Assessment and Future Direction of The Ohio State University Aquaculture Program

Dissertation

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

Laura G. Tiu, B.S., M. S.
Agricultural and Extension Education Graduate Program

The Ohio State University

2010

Dissertation Committee:

Robert J. Birkenholz, Ph.D., Advisor
Joseph A. Gliem, Ph.D.
Keith L. Smith, Ph.D.
Abstract

The Ohio State University Aquaculture Program (OSUAP) has been providing information to Ohio aquaculture producers since 1990. Primary goals of the program were to increase the number of aquaculture producers and volume of aquaculture production and enhance the economic viability of the aquaculture industry in Ohio. In order to address impact, accountability, and guide future programming efforts, a mail census survey was conducted to describe Ohio aquaculture producers and their businesses and assess the impact of the OSUAP on producers and the industry.

A profile of the typical Ohio aquaculture producer reflects a white, male in his fifties. Farming was not his primary occupation and he was usually employed in a full-time job off the farm. More than half of Ohio aquaculture producers do not belong to an aquaculture association. Ohio aquaculture producers occasionally use the Internet to obtain aquaculture production information, although over three-fourths report having access to the Internet. Two-thirds of Ohio Aquaculture producers report annual aquaculture sales of less than $10,000 while five percent reported sales in excess of $500,000.

Ohio aquaculture producers obtain information from a variety of sources. The top five sources ranked in terms of value are books, other producers, the Internet, the Ohio State University Aquaculture Program, and neighbors and friends. The majority
of Ohio aquaculture producers were aware of the OSUAP and had used or benefited from
the products and services it had provided in the past. These data indicate that the
OSUAP has contributed to the economic efficiency of Ohio aquaculture producers by
providing information sources that increase knowledge, are applicable to their
aquaculture businesses, and have some economic value. Ohio aquaculture producers
ranked water quality, fish nutrition, aeration, fingerling production, marketing, fish
genetics, and regulations as topics of greatest importance for future OSUAP research and
Extension programming. Aquaculture producers preferred to get their information via
newsletters and mail.

The utility of this research is to provide direction for the future of the OSUAP.
The OSUAP had an impact on Ohio aquaculture producers that appears to have
contributed to the growth and economic efficiency of the aquaculture industry in Ohio. A
multiple-output strategy, concentrating on high-touch and therefore high impact
activities, should be continued. However, an opportunity exists to reach those not
currently utilizing the OSUAP. Findings from this study can be used in developing new
programs designed to address needs identified by Ohio aquaculture producers.
Dedication

Dedicated to my mother, Irene W. Goodgame who has always been
the wind beneath my wings,

and

to my husband, Jose G. Tiu, my biggest fan,

and my sons Eric Lee Tiu and Adam John Tiu

who are my gifts to the world.
Acknowledgments

I wish to express my sincere appreciation to the many individuals who encouraged and supported me in the pursuit of this degree. My genuine thanks and admiration go to Dr. Robert Birkenholz, my advisor, who graciously acquired me halfway through my program. His patience, direction, and encouragement kept me focused on the goal. To Dr. James Connors, my first advisor, who helped get me started on the road. To Dr. Joe Gliem, statistics guru extraordinaire, for being one of my favorite professors and serving on my committee. To Dr. Keith Smith, for his encouragement and serving on my committee. I would also like to recognize Dr. Don McFeeters, Dr. Carl Webster, Dr. James Tidwell and Dr. Steve Miranda who have served as supervisors and mentors during my career. To Dr. Hanping Wang and Geoff Wallat, thank you for being my invaluable teammates over the years. A special thanks to Dr. Julie Fox and Dr. Lucinda Miller, fellow students on the road to this goal, who kept me positive and provided some laughs along the way. And finally to Mrs. Julie Strawser-Moose, my personal organizer, who helps to keep me sane.
Vita

2000-present……Ph.D. candidate, Agricultural and Extension Education, The Ohio State University

1988-1990………M.S. Wildlife Ecology, Mississippi State University

1982-1986………B.S. Biology, Silliman University, Dumaguete City, Philippines

2003-present……Senior Research and Extension Associate, Ohio State University

1998-2003………Research and Extension Associate, Ohio State University

1991-1998………Co-Investigator for Aquaculture, Kentucky State University

2007-present……National Aquaculture Extension Steering Committee (USDA/NOAA)

2007……………..Co-Chair of the 2007 National Aquaculture Extension Conference in Cincinnati, OH

2005-2007………Class XI graduate of The Ohio Leadership Education and Development (LEAD) Program

2002-2006………North Central Regional Aquaculture Center (NCRAC) Board of Directors


1998-present……Ohio State University Sustainable Agriculture Team
Publications


**Fields of Study**

Major Field: Agricultural and Extension Education
Table of Contents

Abstract ........................................................................................................................................... ii
Dedication ..................................................................................................................................... iv
Acknowledgments .......................................................................................................................... v
Vita................................................................................................................................................ vi
List of Tables ............................................................................................................................... xiii
List of Figures ............................................................................................................................... xiv

Chapter 1: Introduction ............................................................................................................... 1
  Background and Setting .......................................................................................................... 1
  Problem Statement ................................................................................................................. 7
  Purpose of the Study .............................................................................................................. 7
  Objectives of the Study ......................................................................................................... 8
  Definition of Terms ............................................................................................................ 8
  Assumptions ......................................................................................................................... 10
  Limitations ............................................................................................................................ 10

Chapter 2: Review of Literature ............................................................................................... 12
  Extension Programs ............................................................................................................. 12
    Mission ............................................................................................................................... 12
    Adult Participation .......................................................................................................... 13
    Extension Theory ............................................................................................................ 14
Appendix B: Exemption from Office of Responsible Research................................. 92
Appendix C: Panel of Experts.................................................................................. 94
Appendix D: Pre-survey Postcard.......................................................................... 96
Appendix E: Cover Letter...................................................................................... 98
Appendix F: Incentive postcard............................................................................. 100
List of Tables

Table 1. Comparison of Early (first quartile) and Late (last quartile) Respondents on 11 Survey Items using a Chi-Square Test.............................................................................. 34

Table 2. Characteristics of Ohio Aquaculture Producers by Category, Frequency and Percent............................................................................................................................... 41

Table 3. Sources of Information Used by Ohio Aquaculture Producers Ranked by Preference. ........................................................................................................................ 44

Table 4. Impact of Various Sources of Information from the Ohio State University Aquaculture Program on Ohio Aquaculture Producers. .................................................. 48

Table 5. Importance of Aquaculture Topics Ranked by Ohio Aquaculture Producers. ... 50

Table 6. Preferred Formats for Receiving Aquaculture Information as Ranked by Ohio Aquaculture Producers...................................................................................................... 52
List of Figures

Figure 1. Diagram Representing the Complexity of the Ohio Aquaculture Industry. ....... 4
Figure 2. Years in Which Ohio Aquaculture Producers Obtained Aquaculture Permits. 38
Figure 3. Percentage of Gross Farm Sales Attributed to Aquaculture Production. ......... 42
Figure 4. Gross Annual Aquaculture Sales from Ohio Aquaculture Operations 2005-
2009................................................................................................................................... 43
Figure 5. Awareness of the Ohio State University Aquaculture Program by Ohio
Aquaculture Producers...................................................................................................... 45
Figure 6. Use of the Ohio State University Aquaculture Program by Ohio Aquaculture
Producers........................................................................................................................... 46
........................................................................................................................................... 59
Figure 8. Gross Annual Farm Sales from Ohio Farms (NASS, 2007). ......................... 59
Chapter 1: Introduction

Background and Setting

One hundred years ago, more than 50 percent of Americans lived on small farms or in rural towns and produced much of their own food. Today, more than 80% of the American population lives in urban areas. Increases in farm productivity have allowed fewer farmers to produce more food than ever before. As a result less than two percent of the U.S. population is engaged in food production today (United States Department of Agriculture [USDA], 2009). Even so, the demand for food is expected to increase in the coming decades due to a growth in population and rising incomes.

How food is produced is not the only change to United States agriculture. What food is produced has changed as well. America’s demand for a greater variety in food choice, and preference for year round availability, has encouraged the development of new crops. Aquaculture is one of the more recent innovations in food production in the U.S.

Aquaculture is defined as the culture of aquatic organisms under controlled or semi-controlled conditions (Stickney, 1996). World aquaculture production has expanded rapidly and now supplies about fifty percent of all fish consumed (Stanford University, 2009). Seafood, previously supplied from wild harvest of oceans, rivers and lakes, is increasingly being produced on farms. In fact, the global catch of wild harvest seafood has been flat or declining for decades, with three-quarters of the world’s fish stocks at or
below the threshold for sustainable long-term fishing. The Food and Agriculture Organization (FAO) recently reported that 52% of the commercial marine fish stocks were considered fully exploited, 19% percent overexploited, 8% depleted, and 1% recovering from depletion (Food and Agriculture Organization [FAO], 2007). These data suggest that any future increase in demand for seafood will need to be filled by farm-based aquaculture production.

Consumer demand for seafood continues to rise. In the U.S., seafood products are the largest contributor ($8.92 billion in 2009) to the trade deficit among all food items (Myers, 2010). Although annual seafood consumption per capita in the U.S. has remained essentially unchanged (approximately 16.0 pounds/person), it is population growth and the increased standard of living that have been the primary drivers of the growth in seafood demand. Consumers in developed countries generally recognize health benefits to eating fish, whereas consumers in the developing world’s growing middle class have increased their demand for animal protein, especially seafood (FAO, 2007). Without increased aquaculture, some economists have suggested that the price of fish on the world market could triple or quadruple by 2030.

U.S. domestic aquaculture production has expanded and is expected to continue to grow as a source of fish, shellfish and mollusks. The value of U.S. aquaculture production rose to nearly $1.1 billion during the last two decades. The 2007 Census of Agriculture (National Agriculture Statistics Service [NASS], 2009) indicated that sales of fish, shellfish and related products increased by 11.7 percent over the previous seven years.
Aquaculture production is poised to expand rapidly in Ohio. Thirteen species of aquatic animals are currently being produced for food, pond stocking, bait for fishing, or ornamental species. Ohio aquaculture producers reported $6.6 million dollars in sales for 2007. This is an increase from $1.8 million in 1998, and from $3.2 million in 2005 (NASS, 2006), representing an overall annual sales growth rate of 8%. In the North Central Region of the U.S., Ohio currently ranks 3rd among the 12 states in the region for total sales of aquaculture products, up from 7th place in 1998.

While the aquaculture industry centers around aquaculture producers, it is comprised of a complex web of inputs and outputs that is dependent upon concurrent expansion of related industries in order to grow. This includes service from public agencies as well as fish food production facilities, specialized transportation firms, and additional fish processors (Figure 1). Expansion of aquaculture in Ohio may result in a significant economic impact on the state’s economy.
Interest in developing aquaculture businesses in Ohio has been increasing on an annual basis. The Ohio State University Aquaculture Program (OSUAP) receives hundreds of requests each year for information on starting aquaculture production enterprises. The Ohio State University Aquaculture Program at the Piketon Research and Extension Center in Piketon, Ohio was created by Ohio State University Extension and the Ohio Agriculture Research and Development Center (OARDC) in response to the need for research, infrastructure and Extension/outreach programs to assist potential aquaculture entrepreneurs in developing and maintaining profitable operations.

The Piketon Research and Extension Center (PREC), recently renamed The Ohio State University South Centers (OSUSC), is a large, multi-center facility in south central
Ohio (Piketon) that was opened in 1991. Five program areas were developed at the Center to advance the mission and vision: Forestry, Water Quality and Management, Economic Development, Aquaculture, and Horticulture.

The Ohio State University Aquaculture Program (OSUAP) was developed in 1990 to develop, expand and support the aquaculture industry in Ohio. The purpose of the OSUAP was to develop a profitable aquaculture industry in Ohio through research and Extension programs. Initially, research was to focus on production of baitfish, development of technologies for production of fish for food and modification, and adoption, of technologies from other regions. Facility construction and basic research consumed the majority of the first seven years.

A United States Department of Agriculture (USDA) external review team reviewed the OSUAP in 1997. Guided by specific questions, the review team obtained information from various documents and reports, and through meetings and interviews with administration, faculty, staff and stakeholders. During this process, a new strategic plan for the OSUAP was developed. The USDA review team assessed the OSUAP’s strengths and weaknesses, and made suggestions regarding OSUAP research, and Extension programs, as well as the facilities. The review team concluded that the program lacked a clear vision for the future due in part to lack of interaction and feedback from the private sector. They also concluded that the majority of research conducted to that point had been in the form of basic research which had made significant contributions to science, but a lesser contribution to addressing problems and issues facing commercial interests in the state (Davis, Jensen, & Lewis, 1997).
In response, an Aquaculture Program Advisory Committee, consisting primarily of Ohio aquaculture producers, was organized in 1997 to identify goals and action strategies for the OSUAP. The resulting new mission of the OSUAP was to explore economic opportunities in aquaculture by supporting expansion of the industry in Ohio. The goals identified were to: (a) increase the number of aquaculture producers, (b) increase the amount of aquaculture production, (c) increase economic efficiency of aquaculture producers, and (d) demonstrate the economic impact of the industry to the state of Ohio.

