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Long-term Arkansas River Fishery Investigation Leads to Change in Largemouth Bass Minimum-length Limit

Michael A. Eggleton, Associate Professor, UAPB; Ben Batten, Fisheries Biologist, AGFC; Brad Fontaine, Fisheries Biologist, Florida FWCC; and Clint Peacock, Fisheries Biologist, Georgia DNR

Largemouth bass is the most popular sportfish in Arkansas, and is especially popular in the lower Arkansas River. In the early 2000s, the Arkansas Game and Fish Commission (AGFC) was fielding concerns from recreational and tournament bass anglers about the diminishing quality of the largemouth bass fishery in the lower Arkansas River. Specifically, anglers noted smaller sizes compared to previous years, and a large increase in the hours of effort needed to catch a 5-lb bass. This concern arose again in the late 2000s, this time in light of the abnormally high flows the Arkansas River experienced during 2007-2009. However, AGFC had little fisheries data collected from the Arkansas River, especially downstream of Lake Dardanelle.

In response to this concern, fisheries scientists at UAPB, in conjunction with AGFC biologists, conducted extensive stock assessments of largemouth bass populations throughout the Arkansas portion of the Arkansas River at different intervals during 2004-2010. In addition, a series of 12-month creel surveys was done in conjunction with tag-reward studies in several Arkansas River pools during 2007-2010. Following extensive data collection and analysis, computer simulation modeling was conducted that compared the likely effectiveness of the [then] current 15-inch minimum-length (MLL) regulation for largemouth bass against several alternative regulations, including one (10 inches) that simulated no length limit.

One major finding of this research was the significant decrease in fish growth and size between 2004-2005 and 2010. Growth models indicated that bass were taking 4.3 years on average to attain 15 inches (i.e., legal MLL) compared to 3.3 years in 2004-2005. Consecutive years of extreme hydrologic conditions occurring in the Arkansas River during 2007-2009 were suspected to have been largely responsible for the observed decreases in growth, size at age, and perhaps abundance (as "catch per unit effort" or CPUE) of largemouth bass by 2010. Statistical analyses further indicated that hydrology may have affected bass in that younger (hence, smaller) cohorts incurred a "growth deficit" early in life, which may have been problematic for the population over the long-term given that cohort growth potential decreases with age. As a result, several age classes of Arkansas River bass were significantly smaller than average due to consecutive years of below-average growth. This idea was consistent with angler perceptions at the time. However, in examining the Arkansas River's 40-year hydrologic history, the river actually experiences these periodic consecutive years of high water about once per decade. So, if the above suggestion (hypothesis) is correct, Arkansas River bass may have experienced these periodic growth depressions several times before. It may actually be typical for the fishery.

Further simulation modeling suggested that the largemouth bass fishery might be able to sustain itself with a smaller MLL regulation. At the relatively low levels of fishing mortality present in the Arkansas River fishery (about 12%), fishery yield would be improved only with a lower or no MLL. Conversely, the [then] current 15-inch MLL and larger 17-inch MLL had better potential to improve average bass size and population size structure. The 15-inch MLL regulation appeared to be an appropriate management strategy for the Arkansas River largemouth bass fishery, providing the best overall balance among fishery yield, mean size

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Upcoming Events

Seafood Expo North America
March 15-17
Boston, Massachusetts
Formerly known as the International Boston Seafood Show/Seafood Processing America, Seafood Expo North America/Seafood Processing North America is the largest seafood trade event in North America. The event attracts over 20,000 buyers and suppliers of fresh, frozen, packaged and value-added seafood products, equipment and services. Attendees travel from more than 100 countries to do business at the exposition. For more information visit http://www.seafoodexpo.com/north-america/

Aquatic Weed & Irrigation Ditch Management In-Service Training
May 21
UAPB Aquaculture Research Station
For more information contact: seldeng@uapb.edu

World Aquaculture
May 26-30, 2015
Jeju Island, Korea
www.was.org

American Fisheries Society
August 26-20
Portland, Oregon
145th Annual Meeting
www.fisheries.org

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of harvested fish, and population size structure. However, a 14-inch MLL would accommodate competitive tournament anglers, who are only interested in weighing in more bass by catching more 5-fish limits, as opposed to harvest. It would also allow “meat” fishermen to harvest a few more bass. All of this should be possible without negatively impacting the fishery, according to modeling results. As a result of these findings, AGFC approved a regulation change for the minimum-length limit on largemouth bass in the Arkansas River. Effective January 1, 2013, the new legal minimum length regulation on largemouth was reduced from 15 to 14 inches.

