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**AQUACULTURE SITUATION AND OUTLOOK REPORT
PROJECT FOR THE NORTH CENTRAL REGION**

By

Jonathan Charles Ferris

A THESIS

**Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of**

MASTER OF SCIENCE

Department of Fisheries and Wildlife

1996

ABSTRACT

AQUACULTURE SITUATION AND OUTLOOK REPORT PROJECT FOR THE NORTH CENTRAL REGION

By

Jonathan Charles Ferris

Aquaculture is defined as the farming of aquatic plants and animals. In the United States, aquaculture is the fastest growing area of agriculture. Despite this fact, little primary data concerning aquaculture is currently being collected on a regular basis. Most of the growth of the U.S. aquaculture industry has been in the last 10-15 years. In the 1980s alone aquaculture production more than doubled and by 1993 reached an estimated production of 716 million pounds.

The success of future development in the industry is dependent on careful analysis of technical, institutional, and economic factors. Unfortunately, such analysis is currently impossible due to a lack of consistent primary data collection. In order to collect such data in the north central region a mail survey was developed.

Three states were used to test the survey: Illinois, Indiana, and Michigan. This report examines the means and processes utilized to create and distribute the survey, as well as analyze the results. Based upon the results of the survey efforts in these states, recommendations are made regarding changes that should be made to the format of the survey itself, the way in which the survey should be administered, and how it should be used in conjunction with other information to generate a situation and outlook report for aquaculture in the North Central Region.

This work is dedicated to
my loving and patient wife, Pasha,
my Mother, Mary, and my late Father, Merrill.

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I would like to extend a special thanks to Liz Bartels, whose wealth of knowledge and freely given advice made the transfer to a new environment much easier. Her challenging discussions and unique perspectives were always administered with the understanding of mutual respect and friendship. I thank LaDon Swann and Dr. Joseph Morris for their efforts in the development and distribution of the survey. I would also like to thank Ralph Gann and Linda Lawson at the Indiana Agricultural Statistics Service for all of their efforts in distributing and analyzing the surveys in Indiana and Illinois.

I thank my Aunt and Uncle Drs. Jake and Maxine Ferris for their love and support, as well as for their virtual adoption of my wife and myself during these past two years. I thank my loving wife, Pasha, who gave up everything to follow me to Michigan State, and whose selfless sacrifices made my dreams a reality. Her unwavering support and faith in me made all of this possible. I will be forever indebted to her. Finally, I thank my Lord and Saviour Jesus Christ, in whom all things are possible.

PREFACE

The intent of this project was to produce a thesis that would identify the means and processes necessary to collect and analyze aquaculture data in the north central U.S. It was deemed that the most appropriate way to collect such data in the north central region, or NCR, was a mail survey. Three states were used to test this survey: Illinois, Indiana, and Michigan. This thesis examines the development, administration, and results of this survey effort and is divided into three primary sections: introduction, survey, and recommendations.

The Introduction examines the history and current status of the U.S. aquaculture industry, as well as factors that have contributed to its growth. This section also sets forth the need for aquaculture data collection, and discusses several caveats and limitations inherent to data collection efforts in the NCR.

The Survey section is divided into four sub-sections: development, administration, results, and discussion. The development and administration sub-sections follow the survey process from beginning to end. The results and discussion sub-sections examine each of the survey's 11 sections.

Finally, the Recommendations section discusses changes that should be made to the format of the survey itself, the way in which it should be administered, and how it should be used in conjunction with other information to generate a situation and outlook report for aquaculture in the NCR.

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INTRODUCTION

Aquaculture is defined as the farming of aquatic plants and animals. Activities commonly associated with this term include the production of popular fish and shellfish, such as catfish, trout, shrimp, and clams. However, the aquaculture industry in the United States is much more diverse than this, and includes everything from the rearing of tropical aquaria fish, to the production of aquatic plants for food, pharmaceutical, biomedical, and ornamental purposes. In the U.S., aquaculture is the fastest growing area of agriculture (Joint Subcommittee on Aquaculture, 1993). In spite of this fact, aquaculture has not always been considered by many to be an actual form of agriculture. Efforts to define aquaculture as agriculture in the 1996 federal Farm Bill were defeated when the definition was deleted during conference deliberations. However, some states (e.g., Illinois, Indiana, Michigan, Minnesota, Missouri, and Ohio) have recently passed legislation defining aquaculture as agriculture. Other states, e.g., Arkansas, Florida, Maryland, North Dakota, and Wisconsin, also consider aquaculture as agriculture, and are even starting to gather data and produce their own aquaculture reports, much like they would for other agricultural commodities.

Aquaculture is not a new practice. The Chinese have been practicing aquaculture for over 3,500 years (Stickney, 1994). Fishes in the carp family were first kept for pleasure, then raised for food (Brown, 1977). Other countries, such as Egypt and Japan have also practiced aquaculture for thousands of years. In Europe, fish farming began in

the 12th century in the eastern part of the continent, and by 1400 had moved across to England (Hickling, 1962; Lovell, 1989). In the U.S., aquaculture has been practiced since the 1830s (Parker, 1989). By the 1850s, farmers were experimenting with buffalo fish, bass, and crappie (Huner and Dupree, 1984). Most of the growth experienced by the U.S. aquaculture industry, however, has been in the last 10-15 years. During the 1980s, U.S. aquaculture production more than doubled and by 1993 reached an estimated 716 million pounds, with a farm gate value of over \$809 million (USDC, NOAA, NMFS, 1995). This is compared to 1983 production, which was 308 million pounds with a farm gate value of \$261 million. Aquaculture accounts for approximately 181,000 jobs in the U.S. and its total economic impact has been estimated at \$5.6 billion annually (Dicks, et al., 1996).

Several factors have helped create a climate that is conducive to the growth of aquaculture in the U.S. Per capita consumption of fish and shellfish in the United States increased to 15.2 pounds in 1994, 0.2 pounds more than in 1993, and 29% above the 1970 mark of 11.8 pounds (USDC, NOAA, NMFS, 1995) (Figure 1). Another reason for the growth experienced by the aquaculture industry is the apparent inability of the commercial capture fishery to meet the demands placed upon it now and in the future. Many wild stocks are currently being harvested at or above sustainable yield levels and reached 101.4 million metric tons in 1993 (FAO, 1995). The ability of the world's oceans to support similar catches into the future is doubtful. Marine capture fisheries have been shown to be adversely affected by catches above 80 million metric tons per year (FAO, 1995). Currently, the U.S. meets its demand for seafood through imports. In 1994, the U.S. imports of edible fishery products totaled \$6.6 billion (Figure 2). Exports,

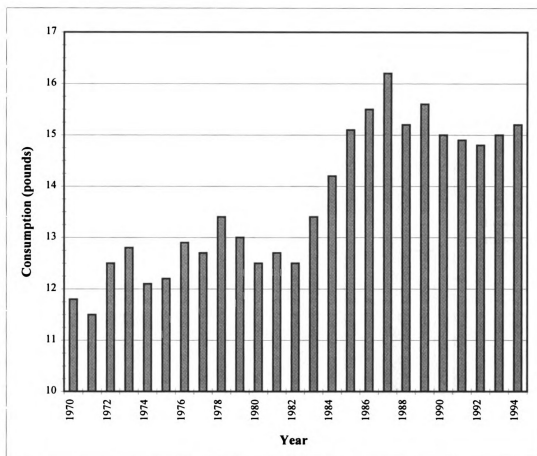


Figure 1. United States annual per capita consumption of fish and shellfish, 1970-94 (USDC, NOAA, NMFS, 1995).

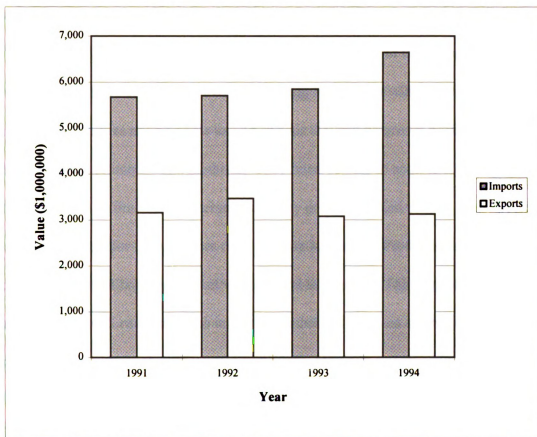


Figure 2. Value of United States edible fishery products imports and exports, 1991-94 (USDA, ERS, October 1995, LPD-AQS-2).

on the other hand, were only \$3.1 billion (USDA, ERS, 1995 [LPD-AQS-2]). Fisheries imports are the leading contributor to the U.S. trade deficit among agricultural products, and largest, after petroleum, among all natural resources products (Joint Subcommittee on Aquaculture, 1993). Domestic aquaculture can make a larger contribution to domestic fisheries production, thereby reducing pressure on commercial fisheries and offsetting costly imports.

In order for the aquaculture industry to take advantage of the currently favorable growth climate, there are a number of constraining factors that will have to be overcome. For example, growers must be able to find species that can be grown profitably with existing culture techniques and methods. They must be able to acquire sufficient operating capital to finance the operation and any permits needed to raise their species. Markets must exist for these species once they are harvested. Producers must have some understanding about how the market will respond to changing fish supplies. Changing market supplies will cause changes in the prices that are received by producers for the cultured species.

Successful enterprise planning and management requires that producers be able to formulate informed price expectations before each growing period. This information is important for those planning to expand or develop new aquaculture operations. Lack of basic economic information both at the farm and market level may impede development and growth of the industry. Future development must be undertaken carefully in order to maximize potential growth opportunities within the industry both across the nation and within the north central region, which will hereafter be referred to as the NCR. Species to be produced must be selected with great care, giving considerations to the technical,

institutional, and economic factors that may constrain or impede future development.

Unfortunately, projections and information needed to evaluate these factors do not exist for many of the species that might be of interest to producers in the NCR due to a lack of consistent, basic primary data collection. Currently, the only agency consistently collecting aquaculture data is the USDA's National Agricultural Statistics Service (NASS), in cooperation with their satellite agencies in the states. NASS is only collecting data for catfish and trout, two of the largest aquacultural industries in the U.S. It is unlikely that NASS will expand their survey efforts to include other species unless mandated by Congress, and given additional revenues to collect such data. They have already had to reduce the frequency with which they produce the catfish and trout reports due to budgetary restrictions.

Their survey efforts result in a high response rate (90% or better) due to the encouragement to participate that comes from the Catfish Farmers of America and the U.S. Trout Farmers Association. Processing reports for catfish are published monthly, sales reports are published once a year, and inventory reports are published quarterly. Trout reports are published once a year. States in the NCR that participate in these efforts are Michigan (trout), Wisconsin (trout), and Missouri (catfish and trout).

Regulatory issues also play an important role in determining the economic feasibility of an expanded aquaculture industry. Policy institutions can create both impediments and incentives for aquacultural producers. Public policy that concerns aquaculture generally can be classified as regulatory because of a state's interest in managing a common pool resource (fisheries and wildlife), commerce, and public health (environmental pollution and food safety). These issues generally can be divided into

three broad categories: (1) regulation of commerce in what are traditionally regarded as wildlife species, (2) regulation of environmental and health issues, and (3) in the NCR, specific Great Lakes issues such as competition with sport fisheries and commercially harvested free-ranging species.

If the U.S. aquaculture industry is to overcome all of these constraining factors, it must have strong national leadership and direction. Recognizing that the aquaculture industry cannot achieve full potential without such leadership and direction, in 1980 the U.S. Congress created an opportunity for making significant progress in aquaculture development by passage of the National Aquaculture Act (P.L. 96-362). This act addressed the importance of a strong domestic aquaculture industry and established the Joint Subcommittee on Aquaculture (JSA). The JSA is an interagency body that is chaired by the Secretary of Agriculture. It has numerous responsibilities and provides coordination and recommendations for federal aquaculture policy.

The Congress also amended the National Agricultural Research, Extension, and Teaching Policy Act of 1977 in Title XIV of the Agriculture and Food Act of 1980 (P.L. 97-98) by granting authority to USDA to establish aquaculture research, development, and demonstration centers in the United States in association with colleges and universities, state departments of agriculture, federal facilities, and non-profit private research institutions. Five such centers have been established: one in each of the northeastern, north central, southern, western, and Pacific regions. The mission of these centers is to support aquaculture research, development, demonstration, and extension education to enhance viable and profitable U.S. aquaculture which will benefit consumers, producers, service industries, and the American economy. The 1996 Federal

Agriculture Improvement and Reform Act (FAIR) (P.L. 104-127), otherwise known as the Farm Bill, has reauthorized the Regional Aquaculture Center program at \$7.5 million per annum.

In 1993, the North Central Regional Aquaculture Center (NCRAC) published an aquaculture situation and outlook report (Hushak, 1993). It was written to fulfill the desire of the NCRAC Board of Directors for a report of activities specific to this region's producers. It was hoped that the report would be beneficial to the aquaculture industry, extension personnel, researchers, legislators, policy makers, and potential investors. The report consisted of four components: an overview of the U.S. seafood industry; highlights from two surveys of retail, wholesale and other food distribution channels; results of a 1991 survey of producers in this region; and an overview of the policy status of each of the north central states.

Favorable response to the first report created a desire on the part of the NCRAC Board of Directors to have another situation and outlook report published. It was decided that a graduate student should generate the next report and produce a thesis identifying the means and processes necessary to collect and analyze the data that would be used to develop that and future reports. Due to a lack of primary data, except for some trout and catfish data, it was determined that the most effective way of gathering aquaculture data in the NCR was to use a mail survey.

There are many caveats and limitations inherent to any data collection effort regarding the aquaculture industry in the NCR. The aquaculture industry in this region is extremely diverse, and many unregulated growers/producers are hard to identify and solicit for data. Particularly problematic in this area are individuals who produce tropical

fish and aquatic plants. Growers who produce most other fish species are required to possess some type of permit, and obtaining lists of those individuals is much easier. Finally, there is a widespread lack of understanding on the part of many producers regarding the benefits of data collection.

Data collection can benefit producers in many ways. Collecting data fosters recognition of aquaculture as a vital economic industry, making it easier for producers to obtain financing. Data collection also helps create potential markets through increased public awareness of aquacultural products, and allows researchers to gain a better understanding of the problems facing the industry and tailor their research efforts to find solutions to these problems. Collected data can also be used to educate or persuade state and federal governments to pass legislation that is in the best interest of the aquaculture industry. Many producers fail to understand these benefits, and for this and other reasons are unwilling to participate in survey activities.

THE SURVEY

DEVELOPMENT

The mail survey was designed with the assistance of Mr. LaDon Swann, Dr. Joseph Morris, and Dr. Donald Garling. They are the aquaculture extension specialists in Indiana, Iowa, and Michigan, respectively. Development of this survey began with the examination of other investigations that had been previously conducted in the NCR, as well as in other regions of the country. Specific questions were then selected based on their relevance to the aquaculture production practices in the NCR. An initial survey was drafted and sent out to all extension specialists in the region for review (APPENDIX D). Specialists in four states: Iowa, Kansas, Missouri, and Wisconsin, distributed this early draft, which contained many of the same questions as the final draft but was much more lengthy due to a different format. Their comments and suggestions were then applied to the survey and appropriate revisions were made. The process of review and revision was repeated numerous times until all the parties involved were satisfied with the final survey instrument. Three states were used to test the survey: Illinois, Indiana, and Michigan.

