


COOPERATIVE EXTENSION PROGRAM • COLLEGE OF AGRICULTURE, FOOD SCIENCE, AND SUSTAINABLE SYSTEMS

KENTUCKY AQUATIC FARMING:

A Newsletter for Kentuckians Interested in Improving Fish and Shellfish Production, and Pond Management

Volume 28, Number 2 *Spring/Summer 2016*

CONTENTS

Sustainable Aquaculture Workshop on Thursday, June 16 from 10:00 to 3:15 at the Harold R. Benson Research and Demonstration Farm, 1525 Mills Lane, Frankfort, Kentucky 40601. Please see Page 7 for the presentations schedule.

Improving Market Access for Small-Scale Seafood Producers

By Richard Bryant, Dr. Siddhartha Dasgupta, Angela Caporelli, Dr. Laura Tiu

Research into "food mileage" has indicated that many consumers do not realize how far the distance between the producer and the consumer has grown over the past few decades (Futamura 2007). Although this has helped increase the availability of food, it has also had negative impacts such as increased reliance on transportation networks and increased competition for local growers. The small-scale aquaculture industry in Kentucky and Ohio relies on direct and niche marketing in order to compete with imported seafood. Marketing to restaurants specializing in local foods is a potential area where small-scale producers could become competitive in the low-margin seafood market. As evident through the huge increase in farmers' market sales in the United States over the past years, some consumers are interested in narrowing the separation between them and the agricultural producers (Curtis 2009).

Channel Catfish

A growing "buy local" movement has been taking place in U. S. restaurants where high competition makes catering to niche markets a necessity for small-scale local growers. Most restaurants have indicated that price is less important to them when compared with food quality, although few restaurants are aware of locally-grown sources of high-quality food (Starr 2003).

Food safety is a major concern by Americans, and many are interested about food origins before making purchasing decisions (Curtis 2009). Also, with the rise in individuals who want food produced with specific production methods such as organic culture

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methods, there are even greater local marketing opportunities (Bukenya 2007). All of these factors have lead to increases in locally-grown food being served in restaurants in Kentucky and Ohio.

Aquaculture producers have the potential to sell their products locally, although very little research has been done to determine restaurant preferences for locally-grown seafood. To successfully sell fish and crustaceans to restaurants, producers must be aware of species, product form, size, and delivery schedule preferred by chefs (Dasgupta 2009). Our study focused on the feasibility of profitably marketing locally-grown fish to restaurants in Kentucky and Ohio. We also investigated the supply of fish from small-scale and seasonal growers in these areas in order to determine whether they could meet the demand for locally-grown seafood.

Study Methods
The objective of this study was to document the demand for fresh locally-grown fish from independent restaurants. Two hundred and eight nine locally owned restaurants in Kentucky and Ohio were surveyed using Survey Monkey. Additionally, 50 questionnaires were hand delivered to locally owned restaurants in the Cincinnati area along with self-addressed stamped envelopes. The link to our electronic survey was also included in the Ohio Restaurant Association's "News Bites" e-publication.

The survey questions focused on restaurant owner's/chef's willingness to purchase fish currently being cultured in Kentucky and Ohio, which included catfish, largemouth bass, bluegill, hybrid striped bass, paddlefish, yellow perch, and rainbow trout. Restaurants were asked about the types of freshwater fish that they currently were serving and their preferred delivery schedule for locally-grown fish. Restaurants were also asked to indicate the seafood attributes that were important to them, such as freshness, taste, product form (whole on ice, live, fillets, etc.), size of fish, and product origin. Finally, restaurants were asked to rank preferred fish species by eliciting their top three choices for fish. The size ranges for each species is reported in Table 1.

Hybrid Striped Bass

Table 1. Size ranges for top three species in FSMIP questionnaire.