In 2012, UAPB conducted a formal evaluation to assess the degree and nature of “impacts” that this study may have had on the AGFC, which is the university’s primary fisheries stakeholder. A single 20-question survey was conducted of 16 AGFC fisheries administrators and biologists with management responsibilities that included black bass and/or the Arkansas River. Survey questions used a scaled response scheme, with answers ranging from 1 (completely disagree) to 3 (neutral – neither agree nor disagree) to 5 (completely agree). The survey was initially reviewed by a program evaluation specialist for the UA Cooperative Extension Service (Dr. Karen Ballard), and administered and summarized by an independent third party (Dr. Roland Pippin, Louisiana College). The survey contained 14 questions that rated the overall value of the research to AGFC (termed “research-related” questions). The other six questions addressed broader factors beyond the research, such as the how the work had affected UAPB’s visibility, how the work had enhanced the relationship between UAPB and AGFC, and rating the quality of the graduate students produced (termed “University/program-level” questions).

Of the 16 AGFC biologists surveyed, 13 (81%) responded. Overall, survey responses towards the research, the fisheries program, and UAPB were very positive. The mean scaled response across all 20 questions was 4.11 (range 3.54-4.46), which exceeded “agree” on the response scale. Individual scaled responses on research-related questions that rated the overall quality and utility of the work averaged 4.05 (range 3.54-4.46). Individual scores on university/program-level questions also were very good, averaging 4.26 and exceeding 4.0 on all questions (range 4.08-4.38). As for specific questions, a mean scaled response of 4.23 was received on a question concerning how much this work influenced AGFC’s decision to reduce the largemouth bass MLL regulation from 15 to 14 inches in 2013. Other questions regarding: 1) how well the work had been communicated to AGFC, and 2) how much understanding of the fishery’s dynamics had increased scored 4.38 and 4.46, respectively. Slightly lower mean responses on three questions (range 3.62-3.85) were expected as those topics had not been emphasized in the research as much as other items, or were only recently highlighted in the later years of the study.

University/program-level questions concerning 1) the quality of graduate students being produced, 2) the increased visibility that fisheries research had given the department and University, and 3) the enhanced relationship between UAPB and AGFC scored 4.31, 4.23, and 4.23, respectively. Clearly, the results of this work were positive, contained a variety of impacts, and were utilized by AGFC to solve a basic management issue for one of the state’s most important and popular recreational fisheries. This conclusion is further evidenced by the number of hires of UAPB graduates made by AGFC over the last decade. In 2001, AGFC employed exactly one UAPB graduate, whereas they now employ nine B.Sc. and M.Sc. graduates (not including two others that have moved on to other opportunities).

Dangerous Fish Hitchhikers

Luke Roy, Extension Aquaculture Specialist, UAPB and Scott Jones, Extension Fisheries Specialist, UAPB

Arkansas has an abundance of farms and suppliers available to meet the needs of landowners that make use of recreational ponds and lakes for fishing. Stocking forage fish is a common practice to increase the growth of popular sportfish in ponds. Each forage species has advantages and disadvantages to a pond management plan.

For example, owners wanting to grow trophy largemouth bass sometimes stock gizzard shad because of their prolific reproduction and large adult size. The nearly identical-looking threadfin shad is also a popular option that is better suited for general pond stocking because it does not get as large as gizzard shad and threadfin shad often die off during Arkansas winters which prevents their overpopulation. In the past, some recreational pond owners have purchased shad from other states in the Southeastern U.S. as there are few sources of shad in Arkansas.

A small number of shad suppliers will obtain shad harvested from commercial catfish ponds and then sell them to recreational pond owners. Catfish farmers will often stock shad to help control algae blooms and improve water quality in their ponds since shad are pelagic filter feeders that eat plankton, algae and suspended organic material. Shad can also serve as a source of forage for catfish during the winter months. Shad can represent a significant source of unwanted bycatch when catfish are harvested. For this reason, some farmers will allow shad to be harvested, particularly in ponds where they are known to be in high numbers.

