Arkansas AQUAFARMING
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UAPB University of Arkansas at Pine Bluff
School of Agriculture, Fisheries and Human Sciences
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Catfish Production using Intensive Aeration

Matthew "Rex" Recsetar, Extension Aquaculture Specialist, UAPB, and Travis W. Brown, Research Fisheries Biologist, USDA-ARS Stoneville, MS

Catfish farmers in Arkansas and Mississippi have been able to produce much higher yields by increasing the aeration rates in their ponds. As of 2010, the average aeration rate within the industry was about 2.5 hp/acre. This roughly equates to a farmer having either two or three 10-hp paddlewheel aerators in a 10-acre pond. In this situation, a pond has a certain production capacity that is limited by the dissolved oxygen in the pond and likely will not produce more than 6,000 lb/acre. A substantial portion of the aeration being deployed at night supplies dissolved oxygen for respiration of both algae and bacteria in the pond, not just the fish. By adding additional paddlewheel aerators to a pond, a farmer is able to provide adequate dissolved oxygen to the entire pond thus relieving the stress of low oxygen on the fish. When dissolved oxygen is not the limiting factor as it has been in the past, yields are free to increase dramatically. Studies at the National Warmwater Aquaculture Center (NWAC) in Stoneville, Mississippi have shown that yields were higher if the dissolved oxygen remained above 3ppm. In some cases it may be even more efficient to utilize smaller ponds around 4-6 acres which can be more easily aerated. Utilizing intensive aeration in smaller ponds also allows for a farmer to have a more manageable standing crop at the end of the season and help mitigate some of the risk. Although it is recommended intensively aerated ponds be stocked with hybrid catfish, there has been success with channels and yields have been shown to increase as aeration increases even before a pond gets to what we would consider intensive aeration levels (6 hp/acre).

For the last three years, researchers at UAPB and NWAC have been monitoring and verifying production yields in intensively aerated catfish ponds with aeration rates greater than 6 hp/acre. We now have three years of data on commercial catfish production in intensively aerated ponds. With stocking densities ranging from 7,500 to 13,000 head per acre, we have seen yields as high as 18,000 lb per acre with an average of about 13,000 lb per acre in Arkansas and 16,000 lb per acre in Mississippi with average aeration rates of about 8 hp/acre. For ponds averaging 4.4 acres in Arkansas, optimal stocking density was found to be around 8,500 head per acre. Also in Arkansas it was found that reworking these small ponds every other year and stockpiling fish while ponds were being dried out and reworked seemed to help increase feeding and growth. Although we observed elevated ammonia levels in all intensive aeration

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Upcoming Events

AFS Fish Health Section Meeting
July 27-30
Ithaca, New York
The annual meeting of the American Fisheries Society, Fish Health Section. For more information visit https://drive.google.com/file/d/0B3Bl5ZrEteAxTG82dmgyTjJaQ0k/view?pli=1

145th Annual Meeting of the American Fisheries Society
August 16-20
Portland, Oregon
The annual meeting of the American Fisheries Society with current research presented. For more information visit http://fisheries.org/annual-meeting-overview

69th Annual Shellfish Conference and Tradeshow
Sept. 22-24
Hood River, Oregon
The annual Pacific Shellfish Growers conference and tradeshow. For more information visit http://pcsga.org/annual-conferences/

2015 Annual Meeting of North American Sturgeon and Paddlefish Society
October 19-22
Oshkosh, Wisconsin – Oshkosh Convention Center
The North American Sturgeon and Paddlefish Society (NASPS) stand-alone meeting for the society will provide a great venue for sturgeon researchers and managers to get together and discuss new and emerging research geared toward sturgeon and paddlefish restoration and sustainable management. For more information visit http://www.nasps-sturgeon.org/conferences/north-american-conference-announcements.aspx

6th International Oyster Symposium
October 21-23
Cape Cod, Massachusetts
The biennial Symposium is being organized and promoted by leaders from the World Oyster Society, Woods Hole Oceanographic Institution; Marine Biological Laboratory; National Oceanic and Atmospheric Administration; East Coast Shellfish Growers Association, Pacific Coast Shellfish Growers Association, Massachusetts Aquaculture Association, The Nature Conservancy; Green Harbors Project – UMASS Boston; Cape Cod Cooperative Extension; RDS Partners, AU; Mangez-Moi Oysters, UK; East Dennis Oysters, Waquoit Bay Reserve, Coggs Island Oysters, CN and a growing list of local, national and international enterprises. For more information visit http://oyster-symposium.org/

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ponds, it seemed to have no effect on growth, feed conversion or survival. The average feed conversion ratio (FCR) over three years of production with hybrid catfish was 2.03, while the survival was 88.3 percent for the Arkansas ponds. The production performance in Mississippi was similar with an average FCR of 2.15 and 89.6 percent survival, although, data is still being collected from farms in both states.