New personnel were hired in 1998 and directed to develop an aquaculture research and Extension program to address the goals identified by the Aquaculture Program Advisory Committee. The new personnel were asked to conduct a needs assessment of the industry and develop an Ohio State Plan for Aquaculture. A taskforce, co-chaired by the Ohio Aquaculture Association (OAA) and the Ohio Department of Agriculture (ODA), was formed (1999). After months of deliberation, the Ohio State Aquaculture Plan was published (Ohio Aquaculture Task Force, 2001) with multiple recommendations and provided the framework for research and Extension programming through the OSUAP.

Coinciding with and subsequent to the implementation of the Ohio State Aquaculture Plan, the aquaculture industry in Ohio expanded in many dimensions (NASS 2006, 2009). Although program evaluations have been conducted on an on-going basis, a comprehensive evaluation of the OSUAP and its impact on the industry has not been completed. Recent public emphasis on accountability elevates the need to assess
program impact in order to obtain information that can be used to prioritize outputs, guide future program development, and justify resource allocation.

**Problem Statement**

Several universities throughout the United States have invested in aquaculture programs since the early 1980’s to address the growing need for research, Extension and education. Since the initial investments, there has been little evidence collected to document the impact of those investments as a basis for program accountability. Furthermore, as financial constraints arise and faculty and Extension specialists retire, universities are faced with resource allocation decisions that influence the future of those programs. Assessing program impact can enhance accountability and provide guidance for decision-making regarding the future direction of programs to meet changing industry needs. Therefore, the central problem for this study was to determine the impact of the Ohio State University Aquaculture Program on aquaculture producers in Ohio.

**Purpose of the Study**

The purpose of this research was to assess the impact of the Ohio State University Aquaculture Program (OSUAP) on Ohio aquaculture producers. In order to accomplish this purpose, data from licensed Ohio aquaculture producers were collected, summarized, and analyzed to determine OSUAP impact and to provide guidance and direction for the future of the program.
Objectives of the Study

The following research objectives were used to guide this effort:

1. Describe the characteristics of Ohio aquaculture producers and their operations.
2. Determine awareness of and participation in the OSUAP by Ohio aquaculture producers.
3. Determine the impact of the OSUAP.
4. Synthesize recommendations for the future of the OSUAP.

Definition of Terms

The following terms require an explanation as to how they were interpreted and applied within the context of this research. These terms are listed alphabetically and operationally defined as they were used in the context of this study.

Aquaculture. The culture of aquatic organisms under controlled or semi-controlled conditions (Stickney, 1996).

Aquaculture permit. An annual permit (January-December) administered by the Ohio Department of Natural Resources, Division of Wildlife, allowing for the culture of approved aquaculture species for sale.
**Demographic variables.** Demographic variables are those characteristics of a population that are unique.

**Impact.** The extent to which any observed changes in respondents was due to your program activities. In this study, impact was calculated as the summation of response frequencies scores of information sources rated by Ohio aquaculture producers on new knowledge gained, new knowledge applied and economic value of OSUAP information sources.

**Ohio aquaculture producers.** Aquaculture producers within the state of Ohio who have obtained an aquaculture permit between the years 2005-2009 from the Ohio Department of Natural Resources with the intent to produce an aquaculture product for sale.

**Ohio aquaculture industry.** A complex web of inputs and outputs including aquaculture producers, feed mills/suppliers, veterinarians, processors, wholesalers, fishmongers, fish haulers, and retailers.

**OSUAP products.** Outputs of the Ohio State University Aquaculture Program (OSUAP) designed to transfer information and technology to the end users. The outputs will be referred to as “products” as the general public may be unfamiliar with the term output.

**Participation.** Engaging in an activity to acquire new knowledge, information or skills.

**Paylake.** A business where customers pay for the right to fish in a private body of water and/or any fish caught.
Assumptions

The researcher acknowledges the following assumptions in planning and conducting this study:

1. The respondents provided the researcher with valid and reliable data.
2. The respondents were honest when answering the questions.

These assumptions can be supported by the theories of perceptual psychologists. Allport (1955) and Combs, Richards, and Richards (1976) theorized that all behavior is influenced, not by the objective environment, but by a personal, individual manner of perceiving that is unique to each person and includes the entire universe as it is experienced by the individual.

Limitations

The following limitations were recognized in this study:

1. The target population was limited to Ohio Aquaculture Producers who had obtained aquaculture production permits, required by the state in order to raise fish to sell, from the Ohio Department of Natural Resources during the years of 2005 to 2009. Therefore, results of this study cannot be generalized to Ohio Aquaculture Producers not holding permits or to producers in other states.
2. The research questionnaire solicited the self-reported perceptions of respondents based on their retrospective, subjective assessment of participation and beliefs about how their participation influenced their aquaculture operation. Independent verification of individual responses was not attempted.

3. The researcher measured perceptions of aquaculture producers using attitudinal scales. Perceptions, attitudes, and practices may change over time as individuals grow and have new or different experiences.

4. This study was limited in its focus on the impact of the OSUAP on Ohio aquaculture producers. There was no attempt to extrapolate the OSUAP impact on the aquaculture industry or economy of the state of Ohio
Chapter 2: Review of Literature

Effective research and Extension programs start with conscientious program development and end with evaluation of impact. This review of literature begins with information about the importance and process of program development. Specifically, it explores preferences in delivery methods, why, and how adults participate and how we measure impact. The focus then narrows to review past assessments of University aquaculture programs and more specifically, the Ohio State University Aquaculture Program (OSUAP). This literature review closes with an overview of the current status of the aquaculture industry in Ohio. This chapter is organized in the following sections:

Extension Programs

Aquaculture Extension Programs

Ohio State University Aquaculture Program

Summary

Extension Programs

Mission

The primary mission of the Cooperative State Research, Education and Extension Service (CSREES), now the National Institute of Food and Agriculture (NIFA), has been to improve lives through research, education, and Extension using knowledge focused on
issues and needs. This mission has been accomplished primarily through a system of Land Grant Universities. Land Grant Universities have three primary functions: education, research, and Extension. Extension has been the mechanism that Land Grant Institutions utilize to transfer research-based information to the public. The Cooperative Extension System is the largest adult education institution in the world and as such, should take into consideration adult education theory in development of programs (Franz, 2007)

Adult Participation

In the first national study on participation in adult education, Johnstone and Rivera (1965) offered a profile of the adult learner and categorized barriers to participation as: (1) situational, including time, money, and transportation, (2) institutional, pertaining to the service provider, (3) socio-demographic, like age, sex, race, and (4) dispositional factors such as feelings toward group participation. Houle (1961) developed the idea that the motivation among adult learners varies considerably, but learners typically fall into one of three subgroups: goal-oriented, activity-oriented, or learner-oriented. Burgess (1971) identified several motivations of adults who choose to participate in a learning experience: they want to know; they’ve engaged in some activity; they need to meet a work-related requirement; or they simply want to escape. Adults participate in Extension educational programs for a variety of reasons. In a 1987 survey of Ohio Extension clientele, five factors influenced participation: low anticipated difficulties with arrangements, high commitment to the Extension
organization, anticipated positive social involvement, anticipated high quality of the information and possession of high internal motivation to learn (Norland, 1992).

Extension Theory

Extension theory draws on teaching and learning theory, as well as adult education theory, in the development of their programs. Program development is typically a complex process that incorporates multiple factors and processes including: an organization’s mission, situation analysis, stakeholder input, target audiences, needs assessment, program objectives, program content and learning strategies (Richardson, 1994). Quality Extension programs are considered to be research-based, learner-centered, use appropriate teaching methods including technology and have a system for assessing quality teaching (Archer, Warner, Clark, Cummings, & Adamu, 2007). Learners should be directly involved in developing, implementing, and evaluating learning experiences for efficient program development (Franz, 2007).

Extension theory revolves around using research-based information developed at the University and using the Extension process of diffusion to transfer the information to clients. The dissemination of research model primarily used in Extension is based upon after Everett Rodger’s diffusion theory outlined in his book, *Diffusion of Innovation* (1964).

If information is to be used, it must be disseminated in a way that best facilitates its use by agricultural producers (Cartmell, Orr, & Keleman, 2006). Dissemination methods have evolved over time. Traditional methods, including farm visits and mailing of fact sheets, are becoming economically prohibitive. Electronic distribution of
information using the Internet is becoming more common. Technology has broadened the number of new methods available for dissemination of information but not all of the recipients have adapted to this new form of communication (Cartmell et al., 2006).

Sources of Information and Delivery Preference

Extension educators serve a very diverse clientele. It is important to understand the information-use patterns and delivery preferences of the audience (Brunson & Price, 2009; Cartmell et al., 2006). Bardon, Hazel, and Miller (2007) identified the association between delivery method preferences and socio-demographics of landowners implying that information delivery methods can be targeted to specific users. Small farm operators in Tennessee reported that their top two sources of information were Extension and other farmers (Muhammad, Tegegne, & Ekanem, 2004). Small-acreage owners in Utah reported friends or relatives and Extension services as the top two sources of information (Brunson & Price, 2009). Limited-scale landowners in Oklahoma ranked Extension and Internet as their top two agricultural information sources (Cartmell et al., 2006). The challenge here seems to be determining the preferred method for reaching a particular audience. Computer access, Internet, and email use were relatively low for small farm operators in Tennessee (Muhammad et al., 2004). However, Brunson and Price (2009) reported a shift in how landowners want to receive information, with Web-based products rating higher than all other sources.
Program Impact

Since the 1970’s, there have been increased demands placed on how Extension accomplishes its mission, resulting in the need to become more accountable (Hamilton, Varma, & Burnett, 1996). Extension programs supported by tax dollars are accountable to multiple stakeholders (Galindo-Gonzalez & Israel, 2010). The Government Performance and Results Act (GPRA) was enacted in 1993 during the Clinton Administration. The purpose of GPRA was to reform the federal government and encourage them to become more results-oriented. This resulted in a shift from process accountability to results accountability (Government Performance and Results Act, 1993). Therefore, summative (i.e. results) evaluation should be a consideration in every Extension program.

Internal evaluations provide learning organizations with invaluable information for program development (Minnett, 1999) and accountability. Extension professionals can do a better job when they know how clients feel about their programs (Gross, 1977). Multiple attempts have been made to determine farmers’ attitudes toward various Extension programs (Gross, 1976; Suvedi, Lapinski, & Campo, 2000). It has been a challenge to find evaluation methods and impact models that fit the wide diversity of Extension programming and can operate within the unique social and political climate. Extension’s challenge has been to develop models of evaluation and impact that address the multiple audiences and contexts in which programs have been conducted (Hamilton et al., 1996). There has also been a movement away from merely reporting activities and outputs to a need for more extensive reporting of outcomes and impacts. Fortunately,
there has been a long history of Extension programs that have used evaluation data and
information to assess and improve programming (O'Sullivan & O'Sullivan, 1998).

Survey research is commonly used in evaluation studies. The purpose of a survey
is to get information from individual people about their knowledge, attitude, or behavior.
Advantages supporting the use of surveys include: ability to gather a lot of data from a
large population or sample, excellent for outcome evaluation, and the responses can be
confidential or anonymous. However, surveys take time to develop, can be expensive to
administer, and have the potential problem of low response rates and consequently
having to deal with non-response error.

Bennett’s Hierarchy of Evidence

One model that has been used to measure impacts and outcomes is Bennett’s
Hierarchy of Evidence. Bennett (1975) suggested a staircase of seven categories of
criteria for developing and evaluating Extension programs. While Bennett encouraged an
examination of how well workshops and training involving people were provided, he
emphasized looking beyond the model of just evaluating activities, and restated the
importance of evidence that the activities (workshops, field days, etc.) were having an
impact. Previously, this was considered a summative form of evaluation that examined
the process, and was designed to be used by management and stakeholders. Impact
evaluations document the degree of achievement of pre-determined targets (from the
program development assessment) and the extent to which program implementation
influenced such achievement. Such program evaluation processes could then be used to
improve program management and accountability.
Aquaculture Extension Programs

Extension aquaculture programs have also been designed to help clients obtain and use new knowledge, adopt new practices and improve their economic well being (French, 1980, Kumar, 1999). Accordingly, increased fish production and income would be indicators of success in aquaculture. Weeks (2009) identified four primary (economics and marketing, production technology, aquatic animal health/biosecurity and regulations) and seven secondary (relevancy, industry involvement, education, public support, sustainability, research and Extension, information transfer methods) factors he labeled influencing components, that can be addressed with information transfer and have the potential to impact industry development.

Most aquaculture programs in the U.S. encompass research and extension components. Aquaculture Extension programs would include training farmers in aquaculture techniques and transferring technology through a variety of methods on a variety of subjects from facility design, culture techniques, aquatic health, fish nutrition, best management practices. Extension also helps by connecting the industry to a network of support services such as feed, fertilizer and chemical manufacturers, equipment suppliers and fish haulers and processors. Assisting with linkages to other government agencies, financial institutions, consumer education and marketing are also important connections that may be facilitated through Extension programs.
Aquaculture Program Evaluations

A number of research and Extension programs dedicated to aquaculture development in the U.S. and specifically in the North Central Region have been in existence since the 1980’s. A national study of selected Extension programs focusing on economic opportunity was conducted in 1980 to better understand the social and economic consequences of publicly-funded educational programs (French, 1980). One of the entities selected for evaluation was the Aquaculture Extension Programs in four states: Alabama, Arkansas, Michigan and Mississippi. The main thrust of this study was to assess the participants’ abilities to improve income, increase awareness of career options, learn specific job skills, gain and hold employment, and stimulate new jobs. The study concluded that the Extension programs helped improve the income of respondents, helped provide new jobs or retained existing jobs, and that respondent’s placed great value on the Extension aquaculture programs. This study was conducted at a time of large growth in the catfish industry in the three southern states. The responses indicated that respondents perceived that Extension played a major role in the support and success of the growing industry (French, 1980).