Trout Size (40% skin on fillet dress out)
SMALL: ≤ 4.9 oz. Fillet; ≤ 1.5 lbs. Whole
MEDIUM: 5-8.9 oz. Fillet; 1.6-2.8 lbs. Whole
LARGE: > 9 oz. Fillet; >2.9 lbs. Whole

Hybrid Striped Bass Size (35% fillet dress out)
SMALL: ≤ 4.9 oz. Fillet; ≤ 1.8 lbs. Whole
MEDIUM: 5-8.9 oz. Fillet; 1.9-3.2 lbs. Whole
LARGE: > 9 oz. Fillet; >3.3 lbs. Whole

Catfish Size (45% fillet dress out)
SMALL: ≤ 4.9 oz. Fillet; ≤ 1.4 lbs. Whole
MEDIUM: 5-8.9 oz. Fillet; 1.5-2.5 lbs. Whole
LARGE: > 9 oz. Fillet; >2.6 lbs. Whole

Results
We received 52 responses from restaurants (39 from Kentucky and 13 from Ohio). Over half of the respondents (52%) currently serve freshwater fish. Among these restaurants, tilapia (37%), catfish (27%), and hybrid striped bass (15%) were the most commonly-served species. Rainbow trout was chosen by 44 percent of the respondents as the first choice of fish they were most interested in trying at their restaurant. Correspondently, the second choice was hybrid striped bass (27%) and the third choice was channel catfish (12%). Food attributes of importance, reported by the respondents, were product quality, consistent supply, and taste. The most convenient delivery schedule was chosen to be once-per-week by over half (51%) of the respondents.

Based on our data, rainbow trout had the highest potential in marketing to restaurants by fish producers in Kentucky and Ohio. Fresh (38%) and fillets (29%) were the two most preferred forms of trout. Small whole trout (1.5 lbs. or less) was preferred by half of the restaurants who chose whole trout as their most preferred local seafood and over half (67%) of the restaurants who chose whole trout as their number two local seafood choice. Medium size fillets (5 oz. to 8.9 oz.) were preferred by 76 percent of restaurants who chose trout fillets as their top local seafood choice. The willingness to pay for trout was $4 to $6/lb. and $8 to $10/lb., for whole fish and fillets, respectively.

Hybrid striped bass had the second-highest sales potential to local restaurants in Kentucky and Ohio. Fresh fish and fillets were preferred by 39 percent and 32 percent of respondents, respectively. Large, whole hybrid striped bass (> 3.3 lbs.) were preferred by the majority (75%) of the restaurants that chose whole hybrid striped bass as their preferred fish. Of those that preferred fillets, most chose a size range of 5 oz. to 8.9 oz. (i.e.,

Rainbow Trout

medium-sized fillets). The most preferred willingness-to-pay was $4 to $6/lb. for whole hybrid striped bass. The preferred price for fillets varied with 29 percent of restaurants preferred hybrid striped bass indicating they would pay $8 to $10/lb., while 36 percent indicated they would pay over $14/lb.

Catfish, one of the most important aquaculture species in the United States, was the third most preferred species among the responding restaurants. Fresh fish (31%) and fillets (31%) were the two most preferred forms of catfish. Whole catfish was generally unpopular among restaurants. The preferred size was 5 oz. to 8.9 oz. fillets (medium size) while 60 percent of restaurants expressing willingness to buy catfish indicated that they were willing to pay $5-$7/lb. for fresh catfish fillets.

Discussion

Due to the growing number of restaurants that are interested in featuring locally-grown food, more marketing opportunities are available to small-scale aquaculture producers. Our survey validated earlier results that restaurants considered taste and freshness of food to be more important than its price. These characteristics are typically attributed to locally raised, small-scale products due to their close proximity and increased care in handling and selection.

Knowing the species, price, form, and size that restaurants prefer is valuable information for aquaculture farmers because it assists them in business planning and marketing prior to raising fish. Marketing aquaculture products from Kentucky and Ohio to regional restaurants is a possible avenue for small-scale aquaculture producers to be profitable, but these farmers must cater to the preferences of the restaurants in order to stay in business. Identifying these opportunities in order to join "buy local" or other agricultural movements can give small scale farmers at an advantage over larger producers.

Literature Cited

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Curtis, K. R., & Cowee, M. W. (2009). Direct marketing local food to chefs: chef preferences and perceived obstacles. *Journal of food distribution research*, 40(2), 26-36.