The result of the extensive review and revision process was a survey tool that consisted of eleven basic sections (APPENDIX A). Section 1 dealt with production, and consisted of a species code list and a table. The species code list was created to prevent any confusion between species, and allow the respondents to abbreviate the species

names. The list contained 30 of what were determined to be the most commonly cultured species in the NCR. The respondents were also given an opportunity to write in the names of species that were not included in the list.

Section 2 contained ten questions that dealt with business management. The first nine questions required the respondents to provide some general background information concerning their operation. Included were questions relating to where fish were obtained, how many years the operation had been carried out, whether or not they owned a farm before starting their aquaculture business, etc. The last question asked the respondents to indicate which of the following activities they were involved in: fish production, capture of wild bait fish, fish wholesaler or live hauler, fee fishing, fish brokering, or "other." The respondents were also asked to indicate what percentage of their total sales came from each activity.

Section 3 contained five questions that dealt with economic issues. Respondents were asked to indicate how their operation was financed, what percentage of their total gross annual income came from aquaculture, and estimate the total value of sales from their aquacultural operation in 1995. Respondents were also asked to indicate how many employees they had as well as whether or not their sales covered their cash costs. If they indicated that their sales did cover their cash costs, they were asked if they felt this profit was adequate compensation for their time and money investment.

Section 4 attempted to collect information on what types of facilities the respondents utilized. To accomplish this, a simple table was used. Four facility types were included in this table: ponds, raceways, cages/net pens, and tanks. For each of these types the respondents were asked to indicate the number they used, if any, and an

appropriate measure of size. For ponds, this was total surface acres, for raceways and cages/net pens it was cubic feet, and for tanks it was gallons.

Section 5 contained five questions that related to marketing. Respondents were asked to indicate where they sold their product, whether or not they processed the product themselves, and whether or not they were members of a cooperative. They were also asked if they transported their fish to market themselves, and finally, they were asked to classify the demand for their product within a given year as constant, predictably fluctuating, or unpredictable.

Section 6 contained six questions that involved water quality. Respondents were asked to identify what water source(s) they utilized, their water use and flow rates, as well as any aspects of water quality they monitored. They were also asked to estimate how many times a year poor water quality reduced their production, and indicate where they discharged their effluent.

Section 7 contained four questions that addressed feeds and feeding practices. First, respondents were asked to indicate if they bought their feed from a local co-op or mill, shipped from the manufacturer, or from another source. Next, they were asked to indicate what type of feed they used: floating, sinking, or slow sinking. Finally, they were asked to indicate their annual feed usage, as well as how much they spent on feed.

Section 8 contained four questions that dealt with disease and wildlife problems that impact aquaculture. The first two questions asked the respondents to indicate how often their stock experienced diseases and where they obtained their fish health information. The third and fourth questions asked the respondents to indicate which agencies helped them with wildlife damage control and whether or not predation was a

problem for their operation. If they indicated that predation was a problem, they were asked to identify the predator type. Their choices were birds, mammals, or “other.”

Section 9 contained two questions that dealt with stock losses. The first question simply asked the respondents if they had any losses from their operation in 1995. If they indicated that they did, they moved on to question 2, which asked them what percentage of their total operation these losses constituted, as well as a dollar amount. The respondents were then asked to complete a table. The table asked the respondents to indicate the percentage of their total losses that came from the following causes: diseases, predation, poaching, escapement, poor water quality, and weather. A blank line was included for the respondents to write in their own cause, if it did not fall into any of the other categories.

Section 10 contained five questions that were unrelated to any of the other sections, and was thus entitled “Miscellaneous.” The first two questions dealt with membership in state or national aquaculture associations. The respondents were asked to indicate whether or not they were members, and if so, if they felt their membership had enabled them to increase their profits in any way. The third question asked them to predict their production levels in five years as higher, no change, or lower. The last two questions asked the respondents who they contacted when they needed to obtain additional information about aquaculture and how often they would be willing to complete a similar survey. This section was included so that individual states could customize the survey by adding questions they felt should have been included, or which dealt with specific issues in their states.

Finally, section 11 was left for comments. It consisted of approximately one-half page of empty space for the respondents to write in their own thoughts, feelings, ideas, complaints, etc. If they felt that they did not have enough room they were instructed to write on the back of the page.

ADMINISTRATION

Administration methods varied by state. In Indiana and Illinois names and addresses were provided to the Indiana Agricultural Statistics Service of those who were on a list possessing a fish haulers and suppliers license, some other type of aquaculture permit or license, or who were not on any list but were believed to be involved in aquaculture. The Agricultural Statistics Service then conducted the survey using the same methods that they employ for their other survey efforts. The initial mailing was made on February 14, 1996. The first page of each survey contained information in regards to the purpose of the survey, an assurance of anonymity and confidentiality, and basic instructions. Also located on the first page was a numerical code that was assigned to a specific producer. This allowed the statisticians to keep track of who had responded. Approximately three weeks later, the survey was mailed again to those who had not responded, and on March 25, telephone follow-ups were initiated.

In Michigan, the initial mailing was made on February 15, 1996. Surveys were mailed to individuals whose names appeared on the 1995 game fish breeders list. This list is published by the Fisheries Division of the Michigan Department of Natural Resources and contains the names of those individuals who possess a game fish breeders

license. Instructions and general information regarding the survey were included in a separate cover page (APPENDIX B). Also included with the survey were two envelopes, one slightly smaller than the other one. Participants were instructed to place their completed survey in the smaller envelope, which was blank, and then place that envelope in the larger one, which was pre-stamped and addressed. This envelope also included a numerical code in the lower left-hand corner that was assigned to a specific producer. Completed surveys were returned to the aquaculture extension specialist who placed the outer envelope with the numerical code in one box and the envelope containing the survey in another box. These were collected by someone else, thus creating a double-blind situation which prevented anyone from knowing from whom the individual surveys were received. Respondents were asked to return the surveys by March 15. Follow-up efforts began on March 22, with a postcard reminder being sent to those who had not yet responded (APPENDIX C). Following the guidelines recommended by Dillman (1978), the postcard included a tie to the previous letter, a thanks to early responders, a statement explaining why participation was important, and an invitation for a replacement survey. These aspects were included because they have been shown to improve response rates. The survey was mailed a second time on April 12 to those who had still failed to respond. The cover page was similar to the first follow-up postcard, and informed the producers that this would be their last chance to participate, as surveys were to be returned by April 26 (APPENDIX C).

After all follow up efforts had been completed, the data were entered and analyzed using the spreadsheet program Microsoft EXCEL[®]. For each state, four worksheets were created to tabulate the responses to sections 1 and 4, as well as questions

3 and 4 in section 7, and question 2 of section 9. The first worksheet recorded the number of producers raising each species, as well as the reported value for each species. The second worksheet recorded the total number and size of each facility type reported by producers. The third worksheet recorded the feed usage, as well as the amount of money spent on feed reported by each producer. Finally, the fourth worksheet recorded the value of losses reported by each producer, as well as the cause of loss. Once the data from each survey had been entered into the appropriate worksheet, the results of the remaining questions were entered into a separate spreadsheet. The number of respondents answering each question, as well as the particular answer to each question was recorded and reported both as a whole number and as a percentage of the total number of answers. These results are presented in tabular form in APPENDIX E. These results are recognized as being minimal, with many of the largest producers not participating, but do provide a starting point to learn from and improve on in the future.

RESULTS

A total of 403 surveys were distributed in Illinois, Indiana, and Michigan. Of these, 325 (81%) were either returned or completed through a telephone interview (Figure 3). Ninety-three (29%) of the 325 who responded indicated that they earned income from aquaculture in 1995; the other 232 (72%) indicated that they did not. Only those reporting an earned income are included in this report. The 93 summarized reports were divided almost evenly among the three states: 33 in Illinois, 31 in Indiana, and 29 in Michigan. However, not every respondent answered all of the questions.

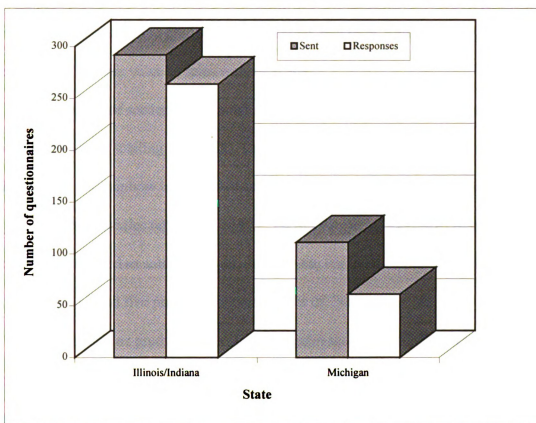


Figure 3. Total number of questionnaires sent and number of responses received, either by mail or telephone follow-up, by state, for the 1995 survey.

Section 1: Production

The directions that preceded the first section asked the respondent to write in a species code, identify which life stage was sold, and complete the production and value columns. The directions specified that only one row was to be completed for each life stage. The number of respondents correctly and thoroughly completing the columns dealing with life stages and production was limited, therefore, only data concerning the species raised and the value of sales were tabulated.

The results of section 1 are summarized in Table 1. The 33 Illinois producers reported 1995 sales totaling \$291,508. The top three species in terms of sales were fathead minnows, rainbow trout, and tilapia, respectively. These three species accounted for 58% of the total sales reported for 1995. Of the 30 species identified in the species list, 22 were reported as sold in Illinois. In addition, one producer reported sales of "other bait fish," and five producers reported sales of "other" species.

The 31 Indiana producers reported 1995 sales totaling \$785,727. The top three species in terms of sales were channel catfish, grass carp, and hybrid bluegill, respectively. These three accounted for 70% of the total sales reported for 1995. Indiana producers reported sales of 24 different species, with one producer reporting sales of "other bait fish," and five more reporting sales of "other" species.

The 29 Michigan producers reported 1995 sales totaling \$1,482,997. The top three species in terms of sales were rainbow trout, yellow perch, and brown trout, respectively. Together, they accounted for 60% of the total sales. Michigan producers reported sales of 17 different species, with one producer reporting sales of "other bait fish."

Table 1. Number of producers and total gross sales by species, 1995.

	Illinois		Indiana		Michigan	
	Producers	Value (\$)	Producers	Value (\$)	Producers	Value (\$)
Aquaria fish			3	6,500		
Bass, Hybrid Striped			4	7,075		
Bass, Largemouth			7	37,200	5	23,015
Bass, Smallmouth	10	11,735	4	2,100	1	NR ¹
Bluegill	3	500	7	12,690	2	NR
Bluegill, Hybrid	6	4,975	6	108,000	5	75,747
Carp, Grass	2	NR	8	112,900		
Carp, Koi	1	NR	8	16,500	2	NR
Catfish, Blue	3	33,225	2	NA ²		
Catfish, Bullhead	1	NA	2	10,200		
Catfish, Channel	19	17,390	22	327,456	3	31,350
Catfish, Flathead	1	NA	2	NA		
Crappie, Black	4	5,000	4	1,200	2	NR
Crappie, White						
Crayfish	9	24,054	4	NA		
Goldfish	1	NR	6	1,500	1	NA
Minnow, Fathead	6	80,450	8	84,000	4	53,750
Perch, Yellow	1	NR	5	250	5	143,840
Pike, Northern	2	NR			2	NR
Salmon, Atlantic						
Salmon, Chinook						
Salmon, Coho						
Shiner, Golden	2	NR	1	NA	1	NA
Sucker, White	1	NR				
Sunfish, Redear	1	NA	6	21,000	1	NA
Tilapia	4	35,350	9	19,356		
Trout, Brook			1	NA	7	45,260
Trout, Brown			1	NA	7	118,930
Trout, Rainbow	3	54,530	3	NA	20	881,030
Walleye	2	NR	3	6,600	4	77,800
Other Bait Fish	1	NR	1	NA	1	NR
Other	5	8,000	5	11,200		
TOTAL ³		291,508		785,727		1,482,997

¹ Not reported to protect confidentiality, included in total.

² Not available.

³ Includes species not reported singly.

Section 2: Business Management

Question 1 asked the respondents to identify if they raised fish, obtained fish and held them for resale, or brokered fish. They were asked to check all that applied. Of the 92 responses, 70 (76%) indicated that they raised fish, 51 (55%) obtained fish and held them for resale, and five (5%) brokered fish.

Question 2 asked the respondents to identify where they obtained their fish. They were provided with three possible answers and asked to check all that applied. Of the 92 responses, 58 (63%) raised their own, 45 (49%) obtained their fish from in-state sources, and 35 (38%) obtained them from out-of-state sources.

Question 3 asked the respondents if their current operation was their first aquaculture business venture. If they responded “no,” they were asked to indicate whether or not their first venture was successful. Of the 85 responses, 76 (89%) reported “yes,” it was their first operation, while nine (11%) indicated “no,” it was not. Of those who responded “no,” the results from Illinois were thrown out because while only one individual responded “no,” four answered the question as to whether or not their first venture was successful. Of the eight growers in Indiana and Michigan who responded “no,” seven (88%) reported that their first venture was successful, while one (13%) reported that it was not.

Question 4 asked the respondents to identify how many years they had an aquaculture business. They were provided with five ranges: 0-5 years, 6-10 years, 11-20 years, 21-30 years, and more than 30 years. Of the 92 responses, 34 (37%) reported 0-5 years, 14 (15%) reported 6-10 years, 16 (17%) reported 11-20 years, 19 (21%) reported

21-30 years, and 9 (10%) reported that they had carried out an aquaculture business for more than 30 years (Figure 4).

Question 5 asked the respondents to identify whether or not their operation was a family operation. In order to conserve space, it was decided not to go into further detail and explain what was meant by “family operation” in the survey. We assumed that the respondents would know that we were referring to whether or not they had other family members involved in the operation. Of the 92 responses, 65 (71%) indicated “yes,” it was a family operation, while 27 (29%) responded “no,” it was not a family operation.

Question 6 asked the respondents to indicate whether or not they took over an existing aquaculture venture. Of the 92 responses, 14 (15%) responded “yes,” and 78 (85%) responded “no.”

Question 7 asked the respondents to indicate whether or not they owned a farm before they started an aquaculture business. If they responded “yes,” then they were asked to identify which type of farm. They were given five farm types to choose from: hogs, dairy, beef, row crops, and “other.” They were asked to check all that applied. Of the 91 responses, 31 (34%) indicated “yes,” they owned a farm before they started an aquaculture business, and 60 (66%) indicated “no.” Of those who responded “yes,” eight (26%) raised hogs, five (16%) operated a dairy farm, 11 (35%) raised beef cattle, 18 (58%) grew row crops, and nine (29%) indicated “other.”

Question 8 attempted to identify what types of inputs, if any, producers are occasionally unable to acquire. The respondents were given four inputs: eggs, fingerlings, feed, and “other.” They were asked to check any of those inputs that they had

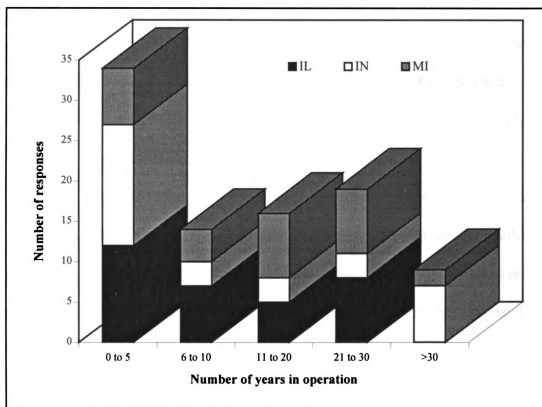


Figure 4. Aquaculture business age structure in Illinois, Indiana, and Michigan, 1995.

been unable to acquire when needed. Of the 35 that did respond, three (9%) indicated eggs, seven (20%) indicated fingerlings, ten (29%) indicated feed, and 19 (54%) indicated “other.”