The University of Tennessee’s Agricultural Development Center recently conducted an assessment of that state’s aquaculture industry (Holland, 2000). The results indicated that Tennessee farmers’ greatest needs were grower education and consumer awareness programs, technical production support, and access to funding. They identified labor, volume of products, and lack of a processor as the greatest constraints to industry expansion. More than 16 percent of the Tennessee aquaculture producers reported that the University of Tennessee’s Extension Program was their primary source
of technical aquaculture information, followed by other aquaculture producers (14.6%) and other state Extension services (12.1%), listed second and third respectively.

Indiana had a notable aquaculture research and Extension program until 1998, when the joint Purdue and Indiana Sea Grant Aquaculture Extension Specialist position was vacated. While the industry grew from 24 farms and $2.7 million in sales in 1998 to 47 farms and $3.2 million in sales in 2002, it declined to 18 farms and $116,000 in sales in 2005 (NASS, 2000; 2006). A new specialist was hired in 2006.

Aquaculture specialists at Purdue University recently partnered with the Indiana Soybean Alliance to provide introductory aquaculture programs designed to address identified needs and help jump start the aquaculture industry in the state. The top three constraints identified by Indiana aquaculture producers in a recent survey related to management and economics including high start-up costs, lack of a well-established market for aquaculture products, and the high cost of day-to-day operation (Quagraine, Hart, & Brown, 2008). Although it may have been logical to assume that the lack of an aquaculture specialist contributed to the decline in the industry in Indiana, the recent survey failed to identify a lack of Extension support or training programs as a major constraint to the industry.

Ohio State University Aquaculture Program

Ohio Aquaculture Task Force

The Ohio Aquaculture Task Force (OATF) was created in 2000 to examine the needs of the Ohio aquaculture industry and develop recommendations to foster aquaculture
expansion in the state (Ohio Aquaculture Task Force, 2001). The task force was initiated by the Ohio Aquaculture Association, with the Ohio Department of Agriculture agreeing to provide co-leadership. The OATF was comprised of persons with an interested the Ohio Aquaculture industry. This included aquaculture producers representing the private sector, various academic programs, and agricultural commodity groups. The OATF also included seven state and federal agencies: Ohio Aquaculture Association (lead agency), Ohio Department of Agriculture (co-lead agency), Ohio Department of Natural Resources, Ohio Environmental Protection Agency, Ohio Farm Bureau, Ohio Sea Grant Program, Ohio Agricultural Research & Development Center (OARDC), OSU South Centers at Piketon, OSU School of Natural Resources, and OSU Extension (OSUE).

The recommendations from the task force have guided program development in the OSU Aquaculture Program from 2001 through 2008. The following nine recommendations were developed for immediate action (OATF, 2001):

1. Initiate a “Triangle Plan” for aquaculture in which three aquaculture Extension specialists used a team approach to address programming and educational needs.

2. Promote aquaculture education by supporting secondary education efforts and the Hocking College Aquaculture Program.

3. Increase funding for research that focuses on collecting baseline production data.

4. Create a State Aquaculture Coordinator position to promote communication among the various agencies, producers, processors, and others involved in aquaculture.

5. Create an Aquaculture Marketing Specialist position within the Ohio Department of Agriculture.
6. Develop and promote a Voluntary Quality Assurance Program for Ohio aquaculture.

7. Create an Aquaculture Health Advisory Committee within the Ohio Department of Agriculture.

8. Develop an environmental “Best Management Practices” program to facilitate adoption of best practicable technology currently available for water outflows.

9. Assist Ohio’s Division of Wildlife, EPA, and Department of Agriculture in achieving their mission of protecting the natural resources of Ohio in a manner that permits farmers to develop aquaculture as an important segment of agriculture.

Ohio Aquaculture Producer Survey

In 2002, an attempt to evaluate the status of the aquaculture industry and to develop strategies to deal with potential threats was organized by the Ohio Cooperative Development Center, the Aquaculture Program at The Ohio State University (OSU) South Centers, and the Ohio Aquaculture Association (OAA). A marketing research study of the aquaculture industry in Ohio was conducted. A mail survey was designed to develop a clearer picture of the status of the aquaculture industry in Ohio. Data collected were deemed necessary to justify a request for additional funding to support on-going research and Extension activities at The Ohio State University.

The results of the Ohio Aquaculture Producer Survey (2002) indicated that the industry was somewhat in its infancy in Ohio with 40% of the businesses having one to five years of operating experience. However, 27% of the respondents indicated they had
more than 20 years of experience. Family-based operations comprised 75% of the aquaculture production businesses in Ohio, and for 87% of these businesses, aquaculture production was not their primary source of income. More than 75% of the aquaculture producers surveyed had a net profit of less than $5,000 annually. Only about four percent of the businesses had a net profit between $30,001 and $40,000. The questionnaire failed to ask for annual sales data, and therefore could not be compared with Census of Aquaculture data. When asked about future plans, 44% of the businesses did not have plans for expansion, while 56% indicated they were going to expand their businesses in some way, which indicated that current producers would help expand the industry in the future.

Ohio Aquaculture Production and Sales Data

Ohio Aquaculture Producers are required to obtain a permit from the Ohio Department of Natural Resources (ODNR) annually. The ODNR permit allowed producers to culture fish for sale from January 1st December 31st of each year. Prior to 2002, each aquaculture facility obtained a permit from the ODNR district where it was located. In order to compile a list of licensed aquaculture producers prior to 2002, one was required to solicit copies of the paper permits from each of the five districts. In 2002, this process was streamlined with all permit applications forwarded to the state ODNR office in Columbus, Ohio. Thereafter, an electronic database of licensed aquaculture producers was maintained in the state ODNR office in Columbus, OH.

Production and sales data has been challenging to collect for Ohio. Aquaculture has not been included in the State of Ohio Agriculture Census, therefore only data from
the two existing Census of Aquaculture reports in 1998 and 2005, and the last two National Census of Agriculture, 2002 and 2007, both which included aquaculture data, was available. The Census of Aquaculture data numbers likely underestimate the number of aquaculture farms and total aquaculture sales in Ohio, as there were approximately 200 licensed farms in 2005, but only 55 farms reported production data during the year.

According to a 1990 survey of Ohio aquaculture producers, there were 33 aquaculture producers growing both recreation and food fish who reported gross annual sales of $1,302,000 (Hushak, 1993). In the 1998 Census of Aquaculture, 33 Ohio aquaculture producers reported $1,788,000 in sales. In the 2002 Census of Agriculture, there were 100 Ohio aquaculture producers reporting $3,338,000 in sales. In the 2005 Census of Aquaculture, 55 aquaculture producers reported sales of $3,185,000. In 2007, 140 Ohio aquaculture producers reported $6.6 million dollars in sales (NASS, 2009).

Summary

The Extension Vision for the 21st Century Committee stated that Extension would benefit from program development that included obtainable and definitive outcome measures (Extension Committee on Organizational Policy, 2002). Many Extension programs have attempted to incorporate more consistent evaluation methods into their programs. Program evaluation helps to identify, clarify, and apply defensible criteria to determine the worth of a program. A recent survey of aquaculture Extension agents, specialists and program administrators identified continuing education in the area of program evaluation as a top desire (Schwarz, 2010).
State aquaculture industries can be enhanced by successful university-based aquaculture research and Extension programs (Swann & Morris, 2001). However, the lack of aquaculture Extension personnel and lack of institutional support for Extension are critical factors that impede the development of aquaculture programs designed to support the industry. For aquaculture to be recognized as a viable agriculture industry by universities and government agencies, aquaculture programs must collect and report information that documents the value of the industry to the state and nation (Swann & Morris, 2001).

Previous studies provided insight regarding demographic characteristics, production methods, and sales of aquaculture producers in Ohio, but failed to assess the impact of The Ohio State University Aquaculture Program (OSUAP) on the industry. Given the current funding environment, with increased competition for limited funds, the OSUAP must be able to document the impact of its research and Extension programs as determined by the perceptions of its stakeholders. Results of this study will help guide the future direction and focus of The Ohio State University Aquaculture Program.
Chapter 3: Procedures

The goal of this study was to assess the impact of The Ohio State University Aquaculture Program (OSUAP). This chapter outlines the process for systematically designing, collecting data, and analyzing the data to increase understanding about Ohio aquaculture producers and the impact of The Ohio State University Aquaculture Program on therm. Sections include:

Research Design
Instrumentation
Population and Sampling
Data Collection
Data Analysis

Research Design

This descriptive survey research was designed to assess the impact of The Ohio State University Aquaculture Program (OSUAP). To accomplish this purpose, a survey was designed to collect data describing the characteristics of Ohio Aquaculture producers, their operations, their participation in, and the perceived impact of the OSUAP.
A mail questionnaire was used to collect data from respondents which provided the basis for the findings, conclusions, and recommendations resulting from this study (Appendix A).

**Instrumentation**

The instrument consisted of three major sections. Section I focused on collecting information regarding aquaculture producers and their operations. Section II asked producers to indicate how they preferred to receive aquaculture information and how they rated information they had received from the OSUAP. Section III asked producers to provide recommendations for future aquaculture programming that may be provided through the OSUAP.

The data collection instrument was developed by the investigator based on the purpose and objectives of this study. A mail questionnaire was used to collect the data needed to address each of the research questions. Development of the questionnaire began by generating a list of the information desired from the target population. The initial list of questions was organized into four different categories. The categories included: demographic items, participation items, impact items, and recommendations for future programming. After the items were categorized, questions were developed, reviewed and analyzed using Dillman’s eight criteria for assessing survey questions (Dillman, 2000). The approved instrument and proposal was submitted to the OSU Office of Responsible Research Practice (ORRP) which determined the study to be exempt.
under category 2 on March 18, 2010 and assigned the Protocol Number 2010E0171 (Appendix B).

Validity

Ary (1990) described validity as the extent to which the instrument measures what the researcher intends to measure. Content and face validity were established through examination of the instrument by a panel of experts (Appendix C). The expert panel consisted of six aquaculture Extension specialists from states other than Ohio that had aquaculture research and Extension programs similar to Ohio State University’s Aquaculture Program.

Members of the expert panel were asked to review the questionnaire for content validity and provide suggestions for improvement. Experts were also asked to assess the appropriateness of each item on the questionnaire as well as to comment on the clarity and wording of each item. The researcher made appropriate modifications to the questionnaire based upon input from the panel of experts.

Reliability

Ary (1990) defined reliability of an instrument as the degree of consistency with which the instrument measures the object being measured. After face and content validity were established, the instrument was converted to an electronic format for a pilot test to assess instrument reliability. Fourteen aquaculture producers from states in the North Central Region (other than Ohio) were selected for the pilot test. Pilot test respondents did not include members of the panel of experts, nor were they a part of the actual study.
population. Data from seven returned surveys were analyzed for reliability. One survey was incomplete resulting in six surveys used in the analysis.

Reliability coefficients measure the extent to which an instrument is repeatable and consistent. Internal consistency was assessed by computing a Cronbach’s alpha coefficient for selected items on the questionnaire. Cronbach’s coefficient alpha was calculated for items 17, 18 and 19. Item 17 did not have enough data resulting from the six pilot scale responses to calculate Cronbach’s alpha. However, item 17 had a Cronbach’s alpha of .97 for the final version of the questionnaire. Item 18 had a Cronbach’s alpha below the .80 threshold based on the pilot test data. Therefore, the item’s response scale was changed from a four-point scale to a five-point scale on the final version of the questionnaire. This resulted in a Cronbach’s alpha of .850 for this item in the final instrument. Item 19 had a Cronbach’s alpha of .822 and remained unchanged for the final questionnaire. A coefficient of 1.0 indicates a perfect correlation; as scores decrease, reliability decreases (Nunnally, 1972). Nunnally also noted that a coefficient of .80 is a commonly used threshold for reliability coefficients, but that coefficients of from .50 to .60 may be sufficient in the early stages of research. This process, expert review, pilot testing, modification and reliability assessment helped control for measurement error in this study.