Dasgupta, S., & Durborow, R. M. (2009). Small-Scale Marketing of Aquaculture Products. Southern Regional Aquaculture Center.

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Starr, A., Card, A., Benepe, C., Auld, G., Lamm, D., Smith, K., & Wilken, K. (2003). Sustaining local agriculture barriers and opportunities to direct marketing between farms and restaurants in Colorado. *Agriculture and Human Values*, 20(3), 301-321.

Does Adding Taurine to the Feed Benefit Largemouth Bass?

By Leigh Anne Bright

Many people do not think of fish farms when you say largemouth bass (LMB), however, it is one of Kentucky's most important aquaculture species. Like many species, feed costs for LMB are a major part of the costs of production. With LMB, their feeds are even more expensive than in most other species. Fish like catfish are omnivores. They eat and grow well on a mix of plant and animal proteins. However, LMB are predators which means they need a lot of protein, primarily animal protein such as fish meal.

In other predators, researchers have found that the amino acid taurine may need to be added to the diet for maximum growth and health. This was first discovered in cats but later found to also be true in certain predator fishes. This was especially true when researchers fed the fish diets made primarily with plant proteins.

To test whether it might be important to add taurine to LMB diets, we set up an experiment evaluating four diets (Figures 1 and 2):

Diet 1 (Control) was similar to a commercial diet, containing 30% fish meal and no added taurine.

Diet 2 replaced the fish meal (which contains taurine naturally) with a pork by-product meal which contains almost no taurine) and no additional added taurine.

Diet 3 was the same as Diet 1 but with taurine added (2%).

Diet 4 was the same as Diet 2 with taurine added.

Fish were fed the four diets twice a day for 12 weeks. There were no major differences in survival or weight gain among fish fed the four diets. Fish fed Diet 4 had slightly better feed conversion ratio (FCR) efficiency (lower FCR) than fish fed Diet 2. This indicates a slight improvement in performance in fish fed diets without fish meal.

The practical implications are that commercial diets which include fish meal probably would not benefit from added taurine. However, in the future, as the trend toward decreasing levels of fish meal in the feeds continues, added taurine might become economically justified.

This study has just been published in one of the aquaculture industry's premier peer-reviewed journals, North American Journal of Aquaculture: *Effect of Taurine Supplementation on Growth Response and Body Composition of Largemouth Bass* by Catherine A. Frederick, Shawn D. Coyle, Robert M. Durborow, Leigh Anne Bright, and James H. Tidwell in volume 78, pages 107-112. Catherine Frederick (Figure 3), performed this study as part of her M.S. degree at KSU. She is currently enrolled in a Ph.D. program at the University of Maine.

Figure 1 — Leigh Anne Bright, Catherine Frederick, and Charlie Shultz collect data next to the study aquaria