Question 9 related to the tax status of the aquaculture operation. Respondents were provided with six options (sole owner, partnership, corporation, joint venture, affiliation with another company, and “other”) and asked which best described the tax status of their operation. Of the 91 responses, 59 (65%) indicated that they were the sole owner, seven (8%) indicated they were involved in a partnership, 18 (20%) indicated they were incorporated, two (2%) indicated they were a joint venture, none were affiliated with another company, and five (5%) indicated “other.”

Question 10, the last question in section 2, provided the respondents with six types of aquaculture activities (fish production, capture of wild bait fish, fish wholesaler or live hauler, fee-fishing, broker, and “other”) and asked them to identify which ones they were involved in by estimating the percentage of total sales that they derived from each activity (Figure 5). By examining how many operations derived the majority of their sales from each type of activity, it is possible to better classify the operations. Of the 88 responses, 54 (61%) derived the majority of their sales from fish production, three (3%) from the capture of wild bait fish, 14 (16%) from wholesaling or live hauling, nine (10%) from fee-fishing, two (2%) from fish brokering, and six (7%) from “other” sources.

Section 3: Economics

Question 1 asked the respondents to identify how their operations were financed. They were given four options: self, bank, family, and “other.” They were asked to check

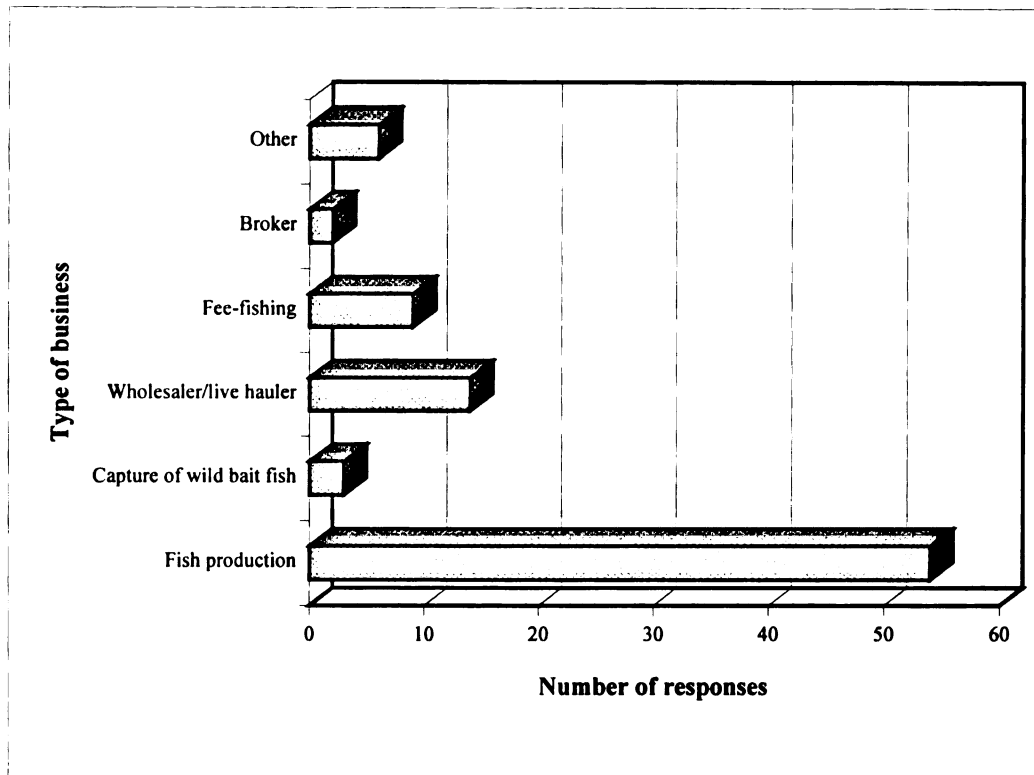


Figure 5. Number of respondents in Illinois, Indiana, and Michigan reporting the majority of their sales from each business type, 1995.

all that applied. Of the 90 responses, 71 (79%) indicated that they financed their operation themselves, 15 (17%) were financed through a bank, five (6%) were financed by family members, and 12 (13%) through “other” means.

Question 2 asked the respondents to identify what percentage of their total gross annual income was from aquaculture. They were given five ranges to choose from: 0-24%, 25-49%, 50-74%, 75-99%, and 100%. Of the 88 responses, 50 (57%) indicated 0-24%, 11 (13%) indicated 25-49%, 8 (9%) indicated 50-74%, 6 (7%) indicated 75-99%, and 13 (15%) indicated 100% of their total gross annual income was from aquaculture.

Question 3 asked the respondents to estimate the total value of sales from their aquaculture operation for 1995. They were given ten categories to choose from: less than \$2,500, \$2,500-\$9,999, \$10,000-\$24,999, \$25,000-\$49,999, \$50,000-\$99,999, \$100,000-\$249,999, \$250,000-\$499,999, \$500,000-\$749,999, \$750,000-\$999,999, and \$1,000,000 or more. Of the 90 responses (Figure 6), 27 (30%) indicated that their sales were less than \$2,500, 15 (17%) indicated sales between \$2,500-\$9,999, eight (9%) between \$10,000-\$24,999, seven (8%) between \$25,000-\$49,999, seven (8%) between \$50,000-\$99,999, 10 (11%) between \$100,000-\$249,999, three (3%) between \$250,000-\$499,999, one (1%) between \$500,000-\$749,999, none between \$750,000-\$999,999, and two (2%) reported sales of \$1,000,000 or more.

Question 4 asked the respondents to indicate the number of workers that were involved in the operation in addition to themselves. There were four different types of workers: paid full-time, paid part-time, unpaid or family help, and students (if they were an educator). They were asked to complete all that applied. Many respondents failed to

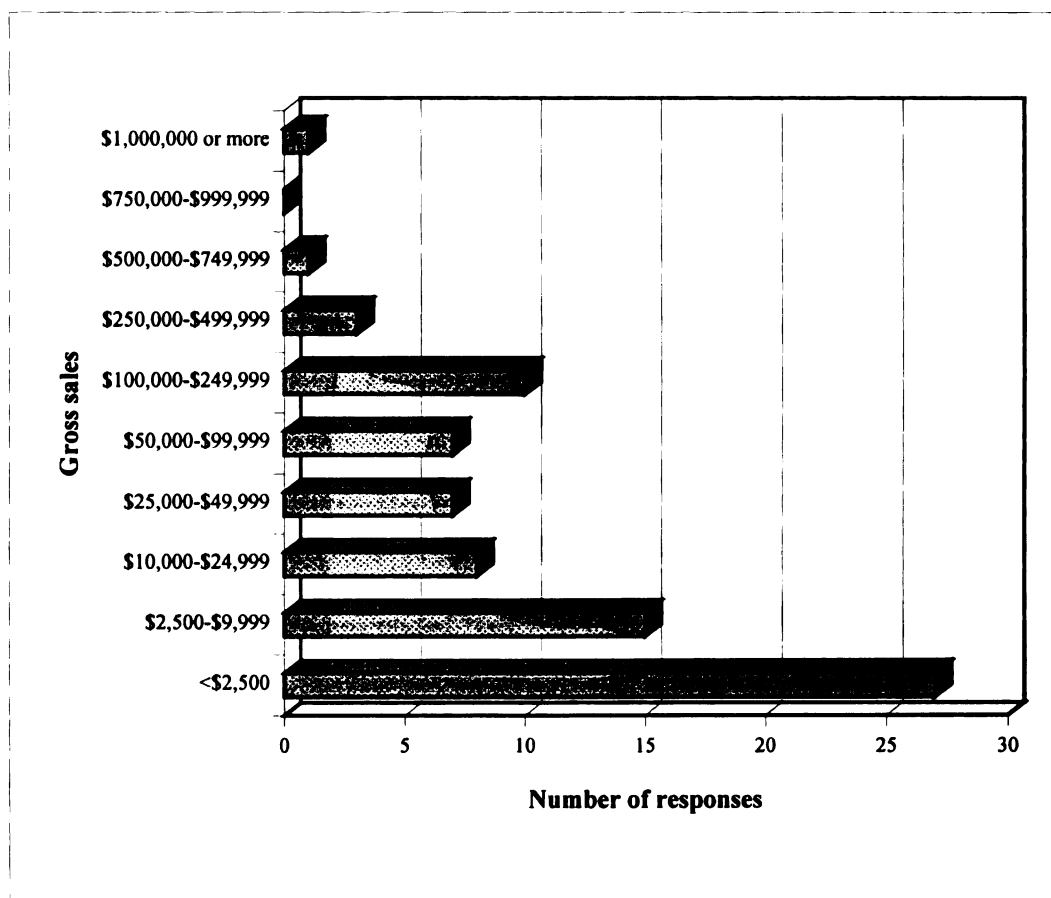


Figure 6. Distribution of gross sales by aquaculture operations in Illinois, Indiana, and Michigan, 1995.

complete the question properly, placing a check beside the type of worker instead of a number. As a result, it was impossible to get an estimate of the number of each type of worker. However, one can get an idea as to how many producers are utilizing each type of worker. Of the 69 responses, 29 (42%) employed paid full-time workers, 26 (38%) employed paid part-time workers, 33 (48%) utilized unpaid or family help, and four (6%) utilized student help.

Question 5, the final question of section 3, asked the respondents to indicate whether or not their sales covered their cash costs. It was noted that cash costs include all variable costs such as feed and electricity, as well as taxes, insurance, interest on loans, etc. If they responded “yes,” they were asked to indicate if they felt this profit was adequate to cover their time and money investment. Of the 89 responses, 60 (67%) responded “yes,” their sales covered their cash costs, while 29 (33%) responded “no,” they did not. Of those who responded “yes,” 22 (37%) felt this gross margin over cash costs was enough to cover their time and money investment, while 23 (38%) did not. The remaining 15 (25%) did not respond.

Section 4: Facilities

This section consisted of one question that took the form of a table in which the respondents were given four production and holding facility types and were asked to indicate how many of each type they used. They were also asked to provide the appropriate measure of area or volume for each type. The four types were: ponds, raceways, cages/net pens, and tanks. Ponds were measured in surface acres, raceways and cages/net pens in cubic feet, and tanks in gallons. Results from this section are

summarized in Table 2. Illinois producers reported using 370 ponds (529 surface acres), 59 raceways (19,415 ft³), 46 cages/net pens (1,296 ft³), and 189 tanks (108,500 gallons). Indiana producers reported using 1,035 ponds (541 surface acres), nine raceways (2,278 ft³), 54 cages/net pens (1,760 ft³), and 509 tanks (340,280 gallons). Michigan producers reported using 152 ponds (100 surface acres), 69 raceways (95,375 ft³), two cages/net pens (510 ft³), and 84 tanks (73,600 gallons). In these states, 62 (67%) used ponds, 18 (20%) used raceways, 15 (16%) used cages/net pens, and 41 (44%) used tanks (Figure 7).

Section 5: Marketing

Question 1 asked the respondents to identify where they sold their products. They were given four choices: locally, in-state, out-of-state, and internationally. They were asked to check all that applied. Of the 90 responses, 69 (77%) indicated that they sold their product locally, 58 (64%) reported in-state sales, 29 (32%) reported out-of-state sales, and five (6%) reported international sales (Figure 8).

Question 2 asked the respondents to indicate whether or not they processed their product themselves. If they responded “no,” they were then asked if they would like to do their own processing. Of the 86 responses, 37 (43%) responded “yes,” they processed their products themselves, while 49 (57%) responded “no,” they did not. Of those who responded “no,” six (12%) indicated they would like to do their own processing, while 29 (59%) indicated they would not. The remaining 14 (29%) did not respond.

Question 3 asked the respondents to identify whether or not they were a member of a cooperative. If they responded “yes,” they were asked to indicate which type of cooperative they were a member of: buying, selling, or advertising. They were asked to

Table 2. Production and holding facilities in Illinois, Indiana, and Michigan, 1995.

State	Type		No. of Respondents	Total
Illinois	Ponds	Number	22	370
		Surface Acres	20	529
	Raceways	Number	6	59
		Volume (ft ³)	3	19,415
	Cages/Net Pens	Number	7	46
		Volume (ft ³)	5	1,296
	Tanks	Number	14	189
		Volume (gallons)	12	108,500
Indiana	Ponds	Number	19	1,035
		Surface Acres	17	541
	Raceways	Number	2	9
		Volume (ft ³)	2	2,278
	Cages/Net Pens	Number	6	54
		Volume (ft ³)	4	1,760
	Tanks	Number	16	509
		Volume (gallons)	14	340,280
Michigan	Ponds	Number	21	152
		Surface Acres	21	100
	Raceways	Number	10	69
		Volume (ft ³)	8	95,375
	Cages/Net Pens	Number	2	2
		Volume (ft ³)	2	510
	Tanks	Number	11	84
		Volume (gallons)	10	73,600

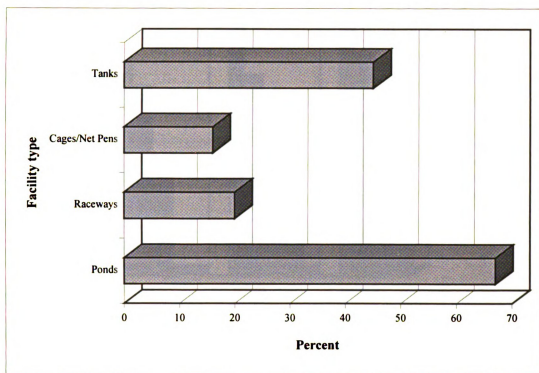


Figure 7. Percent of producers in Illinois, Indiana, and Michigan utilizing various facility types, 1995.

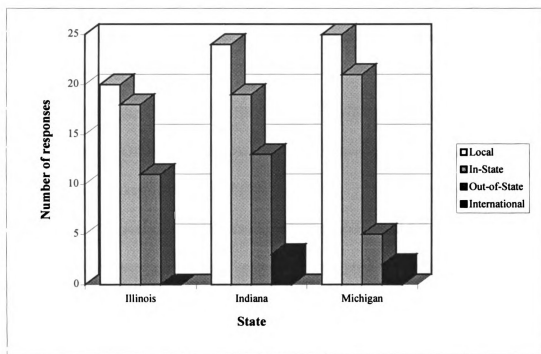


Figure 8. Number of producers in Illinois, Indiana, and Michigan reporting local, in-state, out-of-state, and international sales, 1995.

check all that applied. If they responded “no,” they were not members of a cooperative, they were asked if they would consider joining one. Of the 87 responses, four (5%) responded “yes,” while 83 (95%) responded “no,” they were not members of a cooperative. Of those who responded “yes,” one (25%) indicated being a member of a selling cooperative and two (50%) indicated being members of an advertising cooperative. Of those who responded “no,” 20 (24%) indicated they would consider joining a cooperative, while 16 (19%) indicated they would not. The remaining 47 (57%) did not respond.

Question 4 asked the respondents to identify whether or not they transported their own fish to market. Of the 87 responses, 67 (77%) responded “yes,” they transported their own fish to market, while 20 (23%) did not.

Question 5 asked the respondents to describe the demand for their products within a given year. They were given three choices: constant, predictably fluctuating, and unpredictable. They were asked to pick the choice that best described the demand for their products. Of the 89 responses, 28 (31%) chose “constant,” 30 (34%) chose “predictably fluctuating,” and 31 (35%) chose “unpredictable.”