**Population and Sampling**

The target population for this study was licensed Ohio aquaculture producers. In Ohio, an annual aquaculture permit was required for aquaculture producers raising fish
with the intent to sell them. Originally, the population of licensed Ohio aquaculture producers was defined as persons who had obtained an annual aquaculture permit from the Ohio Department of Natural Resources for any year between and including 2005 through 2009. Annual databases of persons who had obtained aquaculture permits for years 2005-2009 were obtained from the Ohio Department of Natural Resources, merged and then purged (to eliminate duplicate listings) to create a master list (n=331). After viewing the list, it was noted that many paylakes and baitfish stores had obtained aquaculture permits rather than baitfish dealer permits. This may have been because the cost of an aquaculture permit was $50.00 annually and included both a baitfish dealer permit ($40.00 value) and transportation permit ($65.00 value), resulting in a better value for paylakes and baitfish stores than purchasing each of the permits separately. Even so, aquaculture permits are intended for persons who had equipment suitable to engage in the production and sale of specific aquaculture species (Ohio Department of Natural Resources, 2005). Therefore, persons on the master list that were clearly paylakes and baitfish permit holders were purged from the list. Paylakes and baitfish permit holders were categorized as such through a variety of methods including: researcher knowledge, analysis of species permitted, and name and location of facility. Ultimately, there were 203 persons who remained on the list of aquaculture permit holders that comprised the population for this study. Due to the size of the target population, the researcher conducted a census in which the entire target population was surveyed.

A census has the advantage of providing information on each and every individual in the population. In this case, given the small population size, a complete census of all licensed aquaculture producers was conducted. The population (n=203) database
consisted of all persons who had acquired an aquaculture permit from the Ohio Department of Natural Resources (ODNR) for the years 2005 through 2009, after purging the list of paylakes and baitfish stores permit holders.

Several strategies were utilized to control non-response error. Pre-notification has been shown to increase response rates on mailed surveys (Miller & Smith, 1983). A pre-survey postcard (Appendix D) was sent to each person explaining the purpose of the research and informing the recipients that a mail questionnaire would be sent in the mail shortly thereafter. The questionnaire (Appendix A), cover letter (Appendix E), incentive postcard (Appendix F) and a stamped return envelope were all printed on colored paper (grey and scarlet) and distributed via the postal mail service. The cover letter was printed on Ohio State University South Center’s letterhead, assured the respondents that their responses would remain confidential and requested study participants to return completed questionnaires within two weeks (Dillman, 2000; Miller & Smith, 1983).

Motivation to participate in surveys varies widely among respondents. Rewards can be civic responsibility, interest in topic, financial reward and interest in expressing their opinion. As an incentive for completing this questionnaire, respondents received a free 1-year subscription to a leading fish farming magazine, *Fish Farming News* (a $15.00 value)

Data Collection

Questionnaires were mailed to 203 licensed Ohio aquaculture producers on April 5, 2010 with a requested response deadline of April 15, 2010. As of April 23, 2010, 13
questionnaires were returned with invalid addresses. Of the remaining valid 190 addresses, 66 instruments were returned by the cutoff date and included in the data analysis, for an overall response rate of 35%. Mail surveys designed using Dillman’s Total Design Method (TDM) yielded response rates of 58 to 92% (Dillman, 2000). However, research on response rates from farmers, as a particular group of interest, reported lower response rates of 12-35% (Pennings, Irwin, & Good, 1999). Similarly, a response rate of 37% was achieved with a sample of small farms in Tennessee (Muhammad et al., 2004). An assessment of Tennessee’s aquaculture production (Holland, 2000) yielded a response rate of 48%, while a 42% response rate was obtained for a survey of Indiana fish farmers (Quagrainie et al., 2008).

Non-response error refers to the extent to which people fail to provide usable responses and differ from those who do (Miller & Smith, 1983; Linder, Murphy, & Briers, 2001). Comparing early and late respondents is one method to consider for controlling non-response error (Miller & Smith, 1983; Lindner et al, 2001). Non-response error was assessed using a Chi-square to test for significant differences between responses of early (first quartile) with late (fourth quartile) respondents on 11 survey items including demographic characteristics of Ohio aquaculture producers and their businesses: awareness of the OSUAP, years of aquaculture production, whether farming was their primary occupation, if they were employed off the farm, their gross sales from aquaculture production, their future plans for growth of their business, sex, race, age, membership in aquaculture associations, and Internet use (Table 1). Effect size is an indicator of the strength of the difference between two groups. Cramer’s phi or Cramer’s V was calculated for each variable. Cramer’s V ranged from .13 to .82 indicating
moderate to very strong relationship between the early and late responders. Based on the finding no significant differences between the responses of early and late respondents for the 11 items \((p>0.05)\), it was assumed that the data collected were representative and could therefore be generalized to the target population.
<table>
<thead>
<tr>
<th>Item</th>
<th>Chi-square</th>
<th>df</th>
<th>Significance (p)</th>
<th>Effect Size</th>
<th>Cramer’s phi or Cramer’s V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness of OSUAP</td>
<td>.81</td>
<td>1</td>
<td>.37</td>
<td>.15</td>
<td>.37&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Is farming your principal occupation</td>
<td>1.00</td>
<td>1</td>
<td>.32</td>
<td>.17</td>
<td>.32&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Race of principal operator</td>
<td>.91</td>
<td>1</td>
<td>.34</td>
<td>.17</td>
<td>.34&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Sex of principal operator</td>
<td>.89</td>
<td>1</td>
<td>.35</td>
<td>.16</td>
<td>.35&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Are you employed off the farm</td>
<td>.39</td>
<td>2</td>
<td>.82</td>
<td>.11</td>
<td>.82&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Anticipated farm growth</td>
<td>1.88</td>
<td>3</td>
<td>.60</td>
<td>.24</td>
<td>.60&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Do you belong to an aquaculture association</td>
<td>2.42</td>
<td>3</td>
<td>.49</td>
<td>.27</td>
<td>.49&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>How often do you use the Internet</td>
<td>3.10</td>
<td>4</td>
<td>.54</td>
<td>.30</td>
<td>.54&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Percent gross of farm sales from aquaculture</td>
<td>17.61</td>
<td>12</td>
<td>.13</td>
<td>.74</td>
<td>.13&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Years in aquaculture production</td>
<td>13.80</td>
<td>16</td>
<td>.614</td>
<td>.64</td>
<td>.61&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Age of principal operator</td>
<td>21.66</td>
<td>23</td>
<td>.54</td>
<td>.81</td>
<td>.54&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Table 1. Comparison of Early (first quartile) and Late (last quartile) Respondents on 11 Survey Items using a Chi-Square Test.

<sup>a</sup> Cramer’s Phi coefficient  
<sup>b</sup> Cramer’s V coefficient
Data Analysis

Data collected in this study were coded, entered, and analyzed using PASW Statistics 18.0.2 statistical program (PASW, 2010). After all data were entered, the researcher checked the data for accuracy by visually inspecting the data and running frequency analysis for each item. Data points outside the range were eliminated.

Descriptive statistics, including frequencies, percentages, means and standard deviations were used to describe the characteristics of the population of licensed aquaculture producers in Ohio to address research question one in this study.

For research question two, determining participation of Ohio aquaculture producers with the OSUAP products, the percentages of respondents who were aware of and had benefited or used any information from the OSUAP was calculated. Ultimately, the perceptions of the respondents who had utilized information from the OSUAP were analyzed. Respondents rated their experience (0=none, 1=little, 2=some and 3=a lot) with each of the OSUAP sources of information on three scales: knowledge gained, application, and economic value. A weighted frequency was calculated for each source of information on each of the three scales. An overall weighted impact score was calculated for each source of information by summing the weighted frequencies of the three scales for each information source.

Priorities for future programming and delivery were determined by weighted frequencies and determining rank of importance of various aquaculture topics to respondents. Additionally, response frequencies and rank were calculated to determine the respondents’ preferred methods of receiving aquaculture information and assistance.
Finally, responses to the open-ended question regarding suggestions for the OSUAP were summarized.
Chapter 4: Findings

This study was designed to describe Ohio Aquaculture Producers, their participation with the Ohio State University Aquaculture Program (OSUAP) and the impact of the OSUAP. Data were derived from a mail census of Ohio aquaculture producers who had received a permit from the Ohio Department of Natural Resources between and including the years 2005 and 2009. This chapter begins with a description of the respondents, followed by additional sections presenting findings related to the objectives of this study:

- Characteristics of Ohio Aquaculture Producers
- Sources of Information Used and Preferred by Ohio Aquaculture Producers
- Awareness, Participation and Impact of OSUAP
- Future of OSUAP Programs

Characteristics of Ohio Aquaculture Producers

Permitting History

Ohio aquaculture producers who held permits from 2005 to 2009 were included in the population sampled. However, the number of respondents who had obtained permits increased from 2005 to 2009 (Figure 3). The number of respondents with an aquaculture
permit for the years 2005, 2006, 2007, 2008 and 2009 was 42, 41, 48, 55 and 55 respectively representing 65%, 63%, 74%, 85%, and 85% of the respondents from each year respectively. There were a greater percentage of nonrespondents in years 2005, 2006 and 2007 than in 2008 and 2009. Some of the aquaculture producers who purchased permits in the earlier years and may no longer be in business and therefore less likely to respond to a survey.

![Figure 2. Years in Which Ohio Aquaculture Producers Obtained Aquaculture Permits](image)

Principal Operator

Total years in aquaculture production ranged from 1-55 years (Table 2). One respondent reported they had been an aquaculture producer for 100 years. This may indicate that the aquaculture facility has been operating for 100 years; however this cannot be true for the principal operator, so that response was eliminated from the analysis. The majority of aquaculture producers were male (91%) with only 9%
respondents being female. However, five respondents who replied that the principal
operator was male also indicated that a female was an equal and important partner in the
business. One respondent reported being part Hispanic (1.6%) while 98.4% of
respondents reported being white. Respondents varied from 32 to 80 years old with an
average age of 54. The modal category for the age of Ohio aquaculture producers was in
the 50-59 age range (40.3%).

Employment and Business

Farming was considered the primary occupation for 27.7% of the respondents and
not the primary occupation for 72.3% of the respondents (Table 2). No off-farm
employment was reported by 42.2% of the respondents, while 15.6% reported part-time
and 42.2% reported full time off-farm employment. Thirty respondents (45.5%) reported
having a total of 75 full-time employees and 44 farms (66.7%) reported having a total of
81 part-time employees. Nearly half of the respondents (44.3%) planned to expand their
aquaculture production in the future while 42.6%, 4.9%, and 8.2% planned to maintain,
reduce, or discontinue their aquaculture production business, respectively. Respondents
were split on their interest in learning more about a financial planning program called
FINPACK, with 44.1% indicating an interest and 55.9% indicating no interest.

Internet Usage and Association Affiliation

There was wide variability regarding the use of the Internet to obtain aquaculture
information (Table 2) with 23.4% of respondents reporting never, 17.2% seldom, 26.6%
occasional and 23.4% frequent Internet use. Only 9.4% reported using the Internet very
frequently or daily. Slightly more than half (51.6%) of the respondents did not belong to
an aquaculture association. However, 32.8% reported being members of the Ohio Aquaculture Association (OAA), 12.5% the Fish Farmers of Ohio (FFO) and 3.1% both the OAA and the FFO.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Response Category</th>
<th>f</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total years in aquaculture production (min=1, max=55) (n=62)</td>
<td>1-5</td>
<td>25</td>
<td>40.3</td>
</tr>
<tr>
<td></td>
<td>6-10</td>
<td>24</td>
<td>38.7</td>
</tr>
<tr>
<td></td>
<td>11-20</td>
<td>5</td>
<td>8.1</td>
</tr>
<tr>
<td></td>
<td>21-30</td>
<td>5</td>
<td>8.1</td>
</tr>
<tr>
<td></td>
<td>31-50</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>&gt;51</td>
<td>2</td>
<td>3.2</td>
</tr>
<tr>
<td>Sex (n=64)</td>
<td>Male</td>
<td>58</td>
<td>90.6</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>6</td>
<td>9.4</td>
</tr>
<tr>
<td>Age (n=62)</td>
<td>30-39</td>
<td>7</td>
<td>11.3</td>
</tr>
<tr>
<td></td>
<td>40-49</td>
<td>14</td>
<td>22.6</td>
</tr>
<tr>
<td></td>
<td>50-59</td>
<td>25</td>
<td>40.3</td>
</tr>
<tr>
<td></td>
<td>60-69</td>
<td>11</td>
<td>17.7</td>
</tr>
<tr>
<td></td>
<td>&gt;70</td>
<td>5</td>
<td>8.1</td>
</tr>
<tr>
<td>Race (n=62)</td>
<td>White</td>
<td>61</td>
<td>98.4</td>
</tr>
<tr>
<td></td>
<td>Hispanic</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>Primary Occupation (n=65)</td>
<td>Farming</td>
<td>18</td>
<td>27.7</td>
</tr>
<tr>
<td></td>
<td>Non-farming</td>
<td>47</td>
<td>72.3</td>
</tr>
<tr>
<td>Off farm employment (n=64)</td>
<td>No</td>
<td>27</td>
<td>42.2</td>
</tr>
<tr>
<td></td>
<td>Part time</td>
<td>10</td>
<td>15.6</td>
</tr>
<tr>
<td></td>
<td>Full time</td>
<td>27</td>
<td>42.2</td>
</tr>
<tr>
<td>Employees</td>
<td>Full time</td>
<td>30</td>
<td>45.5</td>
</tr>
<tr>
<td></td>
<td>Part time</td>
<td>44</td>
<td>66.7</td>
</tr>
<tr>
<td>Internet Use (n=64)</td>
<td>Never</td>
<td>15</td>
<td>23.4</td>
</tr>
<tr>
<td></td>
<td>Seldom</td>
<td>11</td>
<td>17.2</td>
</tr>
<tr>
<td></td>
<td>Occasionally</td>
<td>17</td>
<td>26.6</td>
</tr>
<tr>
<td></td>
<td>Frequently</td>
<td>15</td>
<td>23.4</td>
</tr>
<tr>
<td></td>
<td>Very frequently</td>
<td>6</td>
<td>9.4</td>
</tr>
<tr>
<td>Change in business (n=61)</td>
<td>Discontinue</td>
<td>5</td>
<td>8.2</td>
</tr>
<tr>
<td></td>
<td>Reduce</td>
<td>3</td>
<td>4.9</td>
</tr>
<tr>
<td></td>
<td>Maintain</td>
<td>26</td>
<td>42.6</td>
</tr>
<tr>
<td></td>
<td>Expand</td>
<td>27</td>
<td>44.3</td>
</tr>
<tr>
<td>Member of an Aquaculture Association (n=64)</td>
<td>Ohio Aquaculture Association (OAA)</td>
<td>21</td>
<td>32.8</td>
</tr>
<tr>
<td></td>
<td>Fish Farmers of Ohio (FFO)</td>
<td>8</td>
<td>12.5</td>
</tr>
<tr>
<td></td>
<td>Both OAA &amp; FFO</td>
<td>2</td>
<td>3.1</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>33</td>
<td>51.6</td>
</tr>
<tr>
<td>Interested in FINPACK (n=59)</td>
<td>Yes</td>
<td>26</td>
<td>44.1</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>33</td>
<td>55.9</td>
</tr>
</tbody>
</table>

Table 2. Characteristics of Ohio Aquaculture Producers by Category, Frequency and Percent.
Income

The percent of gross farm sales attributed to aquaculture production varied from 0 (19.7%) to 100% (16.4%) for farms with aquaculture operations. The majority of farms (52.5%) reported 1-25% of their gross farm sales coming from aquaculture production while 7 farms (8.2%) reported 26-99% of their gross farm sales attributed to aquaculture production (Figure 4).