While the cost of additional aerators, electricity and feed may deter some farmers, all on-farm studies thus far have verified that yields have doubled that of the same size ponds with traditional aeration rates. Intensive aeration of catfish ponds may be an economically feasible solution (although thorough economic analysis is needed) and a potentially good option for farms looking to increase production without needing additional land. Furthermore, decreasing the size of ponds and adding aeration allows for better management, potentially better bird control and easier harvesting. If oxygen is continually low in your ponds and you are not getting the yields you desire, adding even just one aerator may be a smart management decision, especially if you have unused aerators lying around.

Using Kaolin Clay to Combat Columnaris Disease

Benjamin H. Beck, Lead Scientist/Physiologist, and Carl Webster, Center Director, USDA-ARS Harry K. Dupree Stuttgart National Aquaculture Research Center

Bacterial diseases continue to plague the U.S. farmed fish industry. There is a desperate need for new preventatives and therapies that can help producers minimize costly disease-related losses. Recently, scientists at the Harry K. Dupree Stuttgart National Aquaculture Research Center (HKDSNARC) in Stuttgart, Arkansas evaluated a type of clay, called kaolin, for disease control.

Kaolin has a long and storied history of use in human and veterinary medicine, namely for the treatment of gastrointestinal issues. For various cultural and medicinal reasons, the consumption of kaolin is popular in many areas, especially in the southeastern states of the U.S. Kaolin is mined in many places in the world, with large deposits found across the southeastern U.S., particularly in Georgia and parts of Alabama. Kaolin is white in color, and is composed of aluminum and silicate groups, which can act as a scaffolding that bind other substances and particles. One of the things that can be bound to kaolin is bacteria. Since kaolin can bind bacteria, investigators at HKDSNARC examined whether kaolin could be used as a preventative treatment for the bacterial pathogen *Flavobacterium columnare*, the causative agent of columnaris disease; a deadly disease of numerous freshwater cultured fish.

Channel catfish fingerlings were stocked into individual aquaria containing 1 gram of kaolin per liter of well water. After a brief period, a dose of columnaris bacteria known to reliably infect fish was then added to each tank. Following the experimental infection, the fish were closely monitored for the next seven days and any dead fish were counted and promptly removed. Investigators found that kaolin-treated fish showed superior survival (96 percent) as compared to untreated fish (78 percent survival). By using a sophisticated molecular method to count columnaris bacteria, researchers found that kaolin-treated fish had nearly 99 percent fewer disease-causing bacteria attached to the gill, one of the key target tissues of columnaris bacteria. When examined microscopically, the gills of kaolin-treated fish appeared healthy while untreated fish showed obvious signs of damage. Kaolin also minimized damage to the fins of infected fish (Figure 1).

To better understand how kaolin protects fish from bacteria, kaolin was

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mixed in well water at different rates and briefly incubated with a known amount of columnaris bacteria. After incubation, the samples were gently spun in an instrument called a centrifuge, and the upper portion of the water column was measured for columnaris. These studies revealed that kaolin was capable of binding to, and removing, columnaris bacteria from the water column in a dose-dependent manner (Figure 2). Collectively, these findings suggest that kaolin can rapidly bind columnaris and block the essential first step of the disease process, which is the attachment of bacteria to catfish tissues. The research team has since repeated these studies in hybrid striped bass fingerlings and found similar promising results.

Studies are currently underway to test kaolin in industry settings. Kaolin may be best suited for application during conditions where columnaris disease is more likely to occur, such as after hauling or grading. Many questions remain, particularly whether kaolin is capable of both binding to and killing bacteria. Further, kaolin induces a milky white turbidity when applied to water. Thus, flow-through systems, such as vats or raceways, may be more appropriate for kaolin treatments by allowing kaolin/bacterial complexes to be flushed out of the culture systems. At this point, kaolin application to earthen ponds is not recommended until the effects of kaolin-induced turbidity on pond parameters are better characterized. Further, at this time, the cost of treating with kaolin are not known, although it is imagined that they should be less expensive than chemical treatments. The research team at HKDSNARC is also exploring kaolin-based approaches for the treatment of Edwardsiella ictaluri, which causes ESC, and the highly-virulent Aeromonas hydrophila. Both bacteria are responsible for large-scale fish kills in the catfish industry.