In the past, this harvest method was not an issue for Arkansas recreational pond owners. However, since 2009 there has been a virulent strain of Aeromonas hydrophila that has been causing massive fish kills on commercial catfish farms in several southeastern catfish producing states. Most catfish farms in west Alabama, and some in Mississippi and Arkansas, have been exposed. Aeromonas hydrophila is a bacteria commonly found on many species of fish and in water. It can be present without causing obvious signs of disease. Typical strains of Aeromonas hydrophila do not usually cause problems unless the fish is stressed by poor water quality, injury or other infections. However, the virulent Aeromonas appears to cause disease in otherwise healthy fish. Fortunately, the virulent Aeromonas has been confined to only a handful of farms in Arkansas and has not yet become widespread. This disease can be spread by infected fish, fish-eating waterfowl (such as Great Egrets), harvest and hauling equipment (boats, nets, seines, fish hauling tanks), and by water that has been in contact with infected fish.

Gizzard shad (*Dorosoma cepedianum*)

Threadfin shad (*Dorosoma petenense*)

Channel catfish infected with virulent *Aeromonas hydrophila*

The virulent Aeromonas is capable of infecting and killing not just catfish, but also forage fish such as green sunfish, gizzard shad, and fathead minnows grown in commercial ponds. Because of this, stocking shad or any other species of fish harvested from commercial catfish farms exposed to the virulent Aeromonas is potentially dangerous for the fish already in the pond, and could facilitate the spread of a dangerous fish pathogen to the rest of Arkansas. Pond owners purchasing shad should inquire whether the shad were harvested from commercial catfish ponds and whether the source farm has been exposed to the virulent Aeromonas. If this is the case, it would be wise to explore other options, preferably from a source that does not obtain shad directly from commercial catfish ponds in states that are experiencing outbreaks of this disease.

Dr. Herbert Quintero Joins UAPB Aquaculture/ Fisheries Center

Dr. Herbert Quintero has joined the Aquaculture/Fisheries Center of Excellence at the University of Arkansas at Pine Bluff (UAPB) as the new manager of the Aquaculture Research Station. Dr. Quintero received a Bachelor of Science in Marine Biology from Jorge Tadeo Lozano University and a Specialist in Business Administration from the University of Cartagena in Colombia. Before furthering his graduate education, Dr. Quintero served as the biologist and manager of a large shrimp farm in Colombia for eight years. He then pursued a Master of Science in Marine Science at the University of Puerto Rico where he studied reproduction in pacu and tilapia. Dr. Quintero then enrolled in the Fisheries and Aquaculture program at Auburn University where he received a Ph.D. with research focused on hybrid catfish broodstock nutrition.

Since completing his graduate education, Dr. Quintero has served as a Visitor Exchange Scholar at the Claude Peteet Mariculture Center in Gulf Shores, Alabama where he conducted research on Florida Pompano and Pacific white shrimp. He then received an Aquaculture Fellowship from the U.S. Soybean Export Council and was tasked with organizing commercial feed demonstrations in Latin America and Asia with Pacific white shrimp. Most recently, he has served as a Research Associate at the University of British Colombia (Vancouver, Canada) and as an aquaculture consultant for the U.S. Soybean Export Council organizing commercial feed demonstrations in Mexico, Ecuador, Venezuela, Colombia, and Costa Rica using Pacific white shrimp, cobia, red snapper, paiche, tilapia, and rainbow trout. Dr. Quintero has worked in the aquaculture industry for 24 years and brings to UAPB a wealth of knowledge on different production systems and culture techniques with both freshwater and marine commercial aquaculture species.

Time to Re-test Your Hatchery Well?

Nathan Stone, Extension Aquaculture Specialist, UAPB and Luke Roy, Extension Aquaculture Specialist, UAPB

Groundwater quality can change over time. Groundwater quality data from the Arkansas Department of Environmental Quality (ADEQ) for wells in Lonoke that were tested in both 2001 and 2010 are shown in Table 1 on page 5. The table is a partial list of the parameters that were tested by ADEQ. In some cases, well waters were relatively unchanged over time, while others exhibited significant differences. For example, in well LON040, total alkalinity decreased from 282 mg/L to 221 mg/L. Without re-testing, it's difficult to know what if any changes might have occurred in a hatchery water source, given the variability seen among wells.