![Figure 3. Percentage of Gross Farm Sales Attributed to Aquaculture Production.](image)

A majority of the respondents (n=22, 36.1%) reported annual aquaculture sales of less than $999. Nearly one-third of respondents (29.5%) reported annual aquaculture sales of $1,000 to $9,999. Ten respondents (16.4%) reported annual aquaculture sales between $10,000 and $49,000, three respondents (4.9%) reported sales of $50,000 - $99,000 and five respondents (8.2%) reported sales of $100,000 to $499,000. Finally, three (4.9%) respondents reported annual aquaculture sales of greater than $500,000 (Figure 5).

**Sources of Information Used and Preferred by Ohio Aquaculture Producers**

Ohio aquaculture producers obtained aquaculture information from a wide variety of sources (Table 3). Books were the number one source of information and other aquaculture producers ranked second. The Internet was third and the Ohio State University Aquaculture Program (OSUAP) ranked fourth. Neighbors and friends, the Ohio Aquaculture Association, Fish Farmers of Ohio Association and private consultants ranked fifth, sixth, seventh, and eighth, respectively. Government agencies, Universities other than OSU, the North Central Regional Aquaculture Center, and other farm organizations ranked ninth through twelfth, respectively. Respondents also mentioned experience, meetings, old classmates, and Hocking College as other sources of information.
<table>
<thead>
<tr>
<th>Source of Information</th>
<th>Frequency of Responses</th>
<th>Weighted Frequency</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Books</td>
<td>9 7 6 11 4</td>
<td>117</td>
<td>1</td>
</tr>
<tr>
<td>Other aquaculture producers</td>
<td>11 6 6 6 3</td>
<td>112</td>
<td>2</td>
</tr>
<tr>
<td>Internet</td>
<td>8 7 4 5 4</td>
<td>94</td>
<td>3</td>
</tr>
<tr>
<td>The Ohio State University Aquaculture Program (OSUAP)</td>
<td>7 8 3 4 5</td>
<td>89</td>
<td>4</td>
</tr>
<tr>
<td>Neighbors/friends</td>
<td>9 5 2 3 1</td>
<td>78</td>
<td>5</td>
</tr>
<tr>
<td>Ohio Aquaculture Association (OAA)</td>
<td>0 1 10 4 1</td>
<td>43</td>
<td>6</td>
</tr>
<tr>
<td>Fish Farmers of Ohio Association (FFO)</td>
<td>2 3 4 1 5</td>
<td>39</td>
<td>7</td>
</tr>
<tr>
<td>Private consultants</td>
<td>1 1 4 2 6</td>
<td>31</td>
<td>8</td>
</tr>
<tr>
<td>Government agencies</td>
<td>0 4 1 4 2</td>
<td>29</td>
<td>9</td>
</tr>
<tr>
<td>Universities other than OSUAP</td>
<td>2 1 2 1 5</td>
<td>27</td>
<td>10</td>
</tr>
<tr>
<td>North Central Regional Aquaculture Center (NCRAC)</td>
<td>0 4 1 1 2</td>
<td>23</td>
<td>11</td>
</tr>
<tr>
<td>Other farm organizations (i.e. Ohio Farm Bureau)</td>
<td>0 1 1 2 2</td>
<td>13</td>
<td>12</td>
</tr>
</tbody>
</table>

Table 3. Sources of Information Used by Ohio Aquaculture Producers Ranked by Preference.

Weighted frequency was calculated by multiplying the number of 1<sup>st</sup> choice responses by five, the number of 2<sup>nd</sup> choice responses by four, 3<sup>rd</sup> choice response by three, 4<sup>th</sup> choice responses by two and 5<sup>th</sup> choice responses by one and summing the overall result.
Awareness, Participation, and Impact of OSUAP

Awareness and Participation with the OSUAP

More than three fourths (77.3%) of the respondents reported being aware of the Ohio State University Aquaculture program (OSUAP) (Figure 6). More than half of the respondents (54.5%) reported to have benefited from or used information provided by the OSUAP, 27.3% were aware but have not used information from the OSUAP and 18.2% were aware but failed to respond to the question (Figure 7).

Figure 5. Awareness of the Ohio State University Aquaculture Program by Ohio Aquaculture Producers.
Impact of OSUAP

Respondents reported on their experience with various OSUAP sources of information. Ratings for each information source were based on three indicators of impact: knowledge gained by the participant, application of the information, and economic value of the information or experience. Knowledge gained was assessed by asking if respondents had learned new information. Application was assessed by asking if respondents had applied the new information. Economic value was assessed by asking respondents to indicate if they perceived that their net income had improved as a result of the new information. Response frequency was reported for each variable and each level of impact. A weighted frequency was calculated by multiplying each frequency by 0 for a none response, 1 for little, 2 for some, and 3 for a lot. An overall impact score was computed by summing the weighted frequencies of knowledge, application, and economic impact for each source of information. Sources of information were ranked according to its overall impact score (Table 4).
The impacts of various sources of information available from the OSUAP are summarized in Table 4. Calling an aquaculture specialist on the phone, attending a presentation by an aquaculture specialist and participating in a tour of the OSUAP facilities had the highest impact scores of 204, 151, and 136 respectively. Consulting with a specialist on the farm, receiving information via email, or a journal article and reading newspaper or magazine articles authored by OSUAP aquaculture staff had the lowest overall impact scores of 86, 86, 86, and 78 respectively.
<table>
<thead>
<tr>
<th>Information Source</th>
<th>Frequency (f)</th>
<th>Impact Indicator</th>
<th>Weighted Frequency</th>
<th>Impact Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Called the OSUAP on the phone</td>
<td></td>
<td>Knowledge</td>
<td>0</td>
<td>204</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Economic</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Attended a presentation by the OSUAP</td>
<td></td>
<td>Knowledge</td>
<td>0</td>
<td>151</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Economic</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Participated in a tour of the OSUAP facilities</td>
<td></td>
<td>Knowledge</td>
<td>2</td>
<td>136</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Economic</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Received a fact sheet from the OSUAP</td>
<td></td>
<td>Knowledge</td>
<td>3</td>
<td>129</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Economic</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Attended an OSUAP workshop</td>
<td></td>
<td>Knowledge</td>
<td>1</td>
<td>129</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Economic</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Received newsletters from the OSUAP</td>
<td></td>
<td>Knowledge</td>
<td>3</td>
<td>108</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Economic</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Read articles authored by OSUAP staff</td>
<td></td>
<td>Knowledge</td>
<td>2</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Economic</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Received a consultation from the OSUAP</td>
<td></td>
<td>Knowledge</td>
<td>4</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Economic</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Subscribed an OSUAP email list serve</td>
<td></td>
<td>Knowledge</td>
<td>3</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Economic</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Consulted with an OSUAP specialist on my farm</td>
<td></td>
<td>Knowledge</td>
<td>3</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Economic</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Received information by email from the OSUAP</td>
<td></td>
<td>Knowledge</td>
<td>5</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Economic</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Received a journal article from the OSUAP</td>
<td></td>
<td>Knowledge</td>
<td>4</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Economic</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Attended an OSUAP field day</td>
<td></td>
<td>Knowledge</td>
<td>1</td>
<td>78</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Economic</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Impact of Various Sources of Information from the Ohio State University Aquaculture Program on Ohio Aquaculture Producers.

1 Weighted frequency was calculated by multiplying the number of none responses by 0, little responses by 1, some responses by 2, a lot responses by 3 and summing the overall results.

2 Impact score was calculated by summing the weighted impact scores for knowledge, application and economic value for each information source.
Future of the OSUAP

Future Program Topics

Respondents were asked to rate the importance of a variety of topics related to aquaculture production to help identify priorities for future OSUAP programs. Each topic was ranked on its importance from zero to four, with 0=none, 1=little, 2=moderate, 3=great and 4=extreme. Frequency of response was calculated for each topic and then a weighted frequency was calculated and topics were ranked accordingly (Table 5). Water quality, fish nutrition, and aeration ranked as the top three topics in terms of importance with frequencies indicating moderate to great importance. Business or crop insurance information ranked lowest with no or little importance. Other topics not included in the chart, but specifically listed as important to respondents included grass roots research, predators, systems design and fundamentals, and fish disease.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Response Frequencies</th>
<th>Weighted Frequency&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N None Little Moderate Great Extreme</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water quality</td>
<td>63 3 3 12 21 24</td>
<td>182</td>
<td>1</td>
</tr>
<tr>
<td>Fish nutrition</td>
<td>62 2 5 15 24 16</td>
<td>171</td>
<td>2</td>
</tr>
<tr>
<td>Aeration</td>
<td>63 5 2 16 23 17</td>
<td>171</td>
<td>3</td>
</tr>
<tr>
<td>Fingerling production</td>
<td>61 5 9 10 18 19</td>
<td>159</td>
<td>4</td>
</tr>
<tr>
<td>Marketing</td>
<td>61 9 3 13 15 21</td>
<td>158</td>
<td>5</td>
</tr>
<tr>
<td>Regulations</td>
<td>60 5 7 17 15 16</td>
<td>150</td>
<td>6</td>
</tr>
<tr>
<td>Fish genetics</td>
<td>59 4 7 17 16 15</td>
<td>149</td>
<td>7</td>
</tr>
<tr>
<td>Food fish production</td>
<td>60 6 8 19 16 11</td>
<td>138</td>
<td>8</td>
</tr>
<tr>
<td>Facility construction</td>
<td>61 5 15 20 16 5</td>
<td>123</td>
<td>9</td>
</tr>
<tr>
<td>Business planning</td>
<td>60 9 8 23 17 3</td>
<td>117</td>
<td>10</td>
</tr>
<tr>
<td>Financing</td>
<td>59 12 11 15 13 8</td>
<td>112</td>
<td>11</td>
</tr>
<tr>
<td>Processing</td>
<td>59 15 13 11 9 11</td>
<td>106</td>
<td>12</td>
</tr>
<tr>
<td>Baitfish production</td>
<td>57 19 12 5 9 12</td>
<td>97</td>
<td>13</td>
</tr>
<tr>
<td>Labor management</td>
<td>58 14 21 13 5 5</td>
<td>82</td>
<td>14</td>
</tr>
<tr>
<td>Business or Crop Insurance</td>
<td>59 26 16 11 4 2</td>
<td>58</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 5. Importance of Aquaculture Topics Ranked by Ohio Aquaculture Producers.