Figure 1. Kaolin treatment reduced the severity of fin lesions in columnaris-infected catfish. Kaolin-treated fish (left) and untreated fish (right).

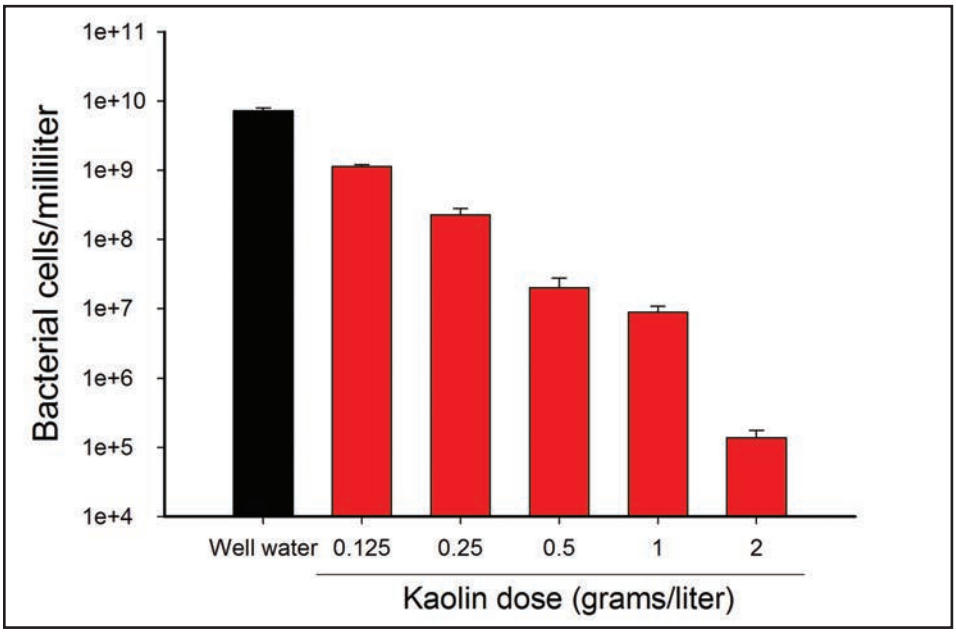

Figure 2. Kaolin binds to *Flavobacterium columnare* in the water column which prevents it from attaching to channel catfish tissues.

Two Join UAPB's Aquaculture/Fisheies Center

Dr. Suja Aarattuthodiyil has been appointed assistant professor of fish pathology. In this position she will provide Extension diagnostic and research support for Arkansas aquaculture. She will oversee UAPB's four-lab diagnostic system in the state and will conduct fish inspections necessary for industry certification. She will also work to develop an Extension educational program focused on fish health and biosecurity.

Prior to this position, Dr. Aarattuthodiyil managed a diagnostic and water quality laboratory for Cargill Foods India. There, she served shrimp and fish farmers' diagnostic needs and traveled to over 30 farms in the West Godavari district of Andhra Pradesh, India. She also implemented shrimp biosecurity plans for demonstration farms and worked as a microbiology laboratory technician at a processing plant for Sandhya Marines Ltd., one of India's largest exporters of cultured shrimp.

Dr. Aarattuthodiyil has a doctorate degree in biochemistry and molecular biology from the University of Arkansas for Medical Sciences, a master's degree in aquaculture and fisheries from UAPB and a master's degree in pathology and microbiology from the Central Institute of Fisheries Education in Mumbai, India.

Dr. Nilima Renukdas is the new lab manager for the UAPB Fish Disease Diagnostic Laboratory. Dr. Renukdas will provide Extension diagnostic and research support for Arkansas aquaculture.

Prior to this position, Dr. Renukdas worked as a post-doc for Dr. Jeongwang Park of UAPB's Aquaculture/Fisheries Center, conducting studies with hybrid catfish, baitfish and largemouth bass. She gained experience in fish health by volunteering at the UAPB diagnostic laboratory during inspections for farmers participating in the Arkansas Baitfish Certification program.