Catherine Frederick performing her M.S. thesis research at KSU

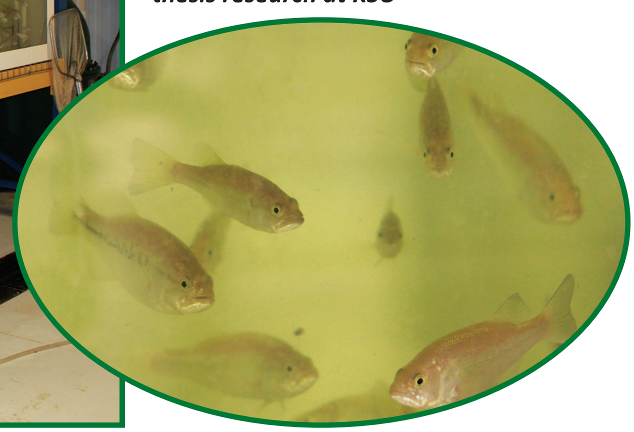


Figure 2 — Largemouth bass used in the taurine study

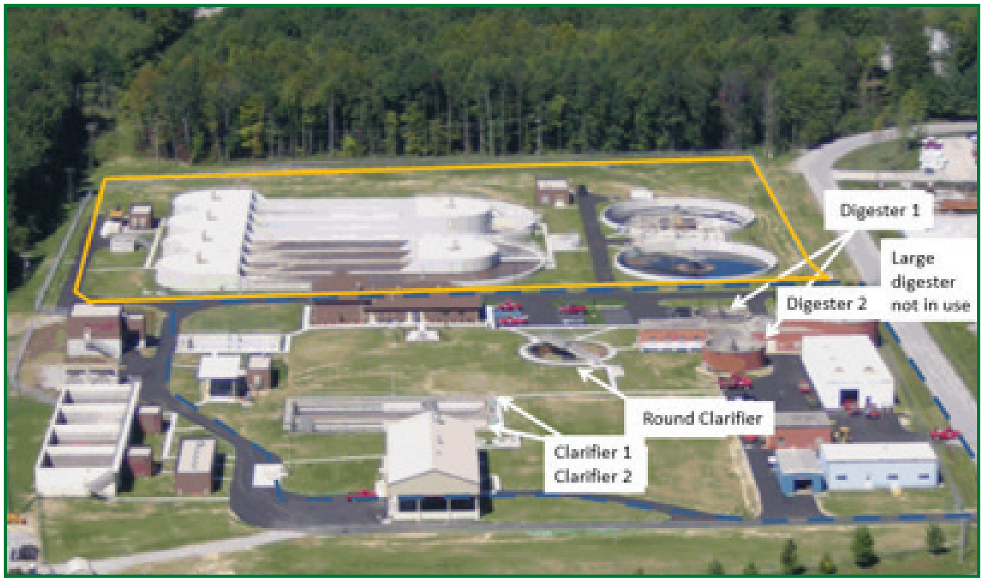
Integrating Aquaculture and Water Reuse

By Ken Semmens, Ph.D. and James Poindexter

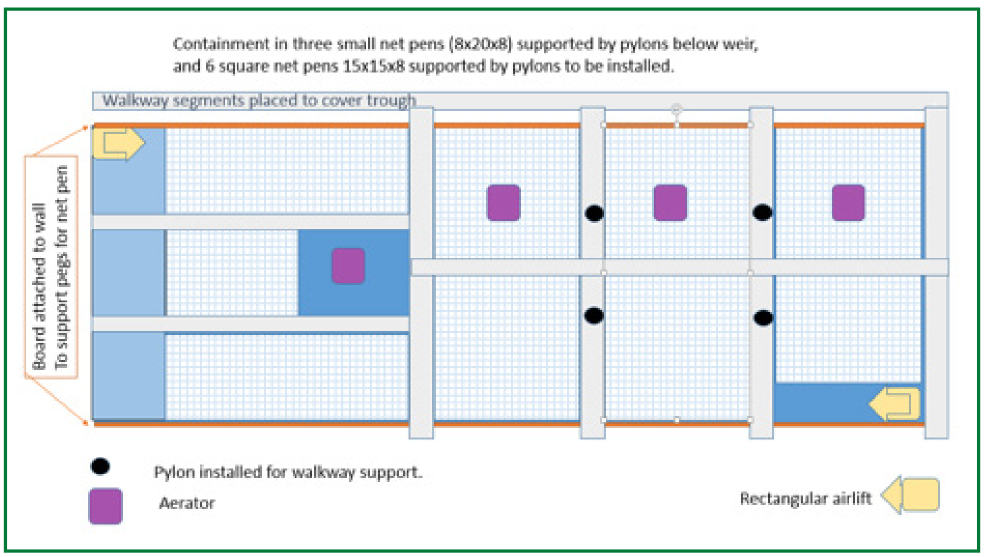
The London Utility Commission and Kentucky State University Division of Aquaculture are collaborating on a project to integrate aquaculture and water reuse at the Water Resource Recovery Facility (WRRF) in London, KY. This project takes advantage of decommissioned facilities, a secure location, treated water discharged from the plant, and other components of the facility to grow fish. It will develop management practices and serve as a demonstration providing a focus for educational programs on aquaculture for a three year period of time.