<sup>1</sup> Weighted frequency was calculated by multiplying the number of none responses by 0, little responses by 1, moderate responses by 2, great responses by 3, extreme responses by 4, and summing the overall result.
Preferred Formats for Information Delivery

Respondents were asked to rate the extent to which they liked or disliked various formats for receiving aquaculture information and assistance. Response frequencies were coded: 1=strongly dislike, 2=somewhat dislike, 3=neither like or dislike, 4=somewhat like, and 5=strongly like. Frequency of response was reported and a weighted frequency was calculated. Formats were ranked in order of preference (Table 6). Newsletters and mail were ranked number one and two and indicated that these were categorized between somewhat like and strongly like categories by the respondents. Workshops, farm visits, phone support, DVDs, email, evening meeting and webpage were categorized between neither like nor dislike and the somewhat like categories on the response scale. Webinars, blogs, Skype, Facebook and Twitter ranked between neither like or dislike and the somewhat dislike categories.
<table>
<thead>
<tr>
<th>Format</th>
<th>Response Frequencies</th>
<th>Weighted Frequency</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Dislike (f)</td>
<td>Somewhat Dislike (f)</td>
<td>Neither Like or Dislike (f)</td>
</tr>
<tr>
<td>Newsletter (n=63)</td>
<td>1</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Mail (n=63)</td>
<td>1</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>Workshop (n=61)</td>
<td>5</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Farm visit (n=63)</td>
<td>6</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Phone (n=62)</td>
<td>9</td>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td>DVD (n=58)</td>
<td>6</td>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>Email (n=59)</td>
<td>9</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>Evening meeting (n=61)</td>
<td>10</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>Webpage (n=58)</td>
<td>9</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>Webinar (n=55)</td>
<td>19</td>
<td>2</td>
<td>28</td>
</tr>
<tr>
<td>Blog (n=56)</td>
<td>23</td>
<td>5</td>
<td>23</td>
</tr>
<tr>
<td>Facebook (n=58)</td>
<td>26</td>
<td>4</td>
<td>24</td>
</tr>
<tr>
<td>Skype (n=55)</td>
<td>23</td>
<td>2</td>
<td>28</td>
</tr>
<tr>
<td>Twitter (n=55)</td>
<td>26</td>
<td>4</td>
<td>24</td>
</tr>
</tbody>
</table>

Table 6. Preferred Formats for Receiving Aquaculture Information as Ranked by Ohio Aquaculture Producers.

Weighted frequency was calculated by multiplying the number of strongly dislike responses by 1, somewhat dislike responses by 2, neither like or dislike responses by 3, somewhat like responses by 4 and strongly like responses by 5, and summing the overall result.
Specific Recommendations for Improving the OSUAP

Respondents were asked via an open-ended question for specific recommendations to improve the OSUAP. Twenty-eight respondents provided thirty comments which were organized into the following themes: research suggestion (n=8), Extension suggestion (n=12), aquaculture regulations (n=2) or an opinion offered by the respondent (n=8), and summarized below.

Research suggestions included:

- Pond management stocking research
- More genetic research coupled with nutritional advances in fish feeds.
- Grow more perch and bluegill
- We are in need of on-farm research
- Genetic improvement and production protocols are needed
- The financial benefits of genetic improvement and production protocol will impact industry in the long haul. Keep up the great work and expand to other species.
- OSU needs to visit local farms and do research that helps with fish production as it pertains to food production. The research we saw was of little help but Laura Tiu was very helpful.
- I think you have highly qualified people doing promotion and research. I think it would be beneficial to have Extension on system design and viable economic enterprises that fit Ohio.
Extension program suggestions included:

- More one-on-one workshops
- Demonstration of proven aquaculture recirculation technology
- Hold the meetings in Ohio
- Marketing, marketing, marketing: there is no sense in raising a product if you can’t sell it.
- Need information on what to do when ice is on your pond.
- What to do after harvest and your pond is drained.
- Information on disease detection, diagnosis, remedies and other production information
- Better profits
- Emphasize practical field production by those producers who will share
- More information on aquaponics
- We need state funding to directly benefit producers with new pond construction or older pond revitalization and help with ongoing predator problems.
- We need better prices on feed. We also would like to order and pick up feed locally.

Aquaculture regulations suggestions included:

- Eliminate quarantine
- Reduction of politically motivated regulations.
Respondent opinions included:

- I am uncertain why OSU funded with state tax dollars is creating programs to help aquaculturists. I don’t think that is the University’s job to do this.
- I want customers to pick up fish in oxygenated bags rather than delivery as fuel costs are too high.
- No help available, anyone interested in taking over please contact me.
- More practicality and less research and development. More hands-on applications.
- These questions don’t have anything to do with my business because I have a fishing lake and don’t sell fish.
- Our profit keeps shrinking.
- I got most of my information from Ohio Department of Agriculture and Ohio Department of Natural Resources at Reynoldsburg and Findlay.
- Appreciate Laura, Geoff and Dr. Forshey at the Ohio Department of Agriculture. Keep up the great work. Please thank all your staff. Thanks for your expertise. Have a great season.
Chapter 5: Summary, Conclusions, and Recommendations

This chapter presents the conclusions and recommendations regarding this study. The aquaculture industry in Ohio is growing rapidly and The Ohio State University Aquaculture Program (OSUAP) must continue to refine itself in order to best serve the needs of the aquaculture producers in the state. A good understanding of our target audience and their preference for receiving new aquaculture-related information is imperative for developing and maintaining a program that has significant impact. Continually evaluating the impact of current methods and exploring the potential for future endeavors help strengthen the quality of Extension programming and keep it relevant.

The purpose of this study was to assess the impact of The Ohio State University Aquaculture Program (OSUAP) on Ohio aquaculture producers. In order to accomplish this purpose, data from licensed Ohio aquaculture producers was collected via mail survey, summarized, and analyzed to determine impact and provide guidance and direction for the program in the future. The following research objectives were used to guide this effort:

1. Describe the characteristics of Ohio aquaculture producers and their operations.
2. Determine awareness of and participation with the OSUAP by Ohio aquaculture producers.

3. Determine the impact of the OSUAP on Ohio aquaculture producers.

4. Synthesize recommendations for the future of the OSUAP.

Conclusions for Objective 1: Describe the Characteristics of Ohio Aquaculture Producers and Their Operations.

A profile of the typical Ohio aquaculture producer reflects a white, male in his fifties. Farming was not his primary occupation and he was usually employed in a full-time job off the farm. This was similar to the aquaculture industry in Tennessee where 38% were full-time farmers and 59% were part-time (Holland, 2000). The typical Ohio aquaculture producer has been engaged in aquaculture production for 1-10 years. These characteristics were not much different from the profile of a typical Ohio farmer who was white (99%), male (88%) and an average age of 55.7 years old (NASS, 2009). However, 26% of Ohio farmers have been engaged in farming ten years or less, whereas 79.0% of Ohio Aquaculture producers have been in aquaculture production for ten years or less. This finding is reflective of the relative infancy of the aquaculture industry in Ohio.

The aquaculture industry continues to grow in Ohio and 87% of Ohio aquaculture producers indicate they plan to maintain or expand production in the future. This was a higher proportion than the small farm owners in Tennessee where the majority of very successful farmers (68.2%) indicated they would stay in farming and expand their
operations, whereas only 46.7% of less successful farmers expressed similar plans (Muhammad et al., 2004). An analysis of the Tennessee aquaculture industry reported that 54% of the respondents planned to expand and 35% planned to discontinue production (Holland, 2000). This seems to imply that most Ohio aquaculture producers are satisfied and want to continue to develop their aquaculture production operation.

More than half (52%) of Ohio aquaculture producers do not belong to an aquaculture association. However, 48% belong to either the Ohio Aquaculture Association (the oldest aquaculture association in Ohio) or the Fish Farmers of Ohio (a newer organization that functions more like a cooperative). It can be advantageous to University specialists for farmers to join producer associations since those who belong to or participate in a farm organization are more likely to have a favorable attitude toward Extension than farmers who do not belong to any farm organization (Gross, 1976).

Ohio aquaculture producers report only occasionally using the Internet to obtain aquaculture production information, although 77% reported having access to the Internet. This was much higher than the 58% of Ohio farms that reported having access to the Internet (NASS, 2009). Similarly, 56% of the respondents were not interested in learning more about a business management program (FINPACK), which uses electronic spreadsheets to track production data.

Sixty-five percent of Ohio Aquaculture producers reported annual aquaculture sales of less than $10,000 and five percent reported sales in excess of $500,000 (Figure 8). This observation was similar to other farms in Ohio where the majority of Ohio farms report sales of less than $2,500 and the fewest number of farms report sales of $500,000 or more (Figure 9). By extrapolating these figures, the researcher estimates annual
aquaculture sales of $2,250,000 to $6,322,000 for the 42 farms reporting. This estimate, extrapolated to all 207 farms in the target population would yield a total that is somewhat higher than the $6,582,000 in sales reported by 140 aquaculture farms in the 2007 Census of Agriculture (NASS, 2009).


Figure 8. Gross Annual Farm Sales from Ohio Farms (NASS, 2007).
For Extension to better serve the target audience, it is necessary to determine where the clients are getting their information (Cartmell et al., 2006). Ohio aquaculture producers obtain information from a variety of sources. The top five sources ranked in terms of value are books, other producers, the Internet, the Ohio State University Aquaculture Program and neighbors and friends. Extension also ranked high in the responses provided by limited scale landowners in Oklahoma who reported Extension, Internet, magazines and person to person as their top four information sources (Cartmell et al., 2006). Similarly, small-acreage owners in Utah ranked friends or relatives, Extension printed materials, personal contact with an Extension agent, and books as their top four information sources. Small farms in Tennessee, who rated themselves as very successful, ranked other farmers, neighbors and Extension Service as their top three sources of information while less successful farmers ranked Extension Service, other farmers and farm magazines as their three main sources (Muhammad et al., 2004). Tennessee aquaculture producers ranked the University of Tennessee’s Agriculture Extension Service, other aquaculture producers and other state’s Extension services as the top three sources of information (Holland, 2000). Based on the findings of these studies, it appears that Extension is considered to be one of the trusted sources of information for a variety of groups.
Conclusions for Objective 2: Determine Awareness of and Participation with the OSUAP by Ohio Aquaculture Producers.

The majority (77%) of Ohio aquaculture producers were aware of the OSUAP and had used or benefited from products and services it provides (55%). Statewide surveys conducted by Michigan State University in 1996 and 1999 also reported that awareness of MSU Extension remained consistently high among agriculture producers (Suvedi, Lapinski, & Campo, 2000). Norland (1992) reported that Extension’s reputation for quality information and quality teaching, appeared to be an incentive to participate. Duc (2008) reported that farmers involved in extension activities have a higher satisfaction with fish farming. A high participation rate would seem to indicate that the OSUAP is providing quality, convenient programs that appeal to respondents need for self-improvement and/or social involvement. It also suggests that the benefit to participants of obtaining information from the OSUAP must be worth the cost, since participation is voluntary. The fact that 23% of Ohio aquaculture producers were unaware of the OSUAP combined with the 22% that knew about OSUAP but have not utilized the services suggests the need to develop a new approach or improved public relations to reach those potential clients.

Conclusions for Objective 3: Determine the Impact of the OSUAP

Assessing impact required a review of the original goals of the OSUAP. In 1997, the goals identified were to: (a) increase the number of aquaculture producers, (b)
increase the amount of aquaculture production, (c) increase economic efficiency of aquaculture producers, and (d) demonstrate the economic impact of the industry to the state of Ohio.

The OSUAP has provided a variety of products and services over the past decade in an effort to achieve the stated goals.

Data from past Census’ show that the number of aquaculture producers in Ohio and the amount of aquaculture production has increased in Ohio over the past decade (NASS, 2000, 2004, 2006, 2009). These numbers reflective a positive economic impact of the aquaculture industry on the state of Ohio. The challenge was to determine if this growth can be attributable to the OSUAP products and services.

To establish the link between client outcomes and Extension program delivery, Ohio aquaculture producers who accessed information from the OSUAP through various sources were asked to rate their experience in an effort to determine the extent of change in clientele knowledge, actions, and economic improvement. Changes in knowledge, action, and economic improvement are all individual indicators of program impact. In this study, respondents rated their knowledge gained, information applied, and the economic value from various OSUAP sources of information.

The evaluative framework proposed by Bennett (1975) categorized changes in knowledge, attitudes, skills, and aspirations as the fifth step in his hierarchy of evidence for program evaluation. Respondents gained a lot of knowledge by calling an aquaculture specialist on the phone or attending a presentation by an aquaculture specialist. Respondents learned some new information from each of the other sources
listed. This suggests an increase in knowledge as a result of Ohio aquaculture producers using the OSUAP.

Bennett (1975) categorized practice change as the sixth step in his hierarchy of evidence for program evaluation. Practice change encompasses the adoption and application of knowledge, attitudes, skills and aspirations to work or life. Respondents applied some of the information gained from each of the OSUAP information sources. This indicated respondents were taking at least some portion of the information learned from the OSUAP and applying it to their aquaculture businesses.

End results, pertaining to the original goal of increased economic efficiency of Ohio aquaculture producers, were measured by determining the economic value of OSUAP information sources to Ohio aquaculture producers. Economic value to a respondent may have included greater efficiency (i.e. lower costs), higher production, better quality, or more income. Respondents reported some economic value for all of the OSUAP information sources excluding reading newspaper or magazine articles authored by OSUAP aquaculture staff, which had little economic value to respondents. This indicates that most OSUAP information sources were perceived to be of some economic value to Ohio aquaculture producers.

In order to assess the overall impact score of each OSUAP source of information, an impact score was computed by summing the knowledge, application, and economic value weighted frequencies for each source of information. Calling an aquaculture specialist on the phone, attending a presentation by an aquaculture specialist, and participating in a tour of the OSUAP facilities generated the highest impact scores of all the OSUAP products and services listed. Similar to the results of a survey of Michigan
State University Extension, outputs involving higher levels of interpersonal interaction (such as farm visits and phone calls) tended to be rated more highly (Suvedi et al., 2000) than impersonal information sources. Based on these findings, it appears that programmatic contacts that have greater costs also appear to produce greater potential benefits (Galindo-Gonzalez & Israel, 2010). Interestingly, each information source had the highest impact score on the knowledge criteria, followed by application and then economic value. This indicated that it may be easier to teach someone something new; than it is to teach them something they can actually apply and use to make money.