Dr. Renukdas has a doctorate in biotechnology, a master's degree in botany, and a bachelor's degree in Botany and Bio-Medical Techniques, all from the University of Prune in India.

Fishing a Pond to Evaluate Population Balance

Scott Jones, Extension Fisheries Specialist , UAPB

The term "balance" is used often in pond management discussions but it is not always well explained, much less understood. The foremost pond researcher from the 1940s and 1950s, Homer S. Swingle, first defined balance: "fish populations are satisfactory if the populations yield, year after year, crops of harvestable fish that are satisfactory in amount when the basic fertilities of the bodies of water containing these populations are considered." Basically, a pond is in balance when the fish populations can reproduce and maintain roughly the same amount of harvestable fish each year. Not all ponds are alike. Some ponds can naturally produce several hundred pounds of harvestable fish per acre each year, while other ponds need regular liming, fertilization and/or feeding programs to produce as much.

Most ponds in Arkansas are stocked with bluegill and largemouth bass. Balanced ponds usually fish well enough that anglers can easily catch various sizes of both bluegill and largemouth bass from spring to late fall. Unbalanced ponds are often disappointing for the casual angler due to low catch rates or the small size of fish being caught. One of the leading causes of unbalanced ponds in Arkansas is a lack of regular fish harvest. These unbalanced ponds can sometimes be returned to a balanced condition through corrective harvest and/or stocking programs. However, one should first determine the condition of the fish populations before developing management plans.

The best way to determine fish population balance in a pond is combining fishing records with shoreline seining. Fishing for various sizes of both bluegill and largemouth bass will determine how the adults of these populations are doing. Seining is used to evaluate fish reproduction. Performing one without the other can sometimes provide enough information about the population, but the picture is much clearer when both methods are used simultaneously.

Fishing

Fish population assessments are more accurate from mid spring to late fall, when Arkansas fish are more active. For catching bluegill, a live night crawler worm on a #6 to #2 aberdeen hook under a cork floater is hard to beat. Bluegill typically congregate around the shoreline, near vegetation, bushes and logs. Simply cast out a few feet from shore, making sure that the hook stays off the pond bottom by adjusting the depth of the cork, and wait for the cork to go completely under the water surface before setting the hook. For catching largemouth bass, a small white spinnerbait is a good way to start. Live minnows or shiners below a cork floater work very well too. Largemouth bass prefer hiding near vegetation, logs, stumps and around windy points. If the pond has so much cover or vegetation that your lures are getting snagged or fouled often, a Texas-rigged soft plastic jerkbait or curly-tailed worm can be used to drag along the bottom and through thick cover without getting snagged.

For each fish caught, measure their total length (if you have a digital scale you can measure their weight too) and record those measurements in a fishing log. Also make note of the overall condition of the fish (plump and healthy looking or skinny and sickly), how long you were fishing, how many fish were caught, how many other species were caught, etc. Detailed records help produce accurate assessments.

Seining

Seining is a great way to sample fish reproduction in ponds. Largemouth bass and bluegill will have spawned by the time water temperatures reach about 70º F, which

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Population Status	Seine Data	Angler Catch Data
Balanced population	Many recently hatched bluegill (< 2 inches) Some intermediate sized bluegill (2 to 4 inches) Some recently hatched largemouth (1 to 4 inches)	Largemouth and bluegill of various sizes
Bluegill crowded	No or very few recently hatched bluegill Many intermediate sized bluegill No recently hatched largemouth	Largemouth average size is large (> 15 inches) but catch rates are low; few large bluegill (> 6 inches)
Largemouth crowded	Many recently hatched bluegill No or very few intermediate sized bluegill No or very few recently hatched largemouth	Largemouth average size is small and thin (< 12 inches) but catch rates are high; bluegill few but large (> 8 inches)

Fish population status based on seine and angler catch of largemouth bass and bluegill.

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should occur sometime in May or June in Arkansas ponds. Fish will spawn in 1 to 3 feet of water on firm pond bottoms. This is where to focus seining efforts. A 20 foot long, 4 to 5 feet deep, 3/8 inch mesh seine is acceptable and can be purchased at sporting goods stores fairly cheap. Make three to five semi-circular passes in shallow areas of the pond. Be sure to allow an arch in the seine while dragging it through the water so fish cannot easily swim around it. At the end of each haul, drag the seine onto shore, then record the number and sizes of each species caught.