There are some general trends seen across the tested wells. The pH decreased in most cases, likely a result of increased carbon dioxide. Similarly, the iron (Fe) concentration increased in most wells. This can place a greater burden on iron-removal aeration and filtration systems.

Small changes are likely not important in most cases. Minor differences are to be expected as part of normal variability in water quality, or as a result of slight differences in sample handling or storage, or changes in testing methods.

For information on water testing and associated fees, contact your University of Arkansas Cooperative Extension Service office. Southern Regional Aquaculture Center fact sheet SRAC4606 provides information on interpretation of water analysis reports for fish culture. The fact sheet can be obtained on-line at https://srac.tamu.edu/ or from your Extension office.

References:

ADEQ (Arkansas Department of Environmental Quality). 2004. 2004 integrated water quality monitoring and assessment report. Water Division, ADEQ, Little Rock, Arkansas.

ADEQ (Arkansas Department of Environmental Quality). 2012. 2012 integrated water quality monitoring and assessment report (draft). Water Division, ADEQ, Little Rock, Arkansas.

Table 1. Groundwater quality in selected wells tested in June or July of 2001 and 2010 (ADEQ 2004, ADEQ 2012). Eight of the wells are in the alluvial aquifer; this information is missing for two wells (LON 41 and LON42). TAN is total ammonia nitrogen (NH_3-N), Ca is calcium, and Fe is total iron.

Well	Year	pH	Alkalinity (mg/L)	TAN (mg/L)	Ca (mg/L)	Fe (mg/L)
LON003A	2001	6.66	61	0.043	12.3	4.37
	2010	6.21	54	0.056	12.2	5.33
LON009A	2001	6.87	87.5	0.058	24.34	2.20
	2010	6.14	86	0.032	26.4	2.35
LON010	2001	6.72	113.5	0.083	29	4.93
	2010	6.06	109	0.115	34.5	6.43
LON017	2001	6.81	258.5	0.194	86.2	3.62
	2010	6.77	222	0.101	72.3	3.22
LON017R	2001	6.86	237.5	0.07	73.1	2.81
	2010	5.55	234	0.239	87.6	4.45
LON021	2001	7.58	299.5	0.364	107.6	7.45
	2010	6.05	291	0.394	110	10.40
LON024	2001	6.91	294.5	0.419	88.7	2.14
	2010	7.04	262	0.405	82.2	2.49
LON040	2001	7.18	282	0.992	95.38	24.00
	2010	6.39	221	0.894	78.4	25.70
LON041	2001	7.16	224	0.859	66.66	28.40
	2010	6.47	211	0.800	77.6	30.00
LON042	2001	7.52	398	0.315	174.1	12.50
	2010	6.15	282	0.43	109	10.60

Catfish-Only Stocking Rates for Fertilized Farm Ponds: What do Snakes, Snappers, and Other Predators Leave Behind?

C. Bauer Duke, Extension Aquaculture Specialist, UAPB; Kayla McCoy, Research Associate, UAPB; Nathan Stone, Extension Aquaculture Specialist, UAPB; and Sindhu Kaimal, Graduate Student, UAPB

Small farm ponds less than 0.5-acre in area are best suited to the culture of only one type of fish, such as channel catfish. The current recommended stocking rate for catfish in fertilized ponds is 200 fingerlings per acre. Small fingerlings are vulnerable to an assortment of predators, extra fish should be stocked to compensate for anticipated losses, but stocking at high rates could slow growth. This study was conducted to examine the variability in catfish fingerling survival and growth when stocked at five rates in small ponds. On March 17, 2014, small channel catfish fingerlings (average length of 2 to 3 inches or 6.6 lb per 1,000 fish) were stocked at rates of 100, 200, 300, 400, or 500 fish/acre into 0.25-acre ponds (6 replicates per treatment) at the Aquaculture Research Station, UAPB. Individual ponds were fertilized when the Secchi disk visibility exceeded 24 inches, except when submersed weeds became established. The ponds were totally harvested after 236-241 days (Nov 7-12). While remaining fish were relatively big, survival averaged only 19.7% across all stocking densities. Surprisingly, survival was not better in ponds where more fish were stocked. Results of this study suggest that stocking small catfish fingerlings into farm ponds may result in poor survival even when no predatory fish are present. A follow-up study will look at the survival of larger catfish fingerlings in ponds.