Impact evaluations document the degree of achievement of pre-determined targets and the extent to which program implementation influenced such achievement. These data indicate that the OSUAP has contributed to the economic efficiency of Ohio aquaculture producers by providing information sources that increase knowledge, can be applied to their aquaculture business, and has some economic value.

Conclusions for Objective 4: Synthesize Recommendations for the Future of the OSUAP

Many of the aquaculture production topics that were rated most highly were focused on production issues. Water quality, fish nutrition, aeration, and fingerling production ranked as the top four topics in terms of importance to Ohio aquaculture producers. This observation indicates that many aquaculture producers still desire basic production information. Given the fact that the average producer has only been in business 1-10 years, this should not be too surprising. Tennessee aquaculture producers
identified grower education programs, consumer awareness programs, technical production support, and access to funding as their greatest needs (Holland, 2000).

It is important to understand the information-use patterns and delivery preferences of specific clientele (Brunson & Price, 2009). Targeting information dissemination to clients based on their preferred methods, Extension specialists have a greater potential impact in reaching their clients (Bardon et al., 2007). Ohio aquaculture producers prefer to receive information through newsletters and mail. This may have been a consequence of the lack of familiarity with the Internet reported by many aquaculture producers, as evidenced by their infrequent use. This was similar to limited-scale landowners in Oklahoma who preferred direct mail, magazines, television and Internet as their preferred media format (Cartmell et al., 2006), but contrary to small-acreage owners in Utah who reported Internet, followed by printed material and newsletters, as the preferred information delivery source (Brunson & Price, 2009).

Workshops, farm visits, DVDs, email, phone, webpage and evening meetings were ranked in the second tier of preferred formats for receiving information. These traditional information transfer methods appealed to a broad spectrum of producers.

Newer electronic technology, such as webinars, blogs, Skype, Facebook and Twitter ranked very low and many respondents questioned what these were. In Tennessee, Muhammud et al. (2004) reported that access to a computer and use of Internet and email were relatively low for small farmers. Extension capitalizes on electronic media as an inexpensive and effective means of transferring information; however it appears that many aquaculture producers are not yet equipped for the electronic communication age.
Open-ended questions at the end of structured questionnaires help increase response rates, elaborate on responses to closed questions, and enable respondents to present issues that were not addressed in the closed questions (Cathain & Thomas, 2004). The general, open-ended question, “any specific recommendations for improving the OSUAP” was used to allow respondents to elaborate on their general experience in relation to the overall theme of the survey.

Ohio aquaculture producers had their own ideas of what they would like to see the OSUAP do for them. Respondents mentioned genetics, fish nutrition, system design and operation, and pond management as a focus for future research. They also emphasized a desire and preference for on-farm research. Respondents would like to see Extension programs developed around marketing, basic aquaculture production techniques, fish health, aquaponics, and fish nutrition. Finally, they would like to see an end to the fish health quarantine in Ohio and fewer bureaucratic regulations.

**Recommendations**

Cooperative Extension has a one-hundred year history of working within the national system of land-grant universities to assist in the growth of agriculture industries. This model of research, Extension, and industry has been successfully used to enhance the production capacity of many agricultural industries. Aquaculture is one of the latest agricultural enterprises to directly benefit from this system.

The changing world demands increased accountability from Extension programs. It has become necessary to carefully assess what we do and how we do it. In the spirit of
efficiency, it is important that we look at the multiple dimensions of Extension programming and make changes to improve efficiency and effectiveness. The Ohio State University Aquaculture Program receives federal and state funding through a variety of funding mechanisms and grants. In an effort to be accountable, a thorough evaluation of the current aquaculture program was needed.

The OSUAP serves as the main conduit of aquaculture information from the University to the aquaculture industry in Ohio. In order to enhance aquaculture products and services, it is imperative to understand the clientele, how they perceive their interaction with the OSUAP, what kind of information they need, and how they prefer to receive information. More effective programs can be planned based on this information.

The more Extension aquaculture personnel know about their audience, the better able they are to develop relevant programs. This study showed that Ohio aquaculture producers were typically white males in their fifties. They were, however, fairly new to aquaculture production with the majority reporting less than ten years of operating experience in aquaculture. For most, aquaculture production is not their primary occupation and over half have either full-time or part-time jobs off the farm. While these producers appeared to be new to aquaculture production, they did seem to be satisfied as the majority planned to maintain or expand the size of their businesses. This presents an opportunity for the OSUAP. Given that the majority of aquaculture producers were fairly new to the business, supplying introductory production information will still be an important component of the program. Information needs to be readily accessible as many producers work off the farm and may only have the ability to solicit information during evenings or weekends, requiring the OSUAP to have an effective web presence.
Ohio aquaculture producers reported that about 25% of their gross farm income is generated from aquaculture product sales. This suggests that aquaculture is not the predominant income source on the farm, but it may be used as a strategy to diversify the farming operation. This observation is similar to findings from a study of Indiana’s aquaculture industry where aquaculture constituted about 25% of total agriculture sales of respondents (Quagrainie et al., 2008). Gross annual sales were comparable to those for other farms in Ohio with the majority having sales of less than $10,000 per year. With many Ohio aquaculture producers hoping to expand their businesses, OSUAP has the opportunity to deliver program information that may help aquaculture producers increase their sales along with their net farm income. This may include programming on enhancing production, marketing, information on developing co-ops, and business planning skills like managing risk and financial planning. While half of all respondents were not interested in learning about FINPACK (a financial planning program commonly used by Extension to assist other commodity farmers), 44% were interested in learning more and may be targeted for such assistance.

Ohio aquaculture producers receive their aquaculture information from a variety of sources, but books, other aquaculture producers, Internet, the OSUAP and neighbors and friends rank as the top five. Historically, farmers often turn to other farmers, neighbors, and friends for information. Similarly, University Extension programs have often been viewed as trusted sources of information. Use of the Internet is a relatively new tool to gather information. The Internet can be a useful tool for farmers allowing them to acquire information at anytime, day or night. It also provides access to information developed in other states and countries. The downside is that users often
experience information overload when searching for information on the Internet.
Similarly, information accessed via the Internet may not be based on scholarly research.
The OSUAP has a real opportunity to educate Ohio aquaculture producers, given the fact
that they tend not to use the Internet to obtain aquaculture information. The OSUAP
should develop a targeted electronic communication program. The program could
include a website through which farmers could access research-based information at any
time, list-serves to quickly disseminate information, and provide email responses to
inquiries.

Ohio aquaculture producers listed producer associations, the Ohio Aquaculture
Association (OAA) and the Fish Farmers of Ohio (FFO) as their fifth and sixth choice for
a source of information. Aquaculture associations provide a mechanism for farmer-to-
farmer information sharing through member networking and monthly and annual
meetings. It also provides producers with leadership opportunities and some potential
influence within their industry. Approximately half of Ohio aquaculture producers
belong to a producer association and half do not. Given that so many Ohio aquaculture
producers report that other farmers, friends, and neighbors are preferred sources of
information; there is a real opportunity for the OAA and the FFO to promote this
potential role for their organization to attract additional members. Aquaculture producers
may in turn enjoy enhanced interaction with other aquaculture producers and more
information could be shared. Further investigation into the reasons why some join
aquaculture associations while others do not, could provide additional insight about this
issue.
More than three-fourths of Ohio aquaculture producers are aware of the OSUAP, but only about half of those who were aware have used or benefited from the program. This suggests that the OSUAP is doing a reasonably good job of advertising itself as a source of aquaculture information in Ohio, but its reach could be improved. The OSUAP has completed mass mailings announcing workshops being held by the OSUAP to the ODNR database of permitted aquaculture producers in the past which has likely helped promote awareness among aquaculture producers. Though Ohio aquaculture producers rank the OSUAP as fourth in terms of information sources used, some aquaculture producers have not accessed the program. This study did not attempt to determine the underlying reason for this observation, but it would be an interesting question for further research.

Ohio aquaculture producers who have used or benefited from the OSUAP rated their experience, based on whether they learned anything new, applied the new information, or improved their income through application of the new information. Of the 13 products or services offered, Ohio aquaculture producers rated their experience talking with an OSUAP aquaculture specialist on the phone, attending a presentation or workshop, participating in a tour of the OSUAP aquaculture facilities or subscribing to one of the OSUAP list serves, the highest. These services tend to be more personalized, high-touch services involving individualized attention. Using list-serves to disseminate new information may not be viewed as high-touch but it does provide an opportunity to disseminate a steady stream of information directly to aquaculture producers.

In terms of being able to apply new information to their situations, Ohio aquaculture producers ranked calling an OSUAP aquaculture specialist on the phone,
attending a presentation workshop by an OSUAP specialist or OSUAP workshop, and participating in a tour of the OSUAP facility as the top four information services. These are also high-touch services where the format typically allows for individual attention. This enables producers to get their specific questions answered and may increase the likelihood of producers applying the new knowledge.

In terms of economic value, Ohio aquaculture producers credited phone calls with an OSUAP specialist, presentations by an OSU specialist, participation in a tour of OSUAP facilities, attending a field day, and receiving one-on-one consultation with an OSUAP specialist as having the highest economic value. Again, these tend to be high-touch activities that provide producers with more personalized, individual attention, and enables unique situations to be more directly addressed.

Receiving fact sheets, newsletters, and consulting on farm visits ranked lowest in terms of knowledge gained, application, and economic value, but still provided little to some value. It is interesting to note that Ohio aquaculture producers listed newsletters as their most liked source of receiving information, but they perceived less impact in terms of their knowledge, application, or economic value from OSUAP newsletters, magazine articles, journal articles or emails from a specialist.

Information on topics of importance to Ohio aquaculture producers should be used to guide the development of future OSUAP programs and services. Ohio aquaculture producers ranked water quality, fish nutrition, aeration, fingerling production, marketing, fish genetics and regulations as topics of greatest importance to them. These are obviously pressing issues that are impacting Ohio aquaculture producers and programs designed to address these issues should be planned to address those
concerns in the near future. Business topics such as business planning, finance, labor management, and insurance were ranked lower in terms of importance. From a University perspective, these are very important topics that influence the success of the industry, but from the producer perspective they were perceived to be of lesser importance. This is not surprising as many of the small aquaculture farms in Ohio fail to follow good business practices such as record keeping.

Knowing the topics that Ohio aquaculture producers are interested in, and how they prefer to receive information on those topics, is important to help guide the development of OSUAP. Ohio aquaculture producers prefer to get information in newsletters and mail. This observation is surprising given that these information sources received relatively low impact ratings for knowledge gained, application, and economic value by users of the OSUAP. However, it does make sense considering that the majority had Internet access, they did not perceive it as useful as information contained in newsletters, etc. Newer electronic technologies like webinars, blogs, Skype, Facebook and Twitter were not viewed as attractive information sources by Ohio aquaculture producers. With technology changing rapidly, it is important for the dispersal of information to be targeted. Extension does this by understanding client needs and preferred delivery methods, and trying to meet client needs.

Ohio aquaculture producers were provided with an opportunity to offer recommendations for improving the OSUAP. Suggestions ranged from topics relating to more research and additional ideas for Extension programming, to a desire for fewer regulations. Some producers used it as an opportunity to express their appreciation of the OSUAP or frustration in their current situation. One of the ideas that seemed to be
stressed was the addition of on-farm research as an OSUAP strategy. Ohio aquaculture producers generally expressed the need for more “real-world” research conducted on farms in Ohio in a collaborative effort between the University and the industry.

The process of evaluation needs to be built into the program and conducted from beginning to end. Clientele needs and delivery preferences change over time, especially with advances in technology. Using the results of this survey as baseline data for a longitudinal study would enable researchers to track changes in clientele and their information preferences over time. Long-term results could provide important impact documentation for the OSUAP. Documentation of impacts will likely influence sustainability of the OSUAP over time.

**Summary of Recommendations**

Evaluation processes often result in suggestions for change in the organization (Minnett, 1999), therefore this study would not be complete without discussing some specific recommendations for change. There were two intended purposes for this study: (a) program improvement and (b) accountability and impact documentation. Therefore, the target audience for change recommendation is program managers and policymakers.

The purpose of this research was to provide direction for the future of the OSUAP. The OSUAP has had an impact on Ohio aquaculture producers by contributing to the growth and economic efficiency of the aquaculture industry in Ohio. A multiple-output strategy to serve the information needs of Ohio aquaculture producers, concentrating on high-touch and therefore high impact activities, should be continued.
However, a great opportunity to reach those not currently utilizing the OSUAP also exists. Data from this study should be used to guide the development of new programs designed to address information needs identified by Ohio aquaculture producers.

Results from this study can be used to document the impact of the OSUAP to policy makers. Policy makers are interested in programs that make a difference and demonstrate impact on producers or consumers or both. Sharing the results of this study would hopefully lead to increased awareness, potential partnerships, and enhanced success. Demonstrating positive results and programmatic impact to decision makers may then lead to a continuation or increase in funding, allowing for additional programming from the OSUAP and further growth in the Ohio aquaculture industry.