Once fishing records and seining have been completed, use the table below to determine the condition of the fish populations.

If the results suggest that the pond is out of balance and the fishing is unsatisfactory, the next step is to develop a plan to return the pond to balance or to renovate the pond completely. University of Arkansas at Pine Bluff Aquaculture and Fisheries Center fisheries specialists can help interpret your results and develop a management plan (call (870) 575-8185). The Extension publication MP360: *Farm Pond Management for Recreational Fishing* contains recommendations for assessing fish populations, explanations of assessment results and tips for managing the fish populations. This publication can be obtained at county extension offices or online at: aqfi.uaex.edu/extension/farmponds/Pond_Management/default.htm.

Patience is required for some corrective management plans as it can take a few years and some serious labor to get badly neglected ponds back into shape. In some cases, the fishery you want to develop may simply be impractical in your pond. For example, ponds less than one acre in size are notoriously difficult to manage for more than one species. In these situations, channel catfish-only or hybrid sunfish-only fisheries may be more successful and enjoyable than trying to do a traditional bluegill and largemouth bass pond.

There are many ways to improve the fishing in a pond. However, it is best to understand the condition of the fish populations before developing new management plans. Fishing records and seining can help determine the fish population balance. This information, combined with the assistance of trained fisheries specialists, routine pond maintenance and regular fish harvest can take that old neglected pond out back to a quality fishing destination that your family and friends can enjoy for many years to come.

Much of the information in this article was summarized or derived from the forthcoming new edition of the MP360: Farm Pond Management for Recreational Fishing. Extension office.

Submitting Aquatic Plant Samples for Identification

George Selden, Extension Aquaculture Specialist, UAPB

The Arkansas summer of 2014 was much like previous summers in two ways. One, the weather was predictably unpredictable with storms, rain, cold fronts and high heat, sometimes seeming to occur on the same day. The second way was the annual explosion of aquatic plants in Arkansas ponds. While we have no influence on the first, the Extension personnel of the UAPB Aquaculture/ Fisheries Center can help with the second problem by providing advice on control options. Our recommendations will often focus on the use of herbicides, because usually when county agents or we receive a call, there is already a problem in need of immediate action.

Currently, there are 14 different chemical active ingredients registered for use in aquatic environments. Unfortunately, not every chemical is equally effective for control of every aquatic plant. This makes correct identification of the unknown plant essential to produce a recommendation that will control the problem plant, and result in the least amount of chemical used and money spent. Once identified, the Weed Response Rating chart in the MP44 can be consulted for the most appropriate herbicide options. (MP44 is available at your county extension office or can be downloaded at http://www.uaex.edu/publications/pdf/mp44/mp44.pdf)

So, what is the best way to submit a plant sample for identification? If your county Extension office is close by, simply grab a sample of the plant, place it in a bucket with water to prevent it from drying out, and drive to the office. Once there, the county agent might be able to ID the plant immediately, or will be able to consult internet resources or contact UAPB Aquaculture/Fisheries personnel for assistance.

It is possible to ID unknown plants using on-line resources. Two websites in particular can be helpful. One is Aquaplant hosted by Texas A&M Extension (http://aquaplant.tamu.edu/), and the other is the Center for Invasive and Aquatic Plants hosted by University of Florida Extension (http://plants.ifas.ufl.edu/). Both sites have pictures and descriptions that can help in plant identification, and in the case of Aquaplant, a short list of possible treatment options.

If transport to the county Extension office is not practical, contacting UAPB Aquaculture/Fisheries personnel is still a good option. While it is possible to sometimes ID a plant with a verbal description, often more information is needed. Under no circumstances should the plant be mailed to us. The ultimate result of a wet mass of plant material that has spent several days traveling through the mail system is a rotting ball of sludge once it arrives. This is very unpleasant to open and more importantly, useless for identification purposes. In addition, several days have been lost during which control methods could have been implemented.

Instead, a much better method involves the use of digital pictures, and either emailing or texting cell phone pictures. This method has proven effective and timely. One thing to remember is that not all pictures are equally useful. Observe the following two pictures; they are of the same plant. Picture 2 is useful for diagnostic purposes because you can determine leaf shape, stem arrangement and other details, while Picture 1 is unable to provide that

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Picture 1.