As the value of water is recognized, it makes sense to develop methods that take greater advantage of existing resources to grow fish for food and recreation. Kentucky State University aquaculture investigators have conducted research on fish grown in water discharged from wastewater treatment plants in Winchester, Frankfort, Midway, and now, London, Kentucky. Paddlefish, hybrid striped bass, channel catfish, colorful koi carp, tilapia, and largemouth bass survive and grow well in these systems. An investigation of contaminants in paddlefish and hybrid striped bass at Winchester demonstrated that fish grown in water reclaimed from a wastewater treatment plant had contaminant concentrations (i.e. mercury, selenium, Chlordane, Mirex, Aldrin, PCB's and more) that were well below the FDA action limits for edible food in all samples. Additional research is underway to assess whether other contaminants may be of concern. At this point, investigators working on this project have not observed a specific contaminant risk associated with growing food fish in water treated at these facilities.

By using decommissioned water treatment facilities and retrofitting them for aquaculture, municipalities may avoid demolition costs, create new jobs, and generate revenue for their communities. Most of the new water resource recovery facilities are being built adjacent to the old and would conveniently allow reclaimed water to be used for aquaculture. Using reclaimed water for aquaculture can be considered a non-consumptive way to reuse water, because the aquaculture effluent is returned to the treatment process. Below is a photo of the London facility.



In 2015 largemouth bass were grown in one tank and paddlefish in another (clarifiers 1 and 2). Two large round tanks (digesters 1 and 2) have been outfitted with net liners. Soon paddlefish will be harvested from the clarifier and divided equally between the two large round tanks so they will continue growing to a harvestable size. Once a clarifier tank is emptied, net pens will be installed so several kinds of fish can be grown and easily harvested once they reach market size. This is not a fish hatchery, but a grow-out facility where fingerlings are stocked, fed, and grown to harvestable size. Net pens will make it easy to harvest some or all of the fish without draining the tanks. Below is a figure showing the planned layout of net pens in a clarifier.



The project has other objectives as well. Aquaculture investigators at Kentucky State University are conducting research on holding systems and the distribution of live farm raised fish to take full advantage of the capacity for local aquaculture producers to deliver the highest quality product at an acceptable price into markets in the Louisville area. Initial harvests of market size fish grown at the London WRRF will be used to obtain information to assess the potential for distributing live food fish to the urban market. This is a collaboration with the Louisville Fish Company to establish a hub to create a new marketing channel that may become especially useful to small Kentucky producers. The project is funded by a Capacity Building Grant to Kentucky State University from USDA/National Institute for Food and Agriculture.

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Irrigating Late Summer Corn with Channel Catfish *Ictalurus punctatus* Pond Water in Western Kentucky: A Demonstration Project

By Forrest Wynne, John Murdock and Rick Murdock

Introduction and methods

This demonstration project addressed two questions: Corn planted late in the growing season requires irrigation, but does irrigation water pumped from commercial channel catfish (*Ictalurus punctatus*) ponds contain enough nutrients to benefit corn production? Does the volume of replacement groundwater improve water quality or increase catfish production in a pond used for irrigation compared to a static pond?

Ponderosa Farms is located near Murray in western Kentucky and produces corn, soybeans, wheat and channel catfish. In three fields that contain poorly drained soils not well suited for grain production, nine levee style commercial catfish ponds were constructed that ranged in size from 4 to 5 acres. Each location contains three ponds that are filled with water from a 164-foot well with a pumping capacity of 600 gal per minute. Each pond is equipped with an electric 10 hp. paddlewheel aerator.

During summer, one pond in each location is used to supply water for crop irrigation. A water pumping truck equipped with an irrigation pump with a 6-inch intake and a 3-inch discharge capacity was connected to the field irrigation system. The pumping trailer is powered by a truck mounted 99 hp. 4 cylinder diesel generator. This engine provided power to the pump and a 480 V, 3 phase electric generator that supplied electricity to the center pivot field irrigation systems. The portable pumping station was constructed to reduce water pumping cost and increase pumping efficiency by locating the source of irrigation water closer to crop fields. Otherwise, irrigation water would have to be pumped to fields located far from the well.