Section 6: Water Quality

Question 1 asked the respondents to identify which water sources they utilized in their operation. They were given seven choices: stream, surface runoff, lake, spring, well, municipal water, and “other.” They were asked to check all that applied. Of the 65 responses, 12 (18%) used streams, 29 (45%) used surface runoff, 14 (22%) used lakes, 24 (37%) used springs, 53 (82%) used wells, 5 (8%) used municipal water, and 3 (5%) used “other” sources (Figure 9).

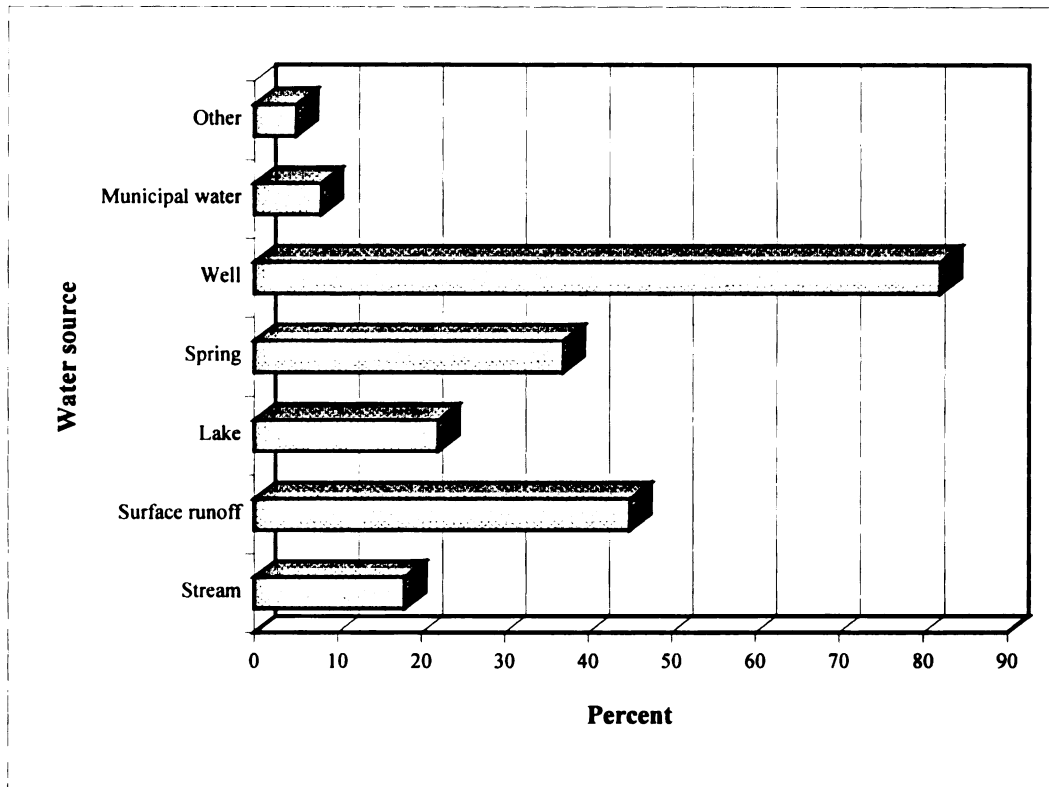


Figure 9. Percent of producers in Illinois, Indiana, and Michigan utilizing various water sources, 1995.

Question 2 asked the respondents to describe their water use. They were given three choices: constant flow, intermittent, and only to refill. They were asked to select the choice that best described their use. Of the 87 responses, 42 (48%) chose “constant flow,” 19 (22%) chose “intermittent,” and 26 (30%) chose “only to refill.”

Question 3 asked the respondents to identify the flow rate of their source water in gallons per minute (gpm). They were given three ranges to choose from: 0-500, 501-1,000, and more than 1,000 gpm. Of the 71 responses, 54 (76%) indicated their flow rate was between 0-500 gpm, nine (13%) between 501-1,000, and eight (11%) indicated their flow rate was more than 1,000 gpm.

Question 4 asked the respondents whether or not they regularly monitored water quality. If they responded “yes,” they were asked to indicate which aspects of water quality they monitored. They were given six aspects to choose from: dissolved oxygen, pH, ammonia, phosphorus, solids, and “other.” They were asked to check all that applied. Of the 91 responses, 55 (60%) responded “yes,” they did monitor water quality, while 36 (40%) did not. Of those who indicated they monitored water quality, 43 (78%) monitored dissolved oxygen, 32 (58%) monitored pH, 27 (49%) monitored ammonia, nine (16%) monitored phosphorus, 11 (20%) monitored solids, and 11 (20%) monitored “other” aspects.

Question 5 asked the respondents to estimate how often poor water quality reduced their production. They were given three choices: never, 1-3 times a year, and 4 or more times a year. Of the 86 responses, 36 (42%) indicated poor water quality never reduced their production, 40 (47%) indicated it reduced production 1-3 times a year, and 10 (12%) indicated it reduced production 4 or more times a year.

Question 6, the last question in section 6, asked the respondents to indicate where they discharged their effluent. They were given five choices: stream/river, pond/lake, land application, do not discharge, and “other.” Of the 84 responses, 22 (26%) indicated they discharged into a stream or river, 12 (14%) discharged into a pond or lake, 18 (21%) utilized land application methods, 27 (32%) did not discharge at all, and 13 (15%) used “other” methods (Figure 10).

Section 7: Feeds/Feeding

Question 1 asked the respondents to identify where they bought their feed. They were given four choices: local co-op, local mill, shipped from manufacturer, and “other.” They were asked to check all that applied. Of the 84 responses, 17 (20%) indicated that they bought their feed at a local co-op, 27 (32%) from a local mill, 33 (39%) had it shipped from the manufacturer, and 11 (13%) bought it from “other” sources.

Question 2 asked the respondents to indicate the type of feed they used. They were given three choices: floating, sinking, and slow sinking. They were asked to check all that applied. Of the 83 responses, 67 (81%) used floating feed, 39 (47%) used sinking, and nine (11%) used slow sinking.

Question 3 asked the respondents to indicate how many pounds of feed they used. They were given a blank line to write in their response. The results are presented in Table 3. There were 71 total responses to this question, 23 from Illinois, 24 from Indiana, and 24 from Michigan. Illinois producers reported using 1,503,575 pounds, Indiana producers reported using 750,375 pounds, and Michigan producers reported using 418,800 pounds of feed.

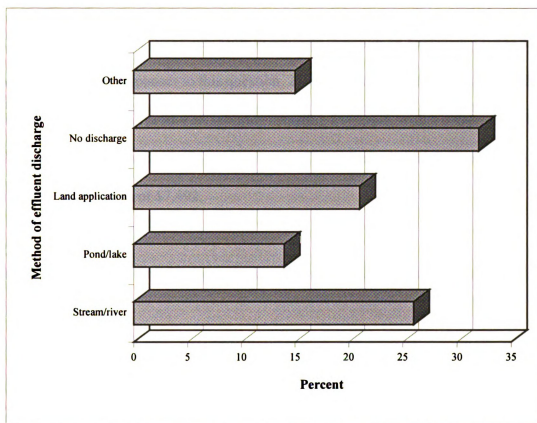


Figure 10. Percent of producers in Illinois, Indiana, and Michigan utilizing various methods of effluent discharge, 1995.

Table 3. Feed usage by aquaculture operations in Illinois, Indiana, and Michigan, 1995.

State	Reports	Sum (lbs.)
ILLINOIS	23	1,503,575
INDIANA	24	750,375
MICHIGAN	24	418,800
TOTAL	71	2,672,750

Question 4 asked the respondents to estimate their annual feed costs (Table 4).

There were 69 total responses to this question, 21 from Illinois, 23 from Indiana, and 25 from Michigan. Illinois producers reported spending \$186,485, with a mean of \$8,880, Indiana producers spent \$122,476, with a mean of \$5,325, and Michigan producers spent \$187,295, with a mean of \$7,492.

Table 4. Feed expenditures by aquaculture operations in Illinois, Indiana, and Michigan, 1995.

State	Reports	Sum (\$)	Mean (\$)
ILLINOIS	21	186,485	8,880
INDIANA	23	122,476	5,325
MICHIGAN	25	187,295	7,492
TOTAL	69	496,256	7,192

Section 8: Disease/Wildlife

Question 1 asked the respondents to indicate how often their stock experienced diseases. They were given three choices: never, 0-3 times a year, and 4 or more times a year. Of the 88 responses, 42 (48%) indicated their stocks never experienced diseases, 36 (41%) experienced diseases 0-3 times a year, and nine (10%) indicated their stocks experienced diseases 4 or more times a year.

Question 2 asked the respondents to identify where they obtained their fish health information. They were provided with four choices: veterinarian, fish disease specialist, other producers, and “other.” They were asked to check all that applied. Of the 77 responses, five (6%) obtained information from veterinarians, 33 (43%) from fish disease specialists, 25 (32%) from other producers, and 36 (48%) from “other” sources.

Question 3 asked the respondents to identify which agencies helped them with wildlife damage control. They were given five choices: none, local, state, federal, and “other.” They were asked to check all that applied. Of the 82 responses, 68 (83%) indicated that they did not receive any help, two (2%) received help from local agencies, eight (10%) from state agencies, three (4%) from federal agencies, and three (4%) from “other” sources.

Question 4, the last question in the section, asked the respondents to indicate whether or not their stock experienced predation. If they responded “yes,” they were then asked to identify the predator. They were given three choices: birds, mammals, and “other.” They were asked to check all that applied. Of the 86 responses, 63 (73%) responded “yes,” their stocks did experience predation, while 23 (27%) responded “no.” Of those who responded “yes,” 59 (94%) indicated their stocks experienced bird predation, 31 (49%) indicated their stocks experienced mammal predation, and 18 (29%) reported “other” predators.

Section 9: Losses

Question 1 asked the respondents to indicate if they had any losses during 1995. Of the 80 responses, 66 (83%) responded “yes,” they had losses during 1995, while 14 (18%) responded “no.”

Question 2 contained three parts: A, B and C. Part A asked the respondents to write in the percentage of losses from their total operation, based on quantity. These numbers were summed, and then a mean percentage was derived for each state. Part B asked the respondents to estimate the dollar value of their losses, and write that figure on the blank line provided. These numbers were also summed, and a mean dollar value was derived (Figure 11). Part C consisted of a table with two columns. The first column contained seven causes of losses: diseases, predation, poaching, escapement, poor water quality, weather, and “other.” The second column contained blank lines on which the respondents were asked to write in the percentage of their total losses that was attributed to each cause. This allowed for the identification of what caused the majority of losses in each operation (Figure 12). In Illinois and Indiana, the greatest cause of loss reported was disease. Michigan producers reported predation as their greatest cause of loss.

Section 10: Miscellaneous

Question 1 asked the respondents to indicate whether or not they were a member of any state aquaculture association. If they responded “yes,” they were asked to indicate whether or not their membership had enabled them to increase their profits. Of the 90 responses, 47 (52%) responded “yes,” they were members of a state aquaculture association, while 43 (48%) responded “no,” they were not. Of those who responded “yes,” 10 (21%) responded “yes,” their membership had helped them increase their profits, while 28 (60%) responded “no” it had not. The other nine (19%) did not respond.

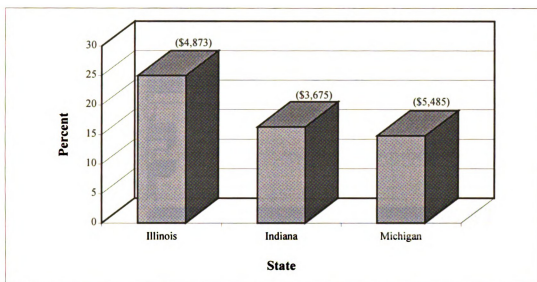


Figure 11. Mean losses as a percent of total production and corresponding dollar value reported by producers in Illinois, Indiana, and Michigan, 1995.

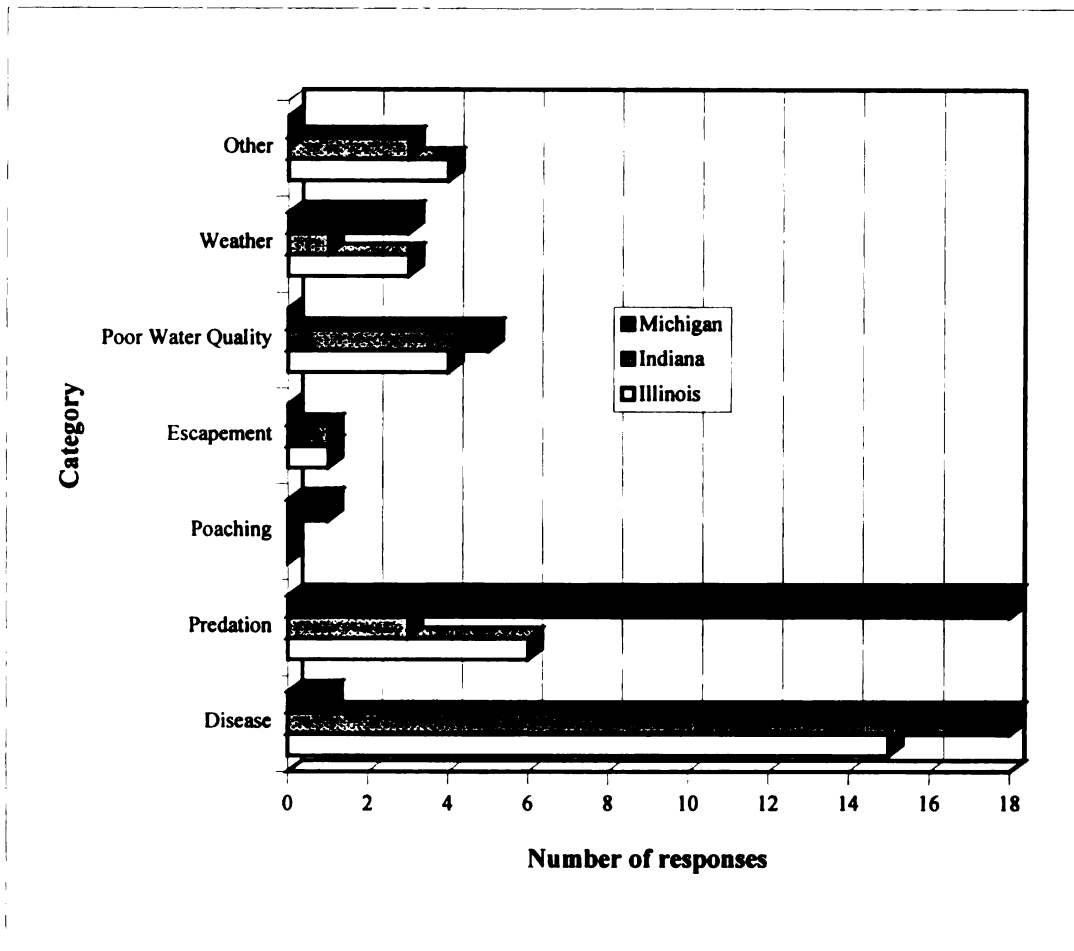


Figure 12. Number of producers in Illinois, Indiana, and Michigan reporting cause of greatest loss by category, 1995.

