
___ lbs.	h. SUPERMARKETS	_____	_____	_____	_____
___ lbs.	i. BAIT DEALERS	_____	_____	_____	_____

Q-5 The expenses required to produce, harvest, and market an aquacultural crop are important to document, both for internal control and profit planning purposes as well as demonstration of financial needs to lenders or investors. Please indicate your approximate expenses in dollars for each of the four categories for last year's crawfish farming season (Nov. 1987 - June 1988).

(Please note: Please remember that this is a confidential survey, and that your information will be combined with others to develop a sketch of the Texas crawfish industry.)

'87--'88

Season's  
Total Cost  
(in dollars)

- \$ \_\_\_\_\_ a. PRODUCTION (including forage cultivation, pond and equipment depreciation, repairs and maintenance on farming equipment, water (if purchased), utilities, interest, and farm labor)
- \$ \_\_\_\_\_ b. HARVEST (including bait, harvest labor, traps, repairs and maintenance on harvest equipment, depreciation of harvest equipment, packaging)
- \$ \_\_\_\_\_ c. MARKETING/DISTRIBUTION (including advertising, promotion, development of new business, driver pay, repairs and maintenance to delivery equipment, depreciation of delivery vehicles)
- \$ \_\_\_\_\_ d. MANAGEMENT (including your salary and other outside management expertise which you may employ for *crawfish aquaculture*)

Q-6 Approximately, what percentage of your total livelihood (i.e., personal family living requirements, personal savings and investment programs, etc.) during the 1987--1988 crawfish farming season came from the following categories?

(Please specify in percentage terms)

- \_\_\_\_\_ % FROM CRAWFISH AQUACULTURE
- \_\_\_\_\_ % FROM OTHER ON-FARM AGRICULTURAL ENDEAVORS
- \_\_\_\_\_ % FROM OFF-FARM (NON AGRICULTURAL) ENDEAVORS (outside employment, spousal employment, pensions, investments, royalties, etc.)

From an industry development perspective, it is important to know how aquacultural projects are financed. The next two questions break out capital financing projects and annual operating budget needs. Please answer both questions.

Q-7 Please indicate the **one** major source for the initial development and construction of your crawfish aquaculture facility (funds which were used for construction of ponds or purging facilities, purchase of specialized equipment, etc.).

(Circle one)

- 1 PRODUCTION CREDIT ASSOCIATION
- 2 FARMERS HOME ADMINISTRATION
- 3 COMMERCIAL BANKS
- 4 FEDERAL LAND BANK
- 5 OUTSIDE INVESTORS
- 6 PERSONAL RESOURCES

Q-8 Please indicate the **one** major source for last year's crawfish operating loan (funds which were used for bait, forage cultivation, labor, utilities, repairs and maintenance).

(Circle one)

- 1 PRODUCTION CREDIT ASSOCIATION
- 2 FARMERS HOME ADMINISTRATION
- 3 COMMERCIAL BANKS
- 4 OUTSIDE INVESTORS
- 5 PERSONAL RESOURCES

Q-9 Do you currently operate a crawfish purging facility in conjunction with your farming operation?

(Circle one)

- 1 NO If NO, please skip to Q-10 and continue.
- 2 YES If YES, please answer the following before continuing.

Q-9A What is the maximum holding capacity of your purging facility?  
(Please specify in live weight pounds).

\_\_\_\_\_ live weight pounds

Q-9B On average, how long do you allow animals to remain in your purging facility?

(please specify in hours)

\_\_\_\_\_ hours

Q-9C Being able to hold large quantities of crawfish after they are trapped has several advantages. Please rank the importance of each purging function to you on a scale of 1 to 4. Let 1 = most important, 2 & 3 = second and third most important and 4 = least important.

RANKING

- a. WAREHOUSING THE PRODUCT UNTIL SOLD  
\_\_\_\_\_
- b. EXTENDS THE LIFE OF THE ANIMAL  
\_\_\_\_\_
- c. ENHANCES TASTE, TEXTURE AND VISUAL APPEAL  
\_\_\_\_\_
- d. EFFECTIVE WAY OF DISPLAYING INVENTORY TO THE BUYING PUBLIC WHICH ENHANCES ON-FARM SALES  
\_\_\_\_\_

Q-10 How many acres of ponds did you have in crawfish production during the 1987--1988 crawfish farming season?

\_\_\_\_\_ surface acres (only impounded acreage excluding levees)

Q-11 Are you planning to change the acres you currently have in crawfish production within the next two years?

(Circle one)

- 1 NO If NO, please skip to Q-12 and continue.
- 2 YES If YES, Please answer the following before continuing.

Q-11A Are you planning to increase or decrease the acreage you currently have in crawfish aquaculture?

(Circle one)

- 1 INCREASE
- 2 DECREASE

Q-11B How many acres are you planning on adding or removing from your crawfish aquaculture operation?

\_\_\_\_\_ surface acres (only impounded acreage excluding levees)

Q-12 During the 1987--1988 crawfish farming season, approximately how many **pounds** of crawfish on average did you produce on a per surface acre basis?

\_\_\_\_\_ pounds per surface acre

Q-13 How many years have you been **commercially** producing crawfish?

\_\_\_\_\_ years

Q-14 In which county (or counties) do you currently farm crawfish?

(Please list)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Q-15 Do you currently belong to any fisheries, seafood or aquaculture trade associations?

(Circle one)

1 NO If NO, please STOP.

2 YES If YES, please answer Q-15A.

Q-15A Which of the following trade associations are you a dues paying member of?

(Please check all that apply)

- a. TEXAS OYSTER ASSOCIATION
- b. TEXAS CRAWFISH FARMERS ASSOCIATION
- c. TEXAS SHRIMP ASSOCIATION
- d. P.I.S.C.E.S.
- e. NATIONAL FISHERIES INSTITUTE
- f. SHELLFISH INSTITUTE OF NORTH AMERICA
- g. NATIONAL BLUE CRAB INDUSTRY ASSOCIATION
- h. TEXAS AQUACULTURE ASSOCIATION
- i. WORLD AQUACULTURE ASSOCIATION
- j. AMERICAN FISHERIES SOCIETY
- k. SOUTHEASTERN FISHERIES ASSOCIATION
- l. LOUISIANA CRAWFISH FARMERS ASSOCIATION
- m. OTHER(S) please list

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If there are any other comments you may have about the educational advancement, developmental opportunities and/or the obstacles in crawfish farming, the future of aquaculture trade groups or the general welfare of fish and shellfish farming in Texas, please use this space for that purpose.

Your contribution to this effort is certainly appreciated. Please use the pre-addressed, postpaid envelope to return this questionnaire. If you would like to receive a copy of the survey results, please complete the post card which is also postpaid and pre-addressed.

Thanks!



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