Harvesting channel catfish with a net hoisted by a crane.

Late summer corn was planted in the stubble of a harvested winter wheat crop during mid-June 2014. Irrigation water was pumped from a 4.2 acre commercial channel catfish production pond and applied to 34 acres located in a 46 acre field of yellow corn. A 677 ft. center pivot irrigation system equipped with a terminal spray gun delivered pond water during seven watering trips between early July and mid-September. The system was calibrated to deliver 0.6 inch of water per acre (16,294 gal) of corn, or an estimated 554,000 gal per application. One water application was estimated to be equivalent to approximately 8% of the catfish irrigation pond volume. Replacement water was pumped a short distance to the catfish irrigation pond from a nearby well. A 4.0 acre catfish production pond located next to the irrigation pond was used as a comparison.

Weekly water samples were taken from both ponds during 11 weeks of irrigation. Comparisons were made between the irrigation and control pond to evaluate differences in water quality that may affect fish production and to estimate the amount of nutrients supplied to the corn from the pond water. Irrigation water suitability analyses were performed by a commercial agricultural laboratory. Rainfall was 7 inches between corn planting in mid-June and harvest in late October, 2014. Ammonium nitrate (34-0-0) fertilizer was applied to emergent corn by spreader truck at a rate of 500 lbs. per acre in early July.

Both ponds were stocked with 6,000 channel catfish per acre and were harvested and restocked in a multiple batch production system. Catfish were fed a floating, 28% protein, commercial catfish diet at a rate of 75 lbs. per acre per day. Daily dissolved oxygen was monitored and night time aeration was provided when dissolved oxygen concentrations fell below 3 mg/L.

Results

Irrigation suitability test means were compared for the irrigation and control pond water parameters listed in Table 1. A two-tailed, Student's t test ($P<0.05$) was used to determine significant difference between parameter means.

Potassium and magnesium were more concentrated in the control pond water than the irrigation pond. Potassium was categorized as normal for irrigation purposes (Waters Agricul-

Table. 1 Mean (+ Standard Deviation) of water quality parameters of a catfish irrigation pond and a control catfish pond. Asterisk indicates a significant difference ($P<0.05$).

	Irrigation Pond mean (standard deviation)	Control Pond mean (standard deviation)
Nitrogen (mg/L)	5.21 (2.12)	4.69 (1.89)
Phosphorus (mg/L)	0.23 (0.17)	0.33 (0.21)
Potassium (mg/L)	6.18 (1.69)*	10.09 (2.29)*
Calcium (mg/L)	4.98 (0.64)	5.26 (0.88)
Magnesium (mg/L)	2.11 (0.38)*	2.72 (0.48)*
Sodium (mg/L)	8.42 (1.30)*	7.01 (1.69)*
Chloride (mg/L)	15.56 (5.62)	12.73 (4.68)
Sulfate (mg/L)	5.77 (1.71)	7.61 (2.40)
Boron (mg/L)	0 (0)	0.02 (0.01)
Carbonate (mg/L)	0 (0)	0 (0)
Bicarbonate (mg/L)	38.77 (14.09)	39.22 (13.29)
pH	6.5 (0.2)	6.5 (0.2)
Conductivity (mmhos/cm)	0.097 (0.004)	0.10 (0.01)
Total dissolved solids (mg/L)	61.37 (3.01)	63.98 (7.01)
Sodium absorption ratio (mg/L)	0.80 (0.16)*	0.62 (0.18)*

John Murdock, in his corn field, passed away in 2015 after this study was completed.

Center-pivot irrigation in the corn field.

tural Laboratory Inc. 2014) with concentrations between 5 -20 mg/L, and magnesium concentrations were low (< 10 mg/L). Sodium concentration was greater in the irrigation pond as was Sodium Absorption Ratio (SAR), but both were evaluated at low concentrations of < 60 mg/L and < 3 mg/L, respectively. Water with an elevated SAR (>8.0 mg/L) displaces calcium and magnesium in the soil and is less suitable for irrigation. Total ammonia nitrogen (TAN) and nitrite was tested weekly with a portable water quality test kit. TAN ranged from 0.5 – 1.6 mg/L and nitrite concentrations were 0 - 0.23 mg/L for both ponds.