Question 2 asked the respondents to indicate whether or not they were a member of any national aquaculture association. If they responded “yes,” they were asked to indicate whether or not their membership had enabled them to increase their profits in any way. Of the 90 responses, 24 (27%) responded “yes,” they were members of a national aquaculture association, while 66 (73%) responded “no,” they were not. Of those who responded “yes,” four (17%) responded “yes” their membership had enabled them to increase their profits, while 18 (75%) responded “no” it had not.

Question 3 asked the respondents to predict their anticipated production levels five years in the future. They were given three choices: higher, no change, or lower. There were 85 responses to this question, 31 from Illinois, 26 from Indiana and 28 from Michigan. The number of producers in each state who anticipated higher production, no change, or lower production is shown in Figure 13.

Question 4 asked the respondents to identify where they usually obtained additional information about aquaculture. They were given five choices: cooperative extension, sea grant agent, natural resource agency personnel, other fish farmers, and “other.” They were asked to check all that applied. Of the 87 responses, 23 (26%) obtained their information from cooperative extension sources, 18 (21%) from a sea grant agent, 16 (18%) from natural resource agency personnel, 56 (64%) from other fish farmers, and 35 (40%) from “other” sources.

Question 5 asked the respondents to indicate how often they would be willing to complete a similar survey. They were given three choices: every year, every other year, and “other.” Of the 87 responses, 53 (61%) indicated that they would complete a similar

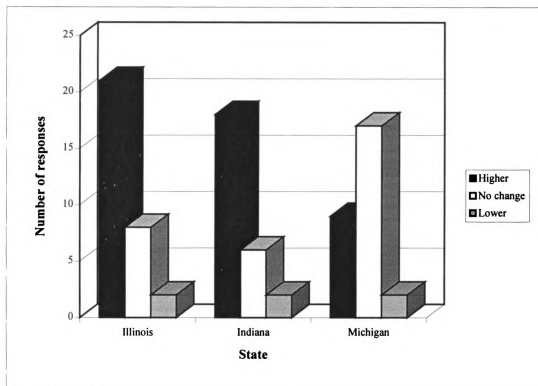


Figure 13. Producers' anticipated production in the year 2000, relative to current levels of production, 1995.

survey every year, 17 (20%) every other year and 17 (20%) responded “other” (Figure 14).

Section 11: Comments

A total of 19 respondents wrote in comments. However, this section was not intended to be a tool that would gather any hard data. Rather, it was included to give those involved in distributing the survey a chance to read what is on the respondent’s mind, and keep up on any current issues that affect producers. Summarized comments are listed in APPENDIX G.

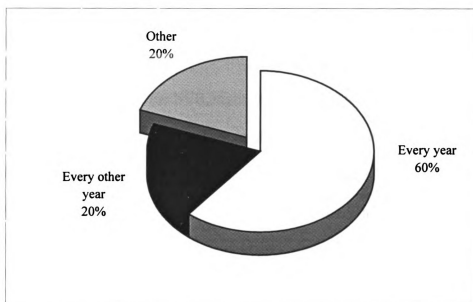


Figure 14. Willingness of producers in Illinois, Indiana, and Michigan to complete a similar survey in the future, 1995.

DISCUSSION

Efforts were made to collect data from all twelve states in the NCR through each state's aquaculture extension specialist. Extension personnel in each state were provided with the survey instrument in two forms, hard copy and on diskette. The NCRAC does not have the authority to compel the states to participate, nor should it, so participation in this effort was strictly voluntary.

Of the twelve states in the NCR, eight participated in the survey efforts. Four of these: Iowa, Kansas, Missouri, and Wisconsin, distributed an early draft of the survey. This survey contained many of the same questions but was much more lengthy due to a different format. The survey was later refined to make it easier to complete by providing the respondents with boxes to check where possible, rather than having to hand-write responses. The survey also underwent many other formatting changes which shortened it from ten to seven pages.

The final draft of the survey was distributed by four states: Illinois, Indiana, Michigan, and Ohio. This document examines the survey results from Illinois, Indiana and Michigan, hereafter referred to as "the survey area," as a case study from which to make recommendations on how to improve the survey itself and how it is conducted. Ohio was not included because the surveys had not been returned in time to be included in this report.

Section 1: Production

Producers in this survey area raised at least 33 different species in 1995 (Table 1), with a reported value of \$2,560,232. These species included: various aquaria fish; hybrid striped bass; largemouth and smallmouth bass; bluegill and hybrid bluegill; grass carp and koi; blue, bullhead, channel and flathead catfish; black crappie; crayfish; goldfish; fathead minnows; yellow perch; northern pike; golden shiners; white suckers; redear sunfish; tilapia; brook, brown and rainbow trout; walleye; other species of bait fish; and at least five more species listed as “other.” Very few producers raised only one species of fish. Most producers raised multiple species, which allowed them to break into multiple markets and meet consumer demands. Production in Illinois was dominated by fathead minnows, a popular baitfish. Indiana production was dominated by channel catfish, a warm-water species that requires a relatively long growing period. Michigan production was dominated by trout, a cold-water species, and perch, a cool-water species, which are more suited to the state’s waters.

Section 2: Business Management

The majority of producers in this survey area who responded indicated that they raised some of their own fish and bought fish from other producers to raise. Only five producers were involved in fish brokering. Over one-third of the producers bought fish from out-of-state producers.

Aquaculture is a relatively young industry in this survey area, with over half of producers reporting they had been in business for ten years or less (Figure 4). Only about one-third of producers had been in business for more than 20 years. Of all the producers in this survey area, almost 90% reported that this was their first aquaculture business

venture. There simply aren't many existing aquaculture operations for sale due to the relative young age of the industry, forcing interested parties to start their own operations.

In this survey area, over 70% of the operations were family run operations. Approximately one-third of producers owned a farm before they started an aquaculture business, with the most common type of farm being a row-crop farm. Most operations were owned by a single owner (65%) and derived the majority of their income from fish production (Figure 5).

Section 3: Economics

Producers in this survey area reported that the most common source of financing for their aquaculture operations was self-financing. Banks were reported as financing sources in only 17% of responses. Other family members assisted with financing in 6% of the responses.

Aquaculture was seldom the primary source of income for aquaculturists in this survey area. Seventy percent of producers in this survey area reported that less than half of their annual income was derived from aquaculture. Only 13% indicated that aquaculture was their only source of income. This distribution is consistent with the observation that approximately one-third of producers reported their income from aquaculture was less than \$2,500 in 1995 (Figure 6). Only 17% of producers reported income from aquaculture in excess of \$100,000 in 1995.

The bottom line for any business venture is profit. One measure of profit is "gross margin," or more specifically "gross margin over cash costs." Sixty-seven percent of producers in this survey area realized some return toward compensating themselves for

their fixed costs (including family labor and management) and risk. Of these, only 38% felt that their gross margins were adequate to cover these additional costs and risk.

Section 4: Facilities

Ponds were the most common type of facility reported, with 1,170 surface acres reported in production (Figure 7). Tanks were the next most common facility reported, with a total of 522,380 ft³ reported in production. Producers also reported using raceways totaling 117,068 ft³, and cages/net pens totaling 3,566 ft³ (Table 2). These figures are consistent with the prevailing climate, water sources, and species raised in each state.

Section 5: Marketing

The most common marketing location reported by producers was local markets. Over three-fourths of producers reported that they sold their products locally, another 64% reported in-state sales, and only 32% of producers reported out-of-state sales (Figure 8). By marketing their products locally, producers can reduce transportation costs and maximize profits. Another way producers can reduce transportation costs is to deliver their product to market themselves, which 77% of producers reported they did. Processing a product adds value, and many producers took advantage of this by processing their products themselves. Of the responding producers surveyed in this survey area, 43% did their own processing, and an additional 12% indicated that they would like to.

Membership in a cooperative was relatively low among producers in this survey area. Only 5% of responding producers in these states were members of either buying or advertising cooperatives. However, 24% of those who were not members said that they would consider joining one. Cooperative membership can be beneficial to producers in

many ways. Membership in a buying cooperative may allow them to purchase feed and other inputs at reduced prices. Membership in an advertising cooperative can assist them with the promotion of their products and location of new markets. Locating a variety of markets helps producers to stabilize the demand for their products. This was a problem for many producers, as 35% of responding producers described the market for their product as unpredictable.

Section 6: Water Quality

In this survey area, the most common sources of water for aquaculture operations reported by producers were wells and surface runoff (Figure 9). Eighty-two percent of producers surveyed used wells in their operation and 45% reported using surface runoff. In addition, 37% of producers reported using springs, which are the preferred source when they are available. Wells may be costly if the water must be pumped out of the ground. Surface runoff also can cause problems as it carries with it unwanted nutrients and silt that can cause algal blooms and rapid sedimentation in ponds. Water from springs flows without being pumped, making it a cheaper alternative to wells, and the water quality is usually superior to surface runoff. Springs are also preferred because their water tends to be more constant in terms of flow rate and temperature. Constant flow rates were important to many aquaculturists in this survey area, as 48% of producers surveyed described their water use as constant.

Water usage by aquaculture operations is typically measured in gallons per minute (gpm). Flow rates determine the amount of production possible in a typical operation by allowing the producer to exchange the water in his/her system a certain number of times per hour or day. The growth and survival of most fish species is directly correlated to

water quality, which is, in turn, correlated to the number of exchanges per hour or day. The task for producers is to find a flow rate that will give them the optimum water quality necessary for their fish species at economically viable production levels while minimizing the costs of pumping. Over three-fourths (76%) of producers surveyed in Illinois, Indiana, and Michigan reported flow rates of less than 500 gpm.

Approximately one-third (32%) of producers in this survey area had no effluent discharge from their operations (Figure 10). Of those that did discharge, the most common method of discharge was into a stream or river (26%), and the next most common method was land application (21%).

Maintaining water quality through routine monitoring is an essential part of any aquaculture operation. Reflecting this is the fact that 59% of responding producers in this survey area reported that water quality reduced their production at least once a year. Sixty percent of responding producers indicated that they monitored water quality. Dissolved oxygen levels, pH, and solids were the three most commonly monitored aspects of water quality.

Section 7: Feeds/Feeding

For many producers feed is the single largest purchased input (Johnson, 1976), and in some cases the cost of feed can reach 50% of total variable costs (Chopak and Newman, 1993). For producers in this survey area, the mean cost per year for feed was \$7,192 in 1995 (Table 4). This cost is often compounded by the additional cost of shipping the feed over long distances. Many producers tried to reduce their feed costs by buying their feed from local sources, even other producers. The most common type of feed used in the region was floating feed.

Section 8: Disease/Wildlife

Disease can be a serious problem for aquaculturists. High fish densities and poor water quality can cause stress on fish stocks (Avault, 1996). In fish, as in other animals, stress lowers their resistance to disease (Brown, 1993). Of the responding producers in this survey area, 51% indicated that their fish stocks experienced diseases. The most common sources of fish health information utilized by producers were fish disease specialists and other producers.

Predation by wildlife is an inherent risk to aquaculture operations, particularly ones which use outdoor facilities. Of the responding producers in this survey area, 73% reported that their stocks experienced predation of some kind. Birds were the most common predators, followed by mammals. Dealing with wildlife predation can be difficult, as many of the predators are protected under state, federal, or international law. Only 16% of producers indicated that they received help with wildlife damage control from local, state, or federal agencies.

Section 9: Losses

Losses due to diseases, predation, poaching, escapement, poor water quality and weather are common occurrences in aquaculture. In Illinois, these losses were, on average, 25% of total production, and cost the producer an average of \$4,873. Indiana producers experienced the fewest losses in terms of average cost at \$3,675. Michigan producers experienced the fewest losses in terms of total production at just under 15%, but they were second in terms of cost at \$5,485 (Figure 11). It is interesting to note that 15 (45%) producers in Illinois, and 18 (58%) producers in Indiana attributed the majority of their losses to disease, while only one (4%) Michigan producer identified disease as

the greatest cause of loss. In Michigan, 18 (78%) producers reported predation as the greatest cause of loss, while only six (18%) in Illinois and three (10%) in Indiana reported predation as the greatest cause of loss (Figure 12).

Section 10: Miscellaneous

As the aquaculture industry continues to grow, the need for producers to have an association to represent them grows as well. State and national aquaculture associations assist their members by speaking for them at all levels of government, and by facilitating the dissemination of information. This is crucial in order for producers to keep up with the latest technology and production methods. Illinois, Indiana, and Michigan all currently have state aquaculture associations. Many producers, however, choose not to join such organizations because of privacy concerns, or fear of promoting competition. Others simply do not believe that membership in such organizations will help them increase their profits. This is reflected by the fact that only 52% of responding producers in this survey area said that they were members of state aquaculture associations and only 24% indicated that they were members of a national aquaculture association. Of those who indicated they were members of such associations, very few felt that their membership had helped them increase their profits in any way. Only 21% of state association members and 17% of national association members felt that their membership had enabled them to increase their profits.

The final questions in this section of the survey asked the respondents to indicate how they saw their future production levels, where they obtained additional aquaculture information, and how often they would be willing to complete a similar survey. The majority of producers in Illinois and Indiana anticipated higher levels of production in the

future relative to current production levels (Figure 13). Michigan producers, however, were less optimistic, with only 32% anticipating higher production. This difference is a reflection of the age of the aquaculture operations in these states. Michigan operations are older on average (Figure 4) than operations in Illinois and Indiana, and many have already reached their maximum production. Many operations in Illinois and Indiana are just beginning, and have not yet reached maximum production.

Respondents also indicated that the majority of them (64%) obtained their aquaculture information from other producers, as opposed to sea grant agents or natural resource personnel. Eighty-one percent of producers surveyed reported that they would be willing to complete a similar survey at least every other year (Figure 14).

Section 11: Comments

In regards to the comments section, the responses varied from apologies for late returns to praises for the value of surveys. Frustration with state agencies and out-of-state products was also expressed. No trend was noticed in the comments, however, as they were all different (see APPENDIX G).

RECOMMENDATIONS

The intent of this project was to produce a thesis that would identify the means and processes necessary to collect and analyze aquaculture data in the north central U.S. A mail survey was deemed the most appropriate method of collecting data, and the survey was tested in Illinois, Indiana, and Michigan. As a result of this test, there are many recommendations regarding the content and format of the survey that need to be mentioned.

First, however, there needs to be some consideration given in regards to the perceived benefits of a survey among producers. It is evident that many producers declined to participate because they failed to understand the value of such information. In the future, attempts need to be made to impress upon producers the importance of their participation in such an effort at every opportunity. This should include discussing the value of economic data reporting and surveys at aquaculture conferences, meetings, workshops, or any other gatherings of producers within the region. State agencies that have an interest or role in commercial aquaculture (e.g., natural resources, environmental licensing/permitting, and agriculture agencies), state aquaculture associations, state extension services, sea grant programs, and economic development groups in each of the states in the NCR should be encouraged to provide input and support future information gathering efforts.

Rationale for public support of information systems has been articulated in a number of publications by James T. Bonnen, an agricultural economist at Michigan State University. Those who may be interested in that justification will want to read his chapter “The Economic Characteristics of Information and the Changing Role of Official Statistics and Analysis” in a forthcoming book edited by David Zilberman at the University of California at Berkeley.

In the cover letter, the respondents were asked to indicate whether or not they earned an income from aquaculture in 1995. If they indicated “no,” then they are asked to return the survey. This eliminated producers who had just started aquaculture operations and who had not yet sold any of their product. In the future, this question should either be removed or reworded to include those producers. Also, a paragraph outlining the importance and potential benefits of participating should be included.

In regards to the format of the survey itself, future survey efforts should always be examined in light of the results from the previous survey. Methods of shortening and simplifying future survey tools should always be considered. However, a certain level of consistency between consecutive survey efforts should be maintained if comparisons are to be made between the surveys.