Appendices

A. Questionnaire
B. Exemption from Office of Responsible Research
C. Panel of Experts
D. Pre-survey Postcard
E. Cover Letter
F. Incentive Postcard
Appendix A: Questionnaire
OF THE OHIO STATE UNIVERSITY
AQUACULTURE PROGRAM

A survey of Ohio Aquaculture Producers
2010

Purpose

The Ohio State University Aquaculture Program (OSUAP) strives to be the leading provider of aquaculture education and information to the aquaculture industry in Ohio. In order to provide premium, valued service it is necessary to understand the characteristics and needs of the industry. This survey will gather critical clientele information to assess the current impact of the OSUAP and help guide and direct the program in the future.

All Information will remain confidential

Your input will be reported only in aggregated statistical summaries so that information from individual respondents cannot be identified.

Please complete this survey and return it by postal mail no later than April 15, 2010.

For questions or assistance contact:
Laura Tiu, tiu.2@osu.edu
1864 Shyville, Rd.
Piketon, OH 45661
(tel. 740-289-2071 x121)
Section I. Please answer the following questions as they relate to your aquaculture business.

1. How many years have you been/were you an aquaculture producer? ____ year(s)

2. During which of the following years did you have an aquaculture permit from the Ohio Department of Natural Resources? (Check all that apply)
   □ 2005  □ 2006  □ 2007  □ 2008  □ 2009  □ 2010

3. How many people (including you) currently work in your aquaculture business? ____ # full time      ____ # part time

4. Do you consider farming as your primary occupation (more than 50% of your work hours)? (check one)
   □ Yes  □ No

5. Is the principal operator of the aquaculture business also employed in an off-farm occupation? (check one)
   □ Part time       □ Full time       □ No

6. What percentage of your farm’s gross sales is generated from your aquaculture business? _______ %

7. What was your farm’s annual gross value of sales of aquaculture products in 2009. (check one)
   □ 0-$999  □ $1000-$9,999  □ $10,000-$49,999  □ $50,000-$99,999  □ $100,000 – $499,999  □ More than $500,000
8. Over the next five years, how do you expect the size of your aquaculture business to change? (check one)

□ Discontinue production
□ Reduce production
□ Maintain production
□ Expand production

9. What is the sex of the principal operator of your aquaculture business?
□ Male □ Female

10. What is the race of the principal operator of your aquaculture business? (check one or more)
□ American Indian or Alaska Native
□ Asian
□ Black or African American
□ Hispanic
□ Native Hawaiian or other Pacific Islander
□ White

11. What is the age (as of 12-31-09) of the principal operator of your aquaculture business? _____ years

12. Are you a member of an aquaculture producer association in Ohio (check all that apply)?
□ No
□ Yes, the Ohio Aquaculture Association
□ Yes, the Fish Farmers of Ohio
□ Other (please specify) ____________________________________________
Section II: Please answer the following questions about how you access aquaculture information.

13. Which of the following are the top five sources of aquaculture information that you use? Check the 1st box next to your most valuable source; check the 2nd box next to your second most valuable source, and so on until you have ranked your top five (5).

<table>
<thead>
<tr>
<th>Source of Information</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Books</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish Farmers of Ohio Association</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government agencies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neighbors/friends</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Central Regional Aquaculture Center (NCRAC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ohio Aquaculture Association (OAA)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other aquaculture producers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other farm organizations (i.e. Ohio Farm Bureau)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private consultants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Ohio State University Aquaculture Program (OSUAP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Universities other than OSUAP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other:______________________</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

14. How frequently do you use the Internet as a resource for aquaculture information? (check one)
   □ Never
   □ Seldom/annually
   □ Occasional/monthly
   □ Frequent/weekly
   □ Very Frequent/daily

15. Are you aware of The Ohio State University Aquaculture Research and Extension Program (OSUAP)? (check one)
   □ Yes  □ No (If no, please skip to question 18).
16. Have you benefited from or used any information provided by The Ohio State University Aquaculture Program (OSUAP) in the past? (check one)  
□ Yes □ No (If no, please skip to question 18).

17. If you have accessed information from The Ohio State University Aquaculture Program (OSUAP) please rate your experience. If you have not used a listed source of information, leave the respective boxes blank, and please move to the next listed information source. For this question:

Knowledge = Did you learn new information?  
Application = Did you apply the new information?  
Economic Value = Did your income improve as a result of the new information?

<table>
<thead>
<tr>
<th>Source of Information</th>
<th>None</th>
<th>Little</th>
<th>Some</th>
<th>A lot</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Attended an OSUAP aquaculture workshop</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic value</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Attended an OSUAP Aquaculture Field Day</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic value</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Attended a presentation by an OSUAP Aquaculture Specialist</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic value</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. Called an OSUAP Aquaculture Specialist on the phone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic value</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. Consulted with an OSUAP Aquaculture Specialist on my farm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic value</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F. Received a fact sheet from the OSUAP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic value</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source of Information</td>
<td>None</td>
<td>Little</td>
<td>Some</td>
<td>A lot</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------------</td>
<td>------</td>
<td>--------</td>
<td>------</td>
<td>-------</td>
</tr>
<tr>
<td>G.  Received a research journal article from the OSUAP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic value</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H.  Subscribed to one or more of the OSUAP list serves (i.e. AquaOhio)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic value</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I.  Received information by email from an OSUAP aquaculture specialist</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic value</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J.  Read newspaper or magazine articles authored by OSUAP aquaculture staff</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic value</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K.  Received newsletters from the OSUAP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic value</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L.  Received a one-on-one consultation with an OSUAP aquaculture specialist</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic value</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M.  Participated in a tour of the OSUAP aquaculture facilities (Piketon or Bowling Green)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic value</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section III: The next questions will help us identify priorities for future OSUAP programs.

18. Please rate the importance of each of the following topics for the success of your aquaculture business. (Please check one answer for each topic)

<table>
<thead>
<tr>
<th>Topic</th>
<th>Extent of Importance to you</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financing</td>
<td>None</td>
</tr>
<tr>
<td>Business planning</td>
<td></td>
</tr>
<tr>
<td>Business or Crop Insurance</td>
<td></td>
</tr>
<tr>
<td>Facility construction</td>
<td></td>
</tr>
<tr>
<td>Fish nutrition</td>
<td></td>
</tr>
<tr>
<td>Fish genetics</td>
<td></td>
</tr>
<tr>
<td>Fingerling production</td>
<td></td>
</tr>
<tr>
<td>Food fish production</td>
<td></td>
</tr>
<tr>
<td>Baitfish production</td>
<td></td>
</tr>
<tr>
<td>Aeration</td>
<td></td>
</tr>
<tr>
<td>Water quality</td>
<td></td>
</tr>
<tr>
<td>Processing</td>
<td></td>
</tr>
<tr>
<td>Marketing</td>
<td></td>
</tr>
<tr>
<td>Regulations</td>
<td></td>
</tr>
<tr>
<td>Labor management</td>
<td></td>
</tr>
<tr>
<td>Other: ____________</td>
<td></td>
</tr>
</tbody>
</table>

88
19. To what extent do you like or dislike each of the following formats for receiving aquaculture information and assistance? (Please check one answer for each format)

<table>
<thead>
<tr>
<th>Format</th>
<th>Strongly Dislike</th>
<th>Somewhat Dislike</th>
<th>Neither Like or Dislike</th>
<th>Somewhat Like</th>
<th>Strongly Like</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm visit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Twitter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facebook</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mail</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Webpage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Email</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workshop</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blog</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phone</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Newsletters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DVD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skype</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Webinar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evening meeting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
20. Are you interested in learning more about a financial planning program (called FINPACK) for collecting and analyzing aquaculture production data to help you examine your financial situation, explore alternative actions, and make informed decisions about the future direction of your aquaculture operation?

☐ Yes  ☐ No

21. Do you have any specific recommendations for improving The Ohio State University Aquaculture Program (please continue on additional sheets if necessary)?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
You are finished!

Please return this survey in the prepaid envelope as soon as possible and no later than April 15, 2010.

Do not forget to include the postcard to reserve your subscription to Fish Farming News.

Thank you for participating in this survey. Your cooperation is greatly appreciated and will support the growth and development of aquaculture in Ohio.

If you have additional comments or requests, feel free to list them here.
Appendix B: Exemption from Office of Responsible Research
March 19, 2010

Protocol Number: 2010E8171
Protocol Title: ASSESSMENT AND FUTURE DIRECTION OF THE OHIO STATE UNIVERSITY AQUACULTURE PROGRAM, ROBERT BIRKENHOLZ, LAURA TIU, HUMAN AND COMMUNITY RESOURCE DEVELOPMENT
Type of Review: Request for Exempt Determination

Dear Dr. Birkenholz,

The Office of Responsible Research Practices has determined the above referenced protocol exempt from IRB review.

Date of Exempt Determination: 3/18/2010
Qualifying Exemption Category: 2

Please note the following:

- Only OSU employees and students who have completed CITI training and are named on the signature page of the application are approved as OSU Investigators in conducting this study.
- No changes may be made in exempt research (e.g., personnel, recruitment procedures, advertisements, instruments, etc.). If changes are made, a new application must be submitted.
- Per university requirements, all research-related records (including signed consent forms) must be retained and available for audit for a period of at least three years after the research has ended.
- It is the responsibility of the investigator to promptly report events that may represent unanticipated problems involving risks to subjects or others.

This determination is issued under The Ohio State University’s OHRP Federally-Assured #00066378. All forms and procedures can be found on the ORRP website – www.orrp.osu.edu. Please feel free to contact the ORRP staff contact listed below with any questions or concerns.

Cheri Petey, MA, Certified IRB Professional
Senior Protocol Analyst—Exempt Research

Office of Responsible Research Practices
Ohio State University
1960 Kenny Road
Columbus, OH 43210
phone: 614.688.0389
fax: 614.688.0366
email: petey.orepsa.edu

Exempt Determination
Version 1.1
Appendix C: Panel of Experts
Dr. Gary Jensen  
National Program Leader for Aquaculture  
U.S. Department of Agriculture  
National Institute of Food and Agriculture  
Mail Stop 2220  
1400 Independence Avenue S.W.  
Washington, D.C. 20250-2220

Mike Frinsko  
Area Specialized Agent – Aquaculture  
Jones County Extension Center  
110 S. market Street  
Trenton, NC 28585

Dr. Kwamena K. Quagrainie  
Aquaculture Marketing Specialist  
Purdue University  
West Lafayette, IN

David Cline  
Extension Aquaculturist  
Alabama Cooperative Extension System  
203 Swingle Hall  
Auburn University, AL 36849

Paul Olin  
Sea Grant Extension Program  
University of California Cooperative Extension  
133 Aviation Blvd., Suite 109  
Santa Rosa, CA 95403

Dr. Maxwell Mayeaux  
Aquaculture Program Specialist  
USDA/national Institute of Food and Agriculture (NIFA)  
Waterfront Centre, Room 3155  
800 9th St., SW  
Washington, DC 20024
Appendix D: Pre-survey Postcard
Dear Ohio Aquaculture Producer,

A few days from now you will receive in the mail a request to fill out a brief questionnaire for an important research project being conducted by The Ohio State University. It concerns the experience of Ohio aquaculture producers (licensed during 2005-2009).

The study is important in that it will help Ohio State University understand the needs of Ohio Aquaculture Producers and how they would like those needs met. If you have any concerns or questions, please do not hesitate to contact us.

Thank you for your consideration. We know your time is valuable.

Sincerely,
Laura G. Tiu, Aquaculture Specialist

P.S. You will be offered a small token of appreciation with the questionnaire as a way of saying thanks.
Appendix E: Cover Letter
April 5, 2010

Dear [personalized],

Serving our customers and meeting their aquaculture information needs are top priorities for the Ohio State University Aquaculture Program. In order to enhance our ability to support the aquaculture industry in Ohio, we are asking you, our customer, to provide information that will help improve our ability to service the aquaculture industry in Ohio. This project is part of a joint effort with the Ohio Department of Agriculture to assess the Ohio Aquaculture Industry and support its development.

I would greatly appreciate your participation in the project. In order for the information from this study to be truly representative, your participation is essential. This questionnaire is designed to be completed by licensed aquaculture producers in Ohio.

Completing this survey should require 15-20 minutes. All data will be held in the strictest confidence. Results will be reported only in statistical summaries and in aggregate by categories so that information about individual respondents can not be identified.

To thank you for your voluntary participation, I would like to offer you a one-year subscription to Fish Farming News, my favorite aquaculture newspaper. Simply return the included postcard with your completed survey in the envelope provided.

Please complete the survey by April 15, 2010

If you have any questions or concerns, please contact me, Laura Tiu, at tiu.2@osu.edu or 740-289-2071 x121. A stamped and addressed envelope has been included for return of the questionnaire.

Thank you in advance for your participation.

Sincerely,

Laura Tiu
Aquaculture Specialist
OSU Aquaculture Program
Appendix F: Incentive postcard
As a THANK YOU for participating in our survey, we would like to offer you a 1 year (7 issues) subscription to Fish Farming News (a $14.95 value).

This is my favorite aquaculture newsletter loaded with stories from aquaculture site visits, suppliers to the industry and lots of national aquaculture news.

Just return this postcard with the box checked on the back with your survey.

If you are already a subscriber, this will be added on to your current subscription.