Irrigation provided water essential to corn production during periods with little rainfall. During each irrigation trip, small amounts of nitrogen (10.8 oz. acre), phosphorus (0.67 oz. acre) and potassium (1.10 lbs. per acre) were delivered to the corn. Yellow corn was harvested during late October 2014. Corn production for the 34 acre irrigated field was 8,047 bushels with an average yield of 234 bushels per acre. The corn crop likely benefitted little from the small amount of nutrients provided by the catfish pond water.

Catfish were harvested from both ponds at individual weights that ranged between 1.5 – 4.0 lbs. and were sold to fee fishing operations. No fish mortality or incidence of disease was observed in either pond during the project. During the July to mid-September irrigation period, 10,278 lbs. of catfish were harvested from the irrigation pond and 14,386 lbs. of fish were taken from the control pond. Total catfish harvested from March through September 2014 was 24,099 lbs. for the irrigation pond and 21,769 lbs. for the control pond. Catfish harvest yield difference of 2,330 lbs. between the irrigation and control pond was likely due to varied seining effort between the ponds. Differences in water quality between the two ponds were slight indicating that the small volume of well water required to replenish the irrigation pond probably had minimal effect on fish production.

Acknowledgements

Many thanks to the late Dr. John Murdock and to Mr. Rick Murdock of Ponderosa Farms for their participation and dedication to this project. Kentucky State University College of Agriculture Food Science and Sustainable Systems provided project funding.

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Agenda for June 16, 2016 Third Thursday workshop 10:00 – 3:00
At the Harold R. Benson Research and Demonstration Farm • 1525 Mills Lane, Frankfort, KY 40601

10:00 – 10:15	Jim Tidwell – Welcome
10:15 – 10:30	Shawn Coyle – Largemouth Bass
10:30 - 10:45	Ken Thompson – Education outreach at high schools
11:45 – 12:00	Ken Semmens – Intensive Production of 1st Year Paddlefish on Feed
12:00 - 1:15	Lunch
1:15 - 1:30	Lesley Sneed – Freshwater Mussels in KY
1:30 – 1:45	Richard Bryant – Local Marketing of Fish and Crustaceans in KY
1:45 - 2:00	Michael Tierney – Marketing Fish
2:00 – 2:15	Forrest Wynne – Catfish production, live hauling, fee fishing etc.
2:15 - 2:30	John Kelso – Fish Disease diagnostic laboratory
2:30 – 2:45	Andrew Ray – Marine Shrimp research
2:45 – 3:00	Waldemer Rossi – Fish Nutrition research
3:00 – 3:15	Christopher Lyvers – Undergraduates' involvement in aquaculture

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KENTUCKY AQUACULTURE ASSOCIATION

Membership Application

Do you give permission to display the following information in an Agricultural Directory? ❑ **Yes** ❑ **No**

AQUACULTURE BACKGROUND *(check more than one where appropriate):*
❑ Producer ❑ Live Hauler ❑ Processor ❑ Pay Lake Owner
❑ Feed Mill ❑ Extension/Research
❑ Other *(explain)* ____________________

SPECIES
❑ trout ❑ minnows ❑ largemouth bass ❑ catfish ❑ bluegill
❑ hybrid striped bass ❑ freshwater shrimp ❑ red claw crayfish
❑ paddlefish
❑ Other *(explain)* ____________________

WATER SOURCE *(if applicable):*
❑ well ❑ spring ❑ watershed pond ❑ stream or lake
❑ Other *(explain)* ____________________
Number of ponds or raceways: __________
Total acreage (if ponds) __________
Comments (e.g. issues you want the Association to address): __________
____

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MEMBERSHIP DUES
Kentucky Aquaculture Association Dues: $25.00
Student KAA Dues: $5.00 School: __________
Current Project: ____________________

Please return this application to the address listed below:
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Frankfort, KY 40601
ph. 502-782-4104; cell 502-330-5808; fx. 502-573-2543
email: angela.caporelli@ky.gov