This survey utilized several format styles that should be implemented in future surveys. One such format style that is helpful is to include answer boxes for the respondent to check, as opposed to including blank lines for them to write in their response. This also helps by ensuring that all the answers will be consistent and legible. Another helpful style is placing the answer boxes on the same line as the question. This

not only shortens the survey but also makes it easier for the respondent to find the correct set of answers for each question.

Many of the questions in this survey could potentially have had multiple answers and, therefore, included instructions for the respondent to “check all that apply.” However, the method in which the results were analyzed was designed to capture only the number of respondents who checked each possible answer, it did not capture combinations of answers for each survey. For example, it is possible to identify the number of operations who raise their own fish, or broker fish, but not the number of operations who do both. Future methods of analyzing such questions should be designed so that the identification of such combinations of answers is possible.

Another recommendation concerns the use of the word “other” as a potential question answer. There are benefits and negatives to using this word. By including it as a possible answer, you eliminate the possibility that respondents will not answer the question because they do not see an appropriate answer, but you also end up with an answer that is not easily analyzed. If a survey includes possible alternative answers that capture the majority of responses, then the number of respondents who choose “other” will be reduced. This is a good way to judge how well the question was constructed. Whenever the word “other” was used as a possible answer in this survey, a short blank line was also included for the respondent to write in exactly what they meant. Careful question construction can prevent excessive use of the “other” response. This is best accomplished by thoroughly discussing each question with individuals who are familiar with the aquaculture industry in the area that is to be surveyed, thereby insuring that appropriate answer boxes have been provided.

There are several recommendations that concern the first section of the survey. The vast majority of the respondents failed to complete all of the columns in this section. This may have been because they failed to understand the importance of this information. Also, many of those who did respond failed to do so correctly. Instructions and an example on the first page apparently failed to simplify responding to this section. Critical to analysis of responses to this section was the instruction that only one row was to be completed for each life stage. Many producers failed to do this, making it impossible to determine the value or production of a single life stage. Despite the trouble that was encountered involving the table in section 1, the species list that was provided along the bottom of the table did an excellent job of capturing the species produced in the survey area. This is evident by the low number of producers reporting sales of “other” species. However, the list should be arrayed along the top or bottom of the page to prevent respondents from completing rows that are directly across from the species code.

RECOMMENDED CHANGES TO QUESTIONS

In this section each question to be changed will be presented as it appeared in the original survey, recommended changes will be discussed, and the new question will be presented.

Section 2: Question 10

Which of the following activities are you involved in and what % of your total sales does each constitute?

- | | | |
|-------|--------------------------------|--------------------------|
| A. | Fish production | = _____ % of total sales |
| B. | Capture of wild bait fish | = _____ % of total sales |
| C. | Fish wholesaler or live hauler | = _____ % of total sales |
| D. | Fee-fishing operation | = _____ % of total sales |
| E. | Broker | = _____ % of total sales |
| F. | Other _____ | = _____ % of total sales |
| TOTAL | | = 100% |

Many respondents appear to have become confused and indicated the percentage of their total income (including non-aquacultural income) derived from each activity. This was apparent when the numbers they provided did not add up to 100%. In the future, this question could be simplified by breaking it into two separate questions. The first one would ask the respondents to check a box beside each activity that they are involved in. The second question would ask them to check a box beside the single activity that makes up the majority of their aquaculture sales.

(1) Which of the following activities are you involved in? (Check all that apply)

- ☐ Fish production ☐ Capture of wild bait fish ☐ Fish wholesaler or live hauler ☐ Fee-fishing operation ☐ Broker
☐ Other

(2) From which of the following activities did you derive the majority of your sales in 1996?

- ☐ Fish production ☐ Capture of wild bait fish ☐ Fish wholesaler or live hauler ☐ Fee-fishing operation ☐ Broker
☐ Other

Section 3: Question 4

How many workers are involved in the operation in addition to yourself? (Complete all that apply)

- | | |
|--------------------------------|--|
| _____ Paid Full Time Employees | _____ Unpaid or Family Help |
| _____ Paid Part Time Employees | _____ Students (Only if you are an educator) |

The intent of this question was that each respondent would write in a number beside each type of employee. Apparently, this was not made clear enough, as many respondents simply checked each type of employee involved in their operation. In the

future, this question would be better served by either asking the respondents to check an actual range of numbers or circling a number in a string of numbers provided beside each employee type.

How many workers are involved in the operation in addition to yourself? (Circle the correct number beside each category)

0 1 2 3 4 5 6 7 8 9 10 >10 Paid Full-Time Employees 0 1 2 3 4 5 6 7 8 9 10 >10 Unpaid or Family Help
0 1 2 3 4 5 6 7 8 9 10 >10 Paid Part-Time Employees 0 1 2 3 4 5 6 7 8 9 10 >10 Students (Only if you are an educator)

Section 6: Question 5

How often would you estimate poor water quality reduces your production?

☐ Never ☐ 1-3 times a year ☐ 4 or more times a year

The question should be reworded to read “How often would you estimate poor water quality reduced your production in 1995?” As it is, the answers to this question did not actually provide any information about 1995. Also, the words “a year” should be removed from the answers. Similar questions include questions 1 and 4 in section 8. These questions should also have included “1995” in their wording and “a year” should have been removed from the answers. Also, questions 3 and 4 should be switched.

How often would you estimate poor water quality reduced your production in 1996?

☐ Never ☐ 1-3 times ☐ 4 or more times

Section 7: Question 1

Where do you buy your feed? (Check all that apply)

☐ Local co-op ☐ Local mill ☐ Shipped from manufacturer ☐ Other

The first answer box that is included is not necessary as a later question asks the respondents to indicate whether or not they are members of a cooperative. Also, enough respondents wrote in that they bought their feed from other producers that this response warrants its own answer box.

Where do you buy your feed? (Check all that apply)

☐ Other producers ☐ Local mill ☐ Shipped from manufacturer ☐ Other _____

Section 9: Question 2

A. Based on quantity, the percent of those losses from your total operation? _____ %

B. What was the estimated dollar value of those losses? \$ _____

C. What of the following, as percent of the total, was attributed to those losses?

<u>Cause</u>	<u>Percent</u>
Diseases	_____
Predation	_____
Poaching	_____
Poor water quality	_____
Weather	_____
<u>Other</u>	_____
TOTAL	100% of Losses

As it is, the question asks the respondents to estimate the dollar value of their losses and then estimate the percentage of their total losses attributable to each cause. These two questions could be combined into one by simply asking them to write in an estimated dollar value of the losses attributed to each cause. These figures could then be summed to provide a total value of losses. Also, if the respondent has correctly completed the table in section 1, it would be possible to calculate the percentage of losses from their total sales.

If you answered yes, please write in the dollar value of losses attributed to each cause

<u>Cause</u>	<u>Value (\$)</u>
Diseases	_____
Predation	_____
Poaching	_____
Escapement	_____
Poor water quality	_____
Weather	_____
Other	_____

The final recommendation regarding the format of the survey concerns the design of section 11. Very few respondents actually wrote in any comments. This section would be better served by a few leading questions that ask the respondent to comment on current issues of importance to their state. The content of such questions should be determined by individuals who are familiar with the current issues in each state, such as the state aquaculture extension specialists. This section could also be included as a separate sheet, so that it could be separated and forwarded to, for example, the extension specialists in each state, allowing them to better serve their producers. Based upon these recommendations, a revised version of the survey has been included in APPENDIX F.

In regards to the administration of the survey, the need for a standard survey distributed by all twelve states in the NCR is clear. The current situation, in which several states are conducting their own surveys, or not collecting data at all, is not conducive to the preparation of a situation and outlook report that accurately represents the aquaculture industries in this region. Undertaking a survey effort such as the one involved in this project is not an easy task and it is unrealistic to expect that every state will have the resources, either in terms of time or money, to participate. Therefore, financial resources to either reimburse the states, or distribute directly to them will need to be secured in the future. The less complex the arrangement the better, so the preferred situation would be one in which all aspects of the survey are conducted under the auspices of a single agency.

As data collection efforts become more and more refined in the future, it will be possible to begin comparing data from various years. No effort was made to compare the data collected from this survey effort to any previous efforts as there was no common

baseline that would render a comparison possible. Once such a baseline is developed, it will be possible to make more accurate statements regarding observed trends.

The process of refining future surveys and data collection efforts should be iterative in nature, with improvements after each iteration. With each new iteration, there should be four primary goals: include more producers, improve on the survey, increase response rates, and improve methods of analyzing the data. Currently, many producers are excluded from survey efforts simply because it is extremely difficult to identify them. Identifying unregulated producers is particularly difficult and may be impossible until they are required to possess some type of permit, or report to some type of agency, from which a list of names could be generated.

Improving future surveys will mean seeking the input not only of producers, but also those who work closely with them, e.g., extension specialists, sea grant agents, or state aquaculture association personnel. Future efforts should be made to explore methods of shortening the survey, creating simpler and more precise questions, and making responses easier to analyze. Response rates are likely to only be increased by impressing upon producers the importance of economic data collection, and their involvement in that collection. This will only be accomplished by impressing upon producers the benefits of participation, as described earlier. The help of key individuals and agencies respected in the aquaculture industry will be needed to achieve this goal.

The task of developing the survey and analyzing the data collected, as was undertaken in this project, is enormous. The NCRAC administrative staff simply does not have the experience, time, or resources necessary to carry out such survey efforts. In the future, this task should be contracted out to an individual or group who specializes in

survey development, administration, and analysis, such as someone in a university's department of agricultural economics and/or rural sociology or an agricultural statistics service. This task could be eased in the future by conducting comprehensive surveys every five years and shorter surveys in the interim years.

Finally, I would like to identify some helpful sources of information which were invaluable in this effort and which would be for future undertakings. State aquaculture extension specialists (APPENDIX D) were invaluable in terms of their close connections with the aquaculture industries in their respective states and their insightful comments in regard to the survey. Also, state agricultural statistics services, especially Indiana's, which handled all aspects of distributing and collating data for the surveys conducted in Indiana and Illinois. In the future, other sources of information may be useful, including state aquaculture coordinators and the JSA. The Internet is also becoming a useful source of aquaculture information as more and more information goes on-line, including USDA's aquaculture situation and outlook reports as well as the NASS's trout and catfish reports. One of the most useful sites currently available on the world wide web is the Aquaculture Network Information Center (AquaNIC) which is maintained at Purdue University. For details concerning how to contact some of these different resources see APPENDIX H.

APPENDIX A

1995 Aquaculture Survey

1995 AQUACULTURE SURVEY

Please Return by March 15, 1996

Did you earn income from aquaculture in 1995? ☐ Yes ☐ No

If you checked yes, please continue. If you checked no, please return this survey.

SECTION 1: PRODUCTION

1. On the next page, please indicate which species you sell using the appropriate species code (in **bold caps**), how they are sold (by checking the appropriate column), your total production of each species by pounds or number, and total value of 1995 sales. If you sell more than one life stage of a species, *please complete a row for each stage*. See example below.

EXAMPLE:

Species Code	HOW SPECIES ARE SOLD				PRODUCTION		VALUE
	Eggs	Fry	Fingerlings	Food Fish	Pounds	Number	Dollars
RBT	X					125,000	\$2,500
RBT			X			500,000	\$200,000
CC		X				300,000	\$18,000
YP				X	10,000		\$21,700

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Aquaria Fish AQF		HOW SPECIES ARE SOLD				PRODUCTION		VALUE
Bass, Hybrid Striped . . HSB	Species	Eggs	Fry	Fingerlings	Food Fish	Pounds	Number	Dollars
Bass, Largemouth LMB								
Bass, Smallmouth SMB								
Bluegill BG								
Bluegill, Hybrid HBG								
Carp, Grass GC								
Carp, Koi KC								
Catfish, Blue BC								
Catfish, Bullhead BHC								
Catfish, Channel CC								
Catfish, Flathead FC								
Crappie, Black BCR								
Crappie, White WCR								
Crayfish CRF								
Goldfish GF								
Minnow, Fathead . . . FHM								
Perch, Yellow YP								
Pike, Northern NP								
Salmon, Atlantic ATS								
Salmon, Chinook CKS								
Salmon, Coho CS								
Shiner, Golden GS								
Sucker, White WS								
Sunfish, Redear RS								
Tilapia T								
Trout, Brook BKT								
Trout, Brown BRT								
Trout, Rainbow RBT								
Walleye W								
Other Baitfish OB								
Other Write in Species								

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SECTION 2: BUSINESS MANAGEMENT

1. In your operation, do you... (Check all that apply)

☐ Raise fish ☐ Obtain fish and hold for resale ☐ Broker fish

2. Where do you obtain your fish? (Check all that apply)

☐ Raise your own ☐ In-State ☐ Out-of-State

3. Is this your first aquaculture business venture?

☐ Yes ☐ No If no, was your first venture successful? ☐ Yes ☐ No

4. How many years have you carried out an aquaculture business?

☐ 0-5 ☐ 6-10 ☐ 11-20 ☐ 21-30 ☐ More than 30

5. Is your aquaculture activity a family operation? ☐ Yes ☐ No

6. Did you take over an existing aquaculture venture? ☐ Yes ☐ No

7. Did you own or operate a farm before you started your aquaculture business?

☐ Yes ☐ No

If yes, what kind of farm? (Check all that apply)

☐ Hogs ☐ Dairy ☐ Beef ☐ Row Crops ☐ Other _____

8. Check any of the inputs that you have been unable to acquire when needed. (Check all that apply)

☐ Eggs ☐ Fingerlings ☐ Feed ☐ Other _____

9. Which best describes the tax status of your aquaculture operation?

☐ Sole Owner ☐ Partnership ☐ Corporation ☐ Joint Venture

☐ Affiliation with another company ☐ Other _____

10. Which of the following activities are you involved in and what % of your total sales does each constitute?

A. Fish production	=	_____	% of total sales
B. Capture of wild bait fish	=	_____	% of total sales
C. Fish wholesaler or live hauler	=	_____	% of total sales
D. Fee-fishing operation	=	_____	% of total sales
E. Broker	=	_____	% of total sales
F. Other _____	=	_____	% of total sales
Total	=	100%	

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SECTION 3: ECONOMICS

1. How is your operation financed? (Check all that apply)

☐ Self ☐ Bank ☐ Family ☐ Other _____

2. What percent of your total gross annual income comes from aquaculture?

☐ 0%-24% ☐ 25%-49% ☐ 50%-74% ☐ 75%-99% ☐ 100%

3. Estimate the total value of SALES from your aquacultural operation for 1995.

☐ less than \$2,500	☐ \$100,000-\$249,999
☐ \$2,500-\$9,999	☐ \$250,000-\$499,999
☐ \$10,000-\$24,999	☐ \$500,000-\$749,999
☐ \$25,000-\$49,999	☐ \$750,000-\$999,999
☐ \$50,000-\$99,999	☐ \$1,000,000 or more

4. How many workers are involved in the operation in addition to yourself? (Complete all that apply)

_____ Paid Full Time Employees	_____ Unpaid or Family Help
_____ Paid Part Time Employees	_____ Students (Only if you are an educator)

5. Do your sales cover your cash costs? (Cash costs include all variable costs such as feed and electricity, as well as taxes, insurance, interest on loans, etc.)