Survival and average weight of catfish stocked as small fingerlings at five densities in fertilized ponds for 134-135 days.

Stocking density (fish/acre)	Survival (%) Mean (range)	Average weight (lb) Mean (range)
100	20 (0 – 32)	0.9 (0 - 1.2)
200	8 (0 – 28)	0.8 (0 - 1.3)
300	25 (0 – 46)	0.7 (0 - 1.3)
400	19 (4 – 49)	0.7 (0.5 - 1.0)
500	25 (11 – 38)	0.7 (0 - 0.9)

Aquatic Weed Control in Split-Ponds

George Selden, Extension Aquaculture Specialist, UAPB

The 2014 catfish growing season saw increased use of the "split-pond" system for growing catfish. If the split-pond production system is unfamiliar, it can be roughly described as two ponds linked together to allow water to be exchanged between the ponds. In this production system, the fish are confined to a small pond, allowing easier and more efficient feeding, harvesting and aeration. The larger pond is not stocked with fish and functions as an algal growth basin that provides oxygen production and waste treatment. Slow turning paddle wheels are used during the day to move water from one pond to the other. During low oxygen events, water circulation is stopped and only the smaller fish containing area is aerated.

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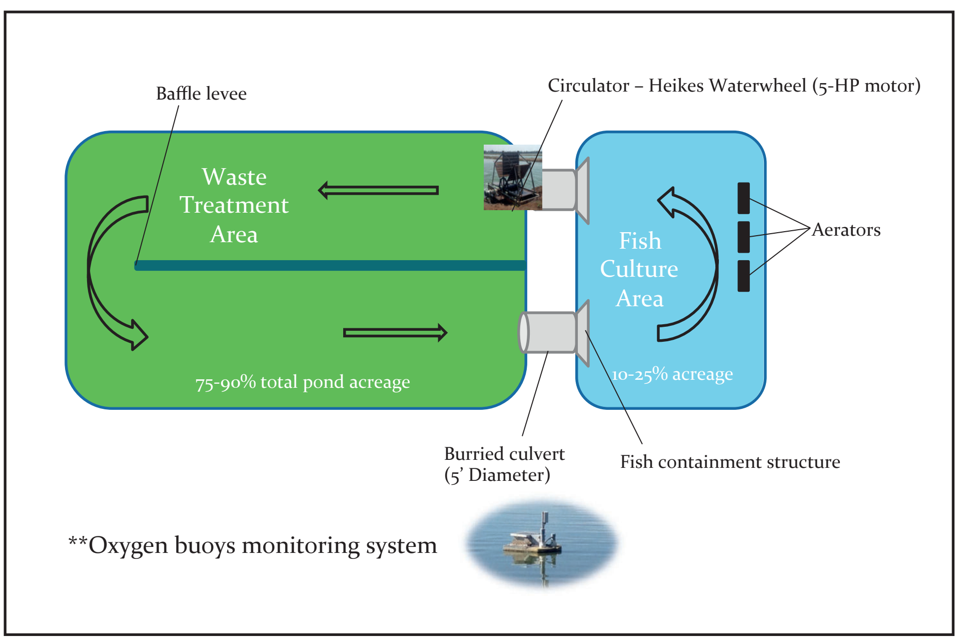

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During the summer of 2014, several farmers reported problems with excessive growth of rooted aquatic plants in the larger "treatment" portion of their split-pond systems. Excessive plant material can impede water flow, which can negatively impact water "treatment" and algal oxygen production.

Any pond with high nutrient levels has the potential to foster excessive growth of aquatic plants. This is a problem that the Arkansas baitfish industry contends with on an annual basis in fry ponds. A common culture practice when raising baitfish is to fill a drained pond, add fertilizer to stimulate a phytoplankton bloom that fish fry can feed upon, and then add fry. After adding the fertilizer, there is a "race" between the establishment of the phytoplankton bloom, which will limit light penetration to the pond bottom, and the seeds and tubers buried in the bottom sediments sprouting, growing, and reaching the top of the water column. If the rooted plants become dominant, a phytoplankton bloom does not become established, the fry have nothing to feed upon and the pond is invariably choked with vegetation.