☐ Yes ☐ No

If yes, do you feel this profit is adequate to cover your time and money investment? ☐ Yes ☐ No

SECTION 4: FACILITIES

1. What types of production and holding facilities do you have? (Check all that apply and provide requested measure of size)

PONDS:	Number: _____	Total Surface Area: _____ acres
RACEWAYS:	Number: _____	Total Volume (length × width × depth): _____ ft ³
CAGES/NET PENS:	Number: _____	Total Volume (length × width × depth): _____ ft ³
TANKS:	Number: _____	Total Gallons: _____

SECTION 5: MARKETING

1. Where do you sell your product? (Check all that apply)

☐ Locally ☐ In-State ☐ Out-of-State ☐ Internationally

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2. Do you process your product yourself?

☐ Yes ☐ No If no, would you like to? ☐ Yes ☐ No

3. Are you a member of a cooperative?

☐ Yes ☐ No If yes, what type? (Check all that apply) ☐ Buying ☐ Selling ☐ Advertising
If no, would you consider joining one? ☐ Yes ☐ No

4. Do you transport your own fish to market?

☐ Yes ☐ No

5. How would you best describe the demand for your products within a given year?

☐ Constant ☐ Predictably fluctuating ☐ Unpredictable

SECTION 6: WATER USE/QUALITY

1. What water source(s) do you utilize? (Check all that apply)

☐ Stream ☐ Surface Runoff ☐ Lake ☐ Spring ☐ Well
☐ Municipal Water ☐ Other _____

2. Which best describes your water use?

☐ Constant flow ☐ Intermittent ☐ Only to refill

3. What is the flow rate of your source water in gallons per minute?

☐ 0-500 ☐ 501-1,000 ☐ More than 1,000

4. Do you regularly monitor water quality? (Check all that apply)

☐ Yes ☐ No If yes, which aspects? ☐ Dissolved Oxygen ☐ pH ☐ Ammonia
☐ Phosphorus ☐ Solids ☐ Other _____

5. How often would you estimate poor water quality reduces your production?

☐ Never ☐ 1-3 times a year ☐ 4 or more times a year

6. Where do you discharge your effluent? (Check all that apply)

☐ Stream/River ☐ Pond/Lake ☐ Land Application ☐ Do Not Discharge ☐ Other _____

SECTION 7: FEEDS/FEEDING

1. Where do you buy your feed? (Check all that apply)

☐ Local co-op ☐ Local mill ☐ Shipped from manufacturer ☐ Other _____

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2. What type of feed do you use? (Check all that apply)

☐ Floating ☐ Sinking ☐ Slow Sinking

3. How many pounds of feed would you estimate you use in a year? _____

4. How much would you estimate you spend on feed each year? \$ _____

SECTION 8: DISEASE/WILDLIFE

1. How often does your stock experience diseases?

☐ Never ☐ 0-3 times a year ☐ 4 or more times a year

2. Where do you get your fish health information? (Check all that apply)

☐ Veterinarian ☐ Fish Disease Specialist ☐ Other producers ☐ Other _____

3. Which agencies help you with wildlife damage control? (Check all that apply)

☐ None ☐ Local ☐ State ☐ Federal ☐ Other _____

4. Does your stock experience predation?

☐ Yes ☐ No

If yes, by what? (Check all that apply) ☐ Birds ☐ Mammals ☐ Other _____

SECTION 9: LOSSES

1. Did you have any losses during 1995? ☐ Yes ☐ No

2. If you answered yes,

A. Based on quantity, the percent of those losses from your total operation? _____ %

B. What was the estimated dollar value of those losses? \$ _____

C. What of the following, as percent of the total, was attributed to those losses?

Cause	Percent
Diseases	_____
Predation	_____
Poaching	_____
Escapement	_____
Poor Water Quality	_____
Weather	_____
Other _____	_____
Total	100% of Losses

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APPENDIX A

SECTION 10: MISCELLANEOUS

1. Are you a member of any state aquaculture association?

☐ Yes ☐ No

If yes, has your membership enabled you to increase your profits in any way? ☐ Yes ☐ No

2. Are you a member of any national aquaculture association?

☐ Yes ☐ No

If yes, has your membership enabled you to increase your profits in any way? ☐ Yes ☐ No

3. How do you see your production in 5 years? ☐ Higher ☐ No change ☐ Lower

4. When you need to obtain additional information about aquaculture, who do you usually contact?
(Check all that apply)

☐ Cooperative Extension ☐ Sea Grant Agent ☐ Natural Resource Agency Personnel

☐ Other Fish Farmer(s) ☐ Other _____

5. How often are you willing to complete a similar survey?

☐ Every year ☐ Every other year ☐ Other _____

SECTION 11: COMMENTS (if you need more room, feel free to write on the back)

THANK YOU FOR YOUR COOPERATION!!

APPENDIX B

1995 Aquaculture Survey Cover Letter

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APPENDIX B

February 15, 1996

Fish Farmer
Address

Dear (Name),

The enclosed survey is being conducted by the North Central Regional Aquaculture Center (NCRAC) in cooperation with the Michigan aquaculture extension specialist. This joint project is aimed at benefitting the producers and the existing programs developed for the benefit of producers. All data that is collected will be used to assist NCRAC in the evaluation, promotion and development of aquaculture as an important component of this region's agriculture. Those completing the survey will be entitled to copies of the summarized data which will be included in the 1996 North Central Regional Aquaculture Industry Situation and Outlook Report.

Your anonymity and confidentiality will be assured using a double blind technique. This prevents anyone from knowing who the responses were received from. Completion of this survey should take no more than 30 minutes. Participation in this effort is strictly voluntary. You may choose not to participate at all, may refuse to complete certain sections, or decline to answer any question you do not feel comfortable with. Should you choose not to complete any part of this survey, you will still be entitled to a copy of the results. You indicate your voluntary agreement to participate by completing and returning this questionnaire.

In order to assure your anonymity and confidentiality, when you have completed your survey, please place it in the unmarked envelope, and then place that envelope in the envelope marked with the number on it. Please return the survey by March 15, 1996.

If you have questions or concerns, please do not hesitate to contact your state aquaculture extension specialist listed below.

We look forward to your cooperation.

Sincerely,

(Signature)

Dr. Donald Garling
Department of Fisheries and Wildlife
Michigan State University
9A Natural Resources Building
East Lansing, MI 48824-1222
Phone: (517) 353-1989
Fax: (517) 432-1699

(Signature)

Jonathan Ferris
Research Assistant
North Central Regional Aquaculture Center
Michigan State University
East Lansing, MI 48824-1222
Phone: (517) 353-1962
Fax: (517) 353-7181

APPENDIX C

1995 Aquaculture Survey Follow-Up Material

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APPENDIX C

March 22, 1996

On February 15, a questionnaire concerning aquaculture production in Michigan was mailed to you, as someone whose name was on the list of those who possess a gamefish breeders license.

If you have already completed and returned it to us please accept our sincere thanks. If not, please do so today. Because of the relative small size of the aquaculture industry in Michigan, it is extremely important that yours be included in the study if the results are to accurately reflect the aquaculture industry in Michigan.

If by some chance you did not receive the questionnaire, or it got misplaced, please call me at (517), 353-1962, and I will get another one in the mail to you today.

Sincerely,

(Signature)

Jonathan Ferris
Research Assistant

APPENDIX C

April 12, 1996

Fish Farmer
Address

Dear (Name)

I am writing to you about our study of aquaculture production in Michigan. We have not yet received your completed questionnaire.

To date, about 43% of the questionnaires have been returned. This is encouraging, but whether or not we will be able to accurately assess the status of the aquaculture industry in Michigan depends upon you and the others who have not responded. This study is aimed at benefitting producers by assisting the North Central Regional Aquaculture Center in the evaluation, promotion, and development of aquaculture as an important component of this region's agriculture.

We realize that this is a busy time of the year, and that you may have misplaced your original survey, so we have included another one. Simply place the completed questionnaire in the unmarked envelope, and then place that envelope in the marked one with the number on it. Even if you did not earn income from aquaculture, please check the appropriate box on the first page and return the survey by April 26. This will be the final follow-up.

Your contribution to the success of this study will be appreciated greatly.

Sincerely,

(Signature)

Jonathan Ferris
Research Assistant

APPENDIX D

NCRAC Aquaculture Extension Contacts

APPENDIX D

<u>STATE</u>	<u>CONTACT</u>	<u>ADDRESS/PHONE/FAX</u>
Indiana/Illinois	Mr. Ladon Swann	Aquaculture Specialist Department of Animal Science Purdue University West Lafayette, IN 47907 PH: (317) 494-6264 FAX: (317) 494-9347
Iowa	Dr. Joseph E. Morris	Aquaculture Specialist Department of Animal Ecology Iowa State University 124 Science II Ames, IA 50011-3221 PH: (515) 294-4622 FAX: (515) 294-7874
Kansas	Mr. Charles Lee	Department of Animal Science & Industry Kansas State University Call Hall Manhattan, KS 66506 PH: (913) 532-5734 FAX: (913) 532-5681
Michigan	Dr. Donald L. Garling	Fish Culture Specialist Department of Fisheries & Wildlife Michigan State University 9A Natural Resources Building East Lansing, MI 48824-1222 PH: (517) 353-1989 FAX: (517) 432-1699
Minnesota	Mr. Jeffrey L. Gunderson	Minnesota Sea Grant Extension Program University of Minnesota-Duluth 2305 East 5th Street Duluth, MN 55812 PH: (218) 726-8715 FAX: (218) 726-6556
Missouri	Mr. Robert A. Pierce II	Fish & Wildlife Specialist School of Natural Resources University of Missouri-Columbia 1-25 Agriculture Building Columbia, MO 65211 PH: (573) 882-4337 FAX: (573) 882-1977

APPENDIX D

Nebraska	Dr. Terrence B. Kayes	Dept. of Forestry, Fisheries & Wildlife University of Nebraska-Lincoln 12 Plant Industry Building East Campus Mall Lincoln, NE 68583-0814 PH: (402) 472-8183 FAX: (402) 472-2964
North Dakota	Dr. David L. Klinkebiel	Carrington Research Extension Center North Dakota State University Box 219 Carrington, ND 58421 PH: (701) 652-2951 FAX: (701) 652-2055
Ohio	Dr. John Hochheimer	Piketon Research & Extension Center 1864 Shyville Road Piketon, OH 45661-9749 PH: (614) 289-2071 FAX: (614) 292-1953
South Dakota	Mr. Larry Tidemann	Cooperative Extension South Dakota State University Agriculture Hall 154, Box 2207 Brookings, SD 57007 PH: (605) 688-4147 FAX: (605) 688-6065
Wisconsin	Mr. Fred P. Binkowski	Senior Scientist Center for Great Lakes Studies University of Wisconsin-Milwaukee 600 E. Greenfield Avenue Milwaukee, WI 53204 PH: (414) 382-1723 FAX: (414) 382-1705 (414) 382-1700

APPENDIX E

Additional Tables

APPENDIX E

Table 5. Section 2 raw data.

QUESTION 1	ILLINOIS	INDIANA	MICHIGAN
Responses	32	31	29
Raise fish	25	24	21
Obtain fish and hold for resale	13	16	22
Broker fish	2	2	1
QUESTION 2			
Responses	32	31	29
Raise your own	19	21	18
In-state	9	12	24
Out-of-state	11	17	7
QUESTION 3			
Responses	28	28	29
Yes	27	24	25
No	1	4	4
(If no,)			
Yes	3	4	3
No	1	0	1
QUESTION 4			
Responses	32	31	29
0-5	12	15	7
6-10	7	3	4
11-20	5	3	8
21-30	8	3	8
>30	0	7	2
QUESTION 5			
Responses	32	31	29
Yes	21	20	24
No	11	11	5
QUESTION 6			
Responses	29	32	31
Yes	9	4	1
No	20	28	30

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APPENDIX E

Table 5 (cont'd).

	ILLINOIS	INDIANA	MICHIGAN
QUESTION 7			
Responses	32	30	29
Yes	14	12	5
No	18	18	24
(If yes,)			
Hogs	4	4	0
Dairy	2	1	2
Beef	5	4	2
Row crops	9	8	1
Other	4	4	1
QUESTION 8			
Responses	15	15	5
Eggs	2	0	1
Fingerlings	3	3	1
Feed	3	6	1
Other	10	6	3
QUESTION 9			
Responses	32	30	29
Sole owner	18	21	20
Partnership	3	1	3
Corporation	7	7	4
Joint Venture	1	1	0
Affiliation with another company	0	0	0
Other	3	0	2
QUESTION 10			
Responses	31	29	28
Fish production (majority of sales)	18	22	14
Capture of wild bait fish (majority of sales)	2	0	1
Fish wholesaler or live hauler (majority of sales)	6	4	4
Fee-fishing operation (majority of sales)	0	1	8
Broker (majority of sales)	1	1	0
Other (majority of sales)	4	1	1

APPENDIX E

Table 6. Section 3 raw data.

	ILLINOIS	INDIANA	MICHIGAN
QUESTION 1			
Responses	30	31	29
Self	25	21	25
Bank	6	5	4
Family	1	2	2
Other	4	5	3
QUESTION 2			
Responses	31	28	29
0-24%	20	17	13
25%-49%	2	3	6
50%-74%	5	1	2
75%-99%	1	1	4
100%	3	6	4
QUESTION 3			
Responses	28	24	28
<\$2,500	11	11	5
\$2,500-\$9,999	4	4	7
\$10,000-\$24,999	2	3	3
\$25,000-\$49,999	3	1	3
\$50,000-\$99,999	1	0	6
\$100,000-\$249,999	4	3	3
\$250,000-\$499,999	1	2	0
\$500,000-\$749,999	1	0	0
\$750,000-\$999,999	0	0	0
\$1,000,000 or more	4	0	1
QUESTION 4			
Responses	21	22	26
Paid full time	10	12	7
Paid part time	8	8	10
Unpaid or family	10	6	17
Students	2	2	0
QUESTION 5			
Responses	30	30	29
Yes	21	18	21
No	9	12	8
(If yes,)			
Yes	7	9	6
No	5	4	14

APPENDIX E

Table 7. Section 5 raw data.

	ILLINOIS	INDIANA	MICHIGAN
QUESTION 1			
Responses	30	31	29
Locally	20	24	25
In-state	18	19	21
Out-of-state	11	13	5
Internationally	0	3	2
QUESTION 2			
Responses	31	27	28
Yes	11	14	12
No	20	13	16
(If no,)			
Yes	2	1	3
No	15	7	7
QUESTION 3			
Responses	31	28	28
Yes	0	4	0
No	31	24	28
(If yes,)			
Buying	0	0	0
Selling	0	1	0
Advertising	0	2	0
(If no,)			
Yes	6	7	7
No	11	3	2
QUESTION 4			
Responses	32	27	28
Yes	28	20	19
No	4	7	9
QUESTION 5			
Responses	32	30	27
Constant	11	13	4
Predictably fluctuating	9	9	12
Unpredictable	12	8	11

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APPENDIX E

Table 8. Section 6 raw data.

	ILLINOIS	INDIANA	MICHIGAN
QUESTION 1			
Responses	19	17	29
Stream	1	5	6
Surface runoff	14	11	4
Lake	7	6	1
Spring	3	6	15
Well	19	17	17
Municipal water	2	3	0
Other	1	1	1
QUESTION 2			
Responses	30	29	28
Constant flow	9	9	24
Intermittent	9	8	2
Only to refill	12	12	2
QUESTION 3			
Responses	24	21	26
0-500	22	17	15
501-1,000	1	2	6
>1,000	1	2	5
QUESTION 4			
Responses	32	30	29
Yes	18	22	15
No	14	8	14
(If yes,)			
Dissolved oxygen	12	19	12
pH	10	15	7
Ammonia	10	14	3
Phosphorus	5	4	0
Solids	6	4	1
Other	3	4	4
QUESTION 5			
Responses	31	27	28
Never	16	5	15
1-3 times a year	11	17	12
4 or more times a year	4	5	1

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APPENDIX E

Table 8 (cont'd).