Traditional catfish ponds typically do not have problems with rooted aquatic weeds. This is possibly due to the action of catfish "rooting" around the bottom of the ponds while looking for food. In addition, production ponds are typically not drained until they are rebuilt, leaving them in production for many years. In split-pond culture, there is a large pond area with no fish. Also, many of the ponds with problems were filled in the spring, mimicking the previously described baitfish pond situation, with competition between phytoplankton and rooted plants.

The treatment options for aquatic plant problems fall into four categories: physical, mechanical, biological and chemical. Physical involves restricting plant growth by physically altering growth conditions. It is impractical to cover the pond bottom and nutrient removal is also not an option. Blocking sunlight penetration through the use of dyes can help, but if the plants are within two feet or so, their effectiveness is decreased. If the ponds are deeper than three feet, adding a dye at filling may limit light penetration enough to restrict plant growth.

Mechanical control involves removal of the offending plants. While there are machines commercially available, which cut aquatic vegetation, they are very expensive to own and/or operate. Smaller patches could potentially be harvested by hand or by using a seine, but this involves a great deal of effort. The potential use of mechanical control techniques is doubtful, and might not be the best use of a farm's resources in a split-pond system.

Biological control involves the use of typically an animal that eats the plants, such as grass carp. Arkansas catfish farmers have a long history of using grass carp in production ponds for vegetation control and as a supplemental crop. Grass carp have specific preferences in the aquatic plants they will consume, which might or might not be the problem plants. They also would likely not survive the low oxygen conditions that occur in the treatment portion of the split-pond system. Biological control agents are of questionable utility in a split-pond system.

The final, and most practical method, is chemical control or herbicides. These have been safely used for many years and are most effective when used early on actively growing plants.

If it was possible to recommend a particular herbicide or combination of herbicides to use, I would. Unfortunately, herbicides can be very selective on the plants they will control, so the key to using herbicides is correct identification of the problem plant. Once the plant has been identified, an herbicide or combination of herbicides can be selected. The Aquatic Weed section of the Cooperative Extension publication MP44 *Recommended Chemicals for Weed and Brush Control* (www.uaex.edu/publications/pdf/mp44/mp44.pdf) can be consulted for herbicide response ratings and other useful information. UAPB Aquaculture/Fisheries Extension specialists can provide assistance in plant identification and treatment recommendations.

It cannot be stressed too greatly that early detection is very important to controlling aquatic weeds. The best time to treat a plant problem is when it is a small problem. Small patches can be treated much more effectively and cheaply than large areas. Pond monitoring for water clarity and plant growth is highly recommended. If a particular plant or plants have grown in the past, it is likely they will show up in the future. This can allow for purchasing herbicides prior to the growing season to have them on hand. Start formulating a weed control plan in the winter to be ready for the growing season.

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UAPB's Dr. Carole Engle Receives Award

Dr. Carole R. Engle, director of the Aquaculture/Fisheries Center of Excellence at the University of Arkansas at Pine Bluff (UAPB), recently received the Distinguished Service Award from the Catfish Farmers of Arkansas (CFAR). The ceremony was held at the organization's annual convention in Hot Springs, Ark.

Under Dr. Engle's leadership, the UAPB Aquaculture/Fisheries Center provides industry support on a state and nationwide basis by providing research-based guidance in many areas that include new production technologies and pond and hatchery management strategies and their economic trade-offs; marketing strategies and changing consumer preferences; fish disease diagnosis, treatment, and management; nutrition and feeding strategies and equipment development.

Dr. Engle's primary research focus has been the production economics and marketing of catfish and the optimal management of catfish farms. She has also provided research-based economics information on a number of policy issues that include food safety and inspection, invasive species, federal assistance programs, risk management programs and effluent guidelines. She has published four books, 107 refereed journal articles, and more than 120 book chapters, monographs, proceedings and Extension publications.

The CFAR is comprised of catfish producers, suppliers, industry-related businesses and research and Extension personnel based in Arkansas.

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Arkansas Aquafarming is published quarterly. Web address: www.uaex.edu/aqfi/newsletters
The purpose is to advance aquaculture production in Arkansas by providing reliable, practical, timely information.