QUESTION 6	ILLINOIS	INDIANA	MICHIGAN
Responses	31	26	27
Stream/river	4	4	14
Pond/lake	6	2	4
Land application	7	8	3
Do not discharge	10	10	7
Other	6	4	3

APPENDIX E

Table 9. Section 7 questions 1-2 raw data.

	ILLINOIS	INDIANA	MICHIGAN
QUESTION 1			
Responses	29	28	27
Local co-op	8	6	3
Local mill	7	11	9
Shipped from manufacturer	10	10	13
Other	5	2	4
QUESTION 2			
Responses	28	28	27
Floating	20	24	23
Sinking	9	11	19
Slow Sinking	2	3	4

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APPENDIX E

Table 10. Section 8 raw data.

	ILLINOIS	INDIANA	MICHIGAN
QUESTION 1			
Responses	31	29	28
Never	17	10	15
0-3	10	15	11
4 or more	4	4	1
QUESTION 2			
Responses	29	25	23
Veterinarian	0	3	2
Fish disease specialist	11	12	10
Other producers	7	8	10
Other	18	8	10
QUESTION 3			
Responses	29	24	29
None	24	22	22
Local	1	1	0
State	3	0	5
Federal	0	0	3
Other	2	1	0
QUESTION 4			
Responses	30	27	29
Yes	21	16	26
No	9	11	3
(If yes,)			
Birds	18	15	26
Mammals	5	7	19
Other	9	3	6

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APPENDIX E

Table 11. Section 9 raw data.

	ILLINOIS	INDIANA	MICHIGAN
QUESTION 1			
Responses	29	25	26
Yes	24	17	25
No	5	8	1
QUESTION 2			
Responses	33	31	23
Disease (majority)	15	18	1
Predation (majority)	6	3	18
Poaching (majority)	0	0	1
Escapement (majority)	1	1	0
Poor water quality (majority)	4	5	0
Weather (majority)	3	1	3
Other (majority)	4	3	0

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APPENDIX E

Table 12. Section 10 raw data.

	ILLINOIS	INDIANA	MICHIGAN
QUESTION 1			
Responses	32	29	29
Yes	13	19	15
No	19	10	14
(If yes,)			
Yes	1	7	2
No	10	5	13
QUESTION 2			
Responses	32	29	29
Yes	5	12	7
No	27	17	22
(If yes,)			
Yes	0	2	2
No	6	8	4
QUESTION 3			
Responses	31	26	28
Higher	21	18	9
No change	8	6	17
Lower	2	2	2
QUESTION 4			
Responses	30	28	29
Cooperative extension	5	11	7
Sea grant agent	2	12	4
Natural resource agency personnel	4	5	7
Other fish farmer(s)	14	18	24
Other	16	10	9
QUESTION 5			
Responses	31	28	28
Every year	22	16	15
Every other year	3	5	9
Other	6	7	4

APPENDIX F

Revised Survey

1996 AQUACULTURE SURVEY

Please Return by (DATE), 199?

Did you earn income from aquaculture in 1996? ☐ Yes ☐ No

If you checked yes, please continue. If you checked no, please return this survey.

SECTION 1: PRODUCTION

1. On the next page, please indicate which species you sell using the appropriate species code (in **bold caps**), how they are sold (by checking the appropriate column), your total production of each species by pounds or number, and total value of 1996 sales.
If you sell more than one life stage of a species, *please complete a row for each stage*.

EXAMPLE:

Species Code	HOW SPECIES ARE SOLD				PRODUCTION		VALUE
	Eggs	Fry	Fingerlings	Food Fish	Pounds	Number	Dollars
RBT	X					125,000	\$2,500
RBT			X			500,000	\$200,000
CC		X				300,000	\$18,000
YP				X	10,000		\$21,700

[illegible]

Aquaria Fish	AQF
Bass, Hybrid Striped	HSB
Bass, Largemouth	LMB
Bass, Smallmouth	SMB
Bluegill	BG
Bluegill, Hybrid	HBG
Carp, Grass	GC
Carp, Koi	KC
Catfish, Blue	BC
Catfish, Bullhead	BHC
Catfish, Channel	CC

Catfish, Flathead	FC
Crappie, Black	BCR
Crappie, White	WCR
Crayfish	CRF
Goldfish	GF
Minnow, Fathead	FHM
Perch, Yellow	YP
Pike, Northern	NP
Salmon, Atlantic	ATS
Salmon, Chinook	CKS
Salmon, Coho	CS

Shiner, Golden	GS
Sucker, White	WS
Sunfish, Redear	RS
Tilapia	T
Trout, Brook	BKT
Trout, Brown	BRT
Trout, Rainbow	RBT
Walleye	W
Other Baitfish	OB
Other	Write in Species

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APPENDIX F

SECTION 2: BUSINESS MANAGEMENT

1. In your operation, do you... (Check all that apply)

☐ Raise fish ☐ Obtain fish and hold for resale ☐ Broker fish

2. Where do you obtain your fish? (Check all that apply)

☐ Raise your own ☐ In-State ☐ Out-of-State

3. Is this your first aquaculture business venture?

☐ Yes ☐ No If no, was your first venture successful? ☐ Yes ☐ No

4. How many years have you carried out an aquaculture business?

☐ 0-5 ☐ 6-10 ☐ 11-20 ☐ 21-30 ☐ More than 30

5. Is your aquaculture activity a family operation? ☐ Yes ☐ No

6. Did you take over an existing aquaculture venture? ☐ Yes ☐ No

7. Did you own or operate a farm before you started your aquaculture business?

☐ Yes ☐ No

If yes, what kind of farm? (Check all that apply)

☐ Hogs ☐ Dairy ☐ Beef ☐ Row Crops ☐ Other _____

8. Check any of the inputs that you have been unable to acquire when needed. (Check all that apply)

☐ Eggs ☐ Fingerlings ☐ Feed ☐ Other _____

9. Which best describes the tax status of your aquaculture operation?

☐ Sole Owner ☐ Partnership ☐ Corporation ☐ Joint Venture

☐ Affiliation with another company ☐ Other _____

10. Which of the following activities are you involved in? (Check all that apply)

☐ Fish production ☐ Capture of wild bait fish ☐ Fish wholesaler or live hauler ☐ Fee-fishing operation

☐ Broker ☐ Other

11. From which of the following activities did you derive the majority of your sales in 1996?

☐ Fish production ☐ Capture of wild bait fish ☐ Fish wholesaler or live hauler ☐ Fee-fishing operation

☐ Broker ☐ Other

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SECTION 3: ECONOMICS

1. How is your operation financed? (Check all that apply)

☐ Self ☐ Bank ☐ Family ☐ Other _____

2. What percent of your total gross annual income comes from aquaculture?

☐ 0%-24% ☐ 25%-49% ☐ 50%-74% ☐ 75%-99% ☐ 100%

3. Estimate the total value of SALES from your aquacultural operation for 1995.

☐ less than \$2,500	☐ \$100,000-\$249,999
☐ \$2,500-\$9,999	☐ \$250,000-\$499,999
☐ \$10,000-\$24,999	☐ \$500,000-\$749,999
☐ \$25,000-\$49,999	☐ \$750,000-\$999,999
☐ \$50,000-\$99,999	☐ \$1,000,000 or more

4. How many workers are involved in the operation in addition to yourself? (Circle the correct number beside each category)

0 1 2 3 4 5 6 7 8 9 10 >10 Paid Full-Time Employees 0 1 2 3 4 5 6 7 8 9 10 >10 Unpaid or Family Help
0 1 2 3 4 5 6 7 8 9 10 >10 Paid Part-Time Employees 0 1 2 3 4 5 6 7 8 9 10 >10 Students (Only if you are an educator)

5. Do your sales cover your cash costs? (Cash costs include all variable costs such as feed and electricity, as well as taxes, insurance, interest on loans, etc.)

☐ Yes ☐ No

If yes, do you feel this profit is adequate to cover your time and money investment? ☐ Yes ☐ No

SECTION 4: FACILITIES

1. What types of production and holding facilities do you have? (Check all that apply and provide requested measure of size)

PONDS:	Number: _____	Total Surface Area: _____ acres
RACEWAYS:	Number: _____	Total Volume (length × width × depth): _____ ft ³
CAGES/NET PENS:	Number: _____	Total Volume (length × width × depth): _____ ft ³
TANKS:	Number: _____	Total Gallons: _____

SECTION 5: MARKETING

1. Where do you sell your product? (Check all that apply)

☐ Locally ☐ In-State ☐ Out-of-State ☐ Internationally

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APPENDIX F

2. Do you process your product yourself?

☐ Yes ☐ No If no, would you like to? ☐ Yes ☐ No

3. Are you a member of a cooperative?

☐ Yes ☐ No If yes, what type? (Check all that apply) ☐ Buying ☐ Selling ☐ Advertising
If no, would you consider joining one? ☐ Yes ☐ No

4. Do you transport your own fish to market?

☐ Yes ☐ No

5. How would you best describe the demand for your products within a given year?

☐ Constant ☐ Predictably fluctuating ☐ Unpredictable

SECTION 6: WATER USE/QUALITY

1. What water source(s) do you utilize? (Check all that apply)

☐ Stream ☐ Surface Runoff ☐ Lake ☐ Spring ☐ Well
☐ Municipal Water ☐ Other _____

2. Which best describes your water use?

☐ Constant flow ☐ Intermittent ☐ Only to refill

3. What is the flow rate of your source water in gallons per minute?

☐ 0-500 ☐ 501-1,000 ☐ More than 1,000

4. Do you regularly monitor water quality? (Check all that apply)

☐ Yes ☐ No If yes, which aspects? ☐ Dissolved Oxygen ☐ pH ☐ Ammonia
☐ Phosphorus ☐ Solids ☐ Other _____

5. How often would you estimate poor water quality reduced your production in 1996?

☐ Never ☐ 1-3 times ☐ 4 or more times

6. Where do you discharge your effluent? (Check all that apply)

☐ Stream/River ☐ Pond/Lake ☐ Land Application ☐ Do Not Discharge ☐ Other _____

SECTION 7: FEEDS/FEEDING

1. Where do you buy your feed? (Check all that apply)

☐ Other Producers ☐ Local mill ☐ Shipped from manufacturer ☐ Other _____

2. What type of feed do you use? (Check all that apply)

☐ Floating ☐ Sinking ☐ Slow Sinking

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APPENDIX F

3. How many pounds of feed would you estimate you use in a year? _____
4. How much would you estimate you spend on feed each year? \$ _____

SECTION 8: DISEASE/WILDLIFE

1. How often did your stock experience diseases in 1996?
- ☐ Never ☐ 1-3 times ☐ 4 or more times
2. Where do you get your fish health information? (Check all that apply)
- ☐ Veterinarian ☐ Fish Disease Specialist ☐ Other Producers ☐ Other _____
3. Did your stock experience predation in 1996?
- ☐ Yes ☐ No
- If yes, by what? (Check all that apply) ☐ Birds ☐ Mammals ☐ Other
4. Which agencies help you with wildlife damage control? (Check all that apply)
- ☐ None ☐ Local ☐ State ☐ Federal ☐ Other

SECTION 9: LOSSES

1. Did you have any losses during 1996? ☐ Yes ☐ No
2. If you answered yes, please write in the dollar value of losses attributed to each cause.

Cause	Value (\$)
Diseases	
Predation	
Poaching	
Escapement	
Poor Water Quality	
Weather	
Other	

SECTION 10: MISCELLANEOUS

1. Are you a member of any state aquaculture association?
- ☐ Yes ☐ No
- If yes, has your membership enabled you to increase your profits in any way? ☐ Yes ☐ No
2. Are you a member of any national aquaculture association?
- ☐ Yes ☐ No
- If yes, has your membership enabled you to increase your profits in any way? ☐ Yes ☐ No

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APPENDIX F

3. How do you see your production in 5 years? ☐ Higher ☐ No change ☐ Lower
4. When you need to obtain additional information about aquaculture, who do you usually contact?
(Check all that apply)
- ☐ Cooperative Extension ☐ Sea Grant Agent ☐ Natural Resource Agency Personnel
- ☐ Other Fish Farmer(s) ☐ Other _____
5. How often are you willing to complete a similar survey?
- ☐ Every year ☐ Every other year ☐ Other _____

SECTION 11: COMMENTS (Please provide any thoughts you have concerning the following questions. If you have additional comments that are not related to these questions, feel free to write them on the back of this page)

1. (QUESTION ?)

2. (QUESTION ?)

3. (QUESTION ?)

THANK YOU FOR YOUR COOPERATION!!

APPENDIX G

Summarized Comments

ILLINOIS

- Hoped to have better production numbers next year.
- Apologized for the need for a second survey.
- Did not plan to raise fish in 1996 due to time and labor requirements of other crops.
- Was looking for a partner to invest in the business, has problems with winter-kill.
- Hoped to get more involved in state and national aquaculture associations, is developing a library of fish culture and disease references, would appreciate information concerning association contacts and additional references.
- Production values represented inventory, minimal sales until processing plant becomes operational.

INDIANA

- Leases pay-lake to relatives, is a live hauler.
- Wholesale live bait dealer only, does not raise fish.
- Small operation now, plans to increase production after retirement, gave away production this year to create demand.
- Began operation to sell food-size fish but couldn't find enough markets, so has since converted to a fee-fishing operation.
- Pet store, sells 60 freshwater species and 10 saltwater species.
- Just getting started as a hauler of live tilapia to an oriental market, good demand for a quality product.

MICHIGAN

- Has not raised fish since 1994 due to health problems.
- Trying to work with Michigan Department of Natural Resources was very trying.
- Should try to keep aquaculture from becoming too regulated, should keep a common sense approach.
- Has limited water resources, most of work was done for small research projects or as a hobby.
- Expressed frustration with trying to compete with aquaculture products from other states that are less expensive, unable to receive help from extension personnel.
- Acknowledged surveys as a useful tool for gathering information, realized producers can obtain grants more easily if information from the farm is available.
- Apologized for the delay, indicated that 95% of fish were processed at the farm and sold directly to restaurants and fish markets.

APPENDIX H

Additional Resources

Agricultural Statistics Service

For information regarding the agricultural statistics service in a particular state, look under the government section of the local phone directory. For assistance with general agricultural statistics, information about the National Agricultural Statistics Service (NASS), its products or services, contact the NASS information hotline at 1-800-727-9540, or E-mail: NASS@AG.GOV.

AquaNIC

WWW: <http://www.ansc.purdue.edu/aquanic/>

TELNET: www.ansc.purdue.edu

For further information about AquaNIC, contact Mark Einstein at 1-317-494-4862, or E-mail: meinstei@hub.ansc.purdue.edu

USDA Aquaculture Outlook Reports

Subscriptions to the printed version of these reports, which are published twice a year, are available from the ERS-NASS order desk. Call toll-free, 1-800-999-6779. Subscriptions are \$15/year, and ERS-NASS accepts MasterCard and Visa. The order desk can also provide information regarding how to access these reports electronically.

USDA Trout Reports

For information on trout production, call Jim Brewster at 1-202-720-8784, office hours are 8:00 a.m. to 4:30 p.m. ET. He can also provide instructions on how to access the information electronically.

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MICHIGAN STATE UNIV. LIBRARIES



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