Picture 2.

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information. Picture 1 shows a mass of submersed vegetation, which helps narrow down the best controls options some, but not enough to determine the optimal management plan.

Taking a useful plant picture is not difficult, it just requires following a few steps and using a suitable background. Remove the plant from the water and place it on a white or light colored background. The plastic "chorplast" material used for signs is ideal for this. Take the time to spread the plant leaves and stems out so that you can differentiate the arrangement of the leaves (alternate or opposite), stem shape, size and shape of any flowers or fruiting bodies and the general morphology of the plant. At this point, start taking pictures as close as you can while still maintaining image clarity. Typically, this will be between 6-inchs to 2-feet away. Many cameras are equipped with a macro zoom feature which allows you to take better close ups. For larger plants, like cattails, a close up is not as essential. The goal is to capture as much of the plant as you can while still being able to make out essential features.

In summary, digital cameras, cell phone cameras, email, text messaging, and the internet can help correctly identifying an unknown aquatic plant much easier and faster. Using these tools will lead to a better served stakeholder and less money spent on postage.

Carole Engle and Nathan Stone Retire from UAPB

Anita Kelly, Extension Fish Health Specialist, UAPB

Dr. Carole Engle and Dr. Nathan Stone are retiring from UAPB after 27 years of service to the University and the aquaculture industry. Dr. Engle, who served as chair of the department and director of the Aquaculture/ Fisheries Center of Excellence, had a very successful tenure at the helm of one of the top aquaculture/fisheries departments in the U.S. "She has taken an unknown aquaculture program at a small university to a world class center of aquaculture excellence," Mike Freeze, owner of Keo Fish Farms and current president of the National Aquaculture Association, said.

During her tenure as chair and director, the UAPB Aquaculture/ Fisheries Center of Excellence developed the University of Arkansas at Pine Bluff's first research-based master of science program and its first doctorate program. She has taught 14 different graduate and undergraduate courses related to agricultural economics and aquaculture.

Dr. Engle's research focus is catfish production economics and farm management, catfish marketing, optimal management of catfish farms, aquaculture economics and marketing. Her economic-based research related to effluent guidelines, food safety and inspection services, invasive species, federal assistance programs, risk management programs and the cost of regulations on producers has been especially significant.

"Because of Dr. Engle's efforts, UAPB's Aquaculture Center has become 'the go to place' for numerous federal and state regulatory agencies whether they are dealing with disease outbreaks of Viral Hemorrhagic Septicemia (VHS) and Spring Viremia of Carp (SVC) or if they need economic data to justify their proposed actions," Ted McNulty, director of Aquaculture, Arkansas Department of Agriculture, said.

Dr. Engle serves on many advisory councils including the U.S. Secretary of Agriculture Advisory Committee, Monterey Bay Aquarium Science Advisory Board, U.S. Fish and Wildlife Service's Asian Carp Working Group, Steering Committee for the U.S. Department of Agriculture Catfish Forum and Technical Committee for the Southern Regional Aquaculture Center.

She currently serves as the editor or lead editor for the leading journal in aquaculture economics, the editor for the Journal of the World Aquaculture Society, associate editor for two other journals and as a reviewer for more than 20 different scientific journals and funding programs.

She is only one of two people to have twice received the Joseph McCraren Award from the National Aquaculture Association. She was the recipient of the Researcher of the Year Award from the Catfish Farmers of America, the Distinguished Service Award from the Catfish Farmers of America, Service Award from the from the Catfish Farmers of Arkansas, USDA Service Award for service on the Joint Subcommittee for Aquaculture Effluents Task Force, the Harvey McGeorge Award of Distinguished Contributions to Agriculture and the Distinguished Service Award from the United States Aquaculture Society, a chapter of the World Aquaculture Society.

Dr. Stone's contributions are equally as impressive. As the Extension section leader, he has ensured that the research conducted by UAPB aquaculture and fisheries scientists has been transferred to producers. Dr. Stone supports Extension programming in the areas of aquaculture, farm pond management, aquatic nuisance species, water quality, effluents and alternative and small-scale production. His research focuses on baitfish hatchery technologies, nutrient management, feeding strategies and water quality. His work led to the transformation of baitfish hatcheries from a low to high technology, skilled labor

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industry that reduced hatchery production costs by 30 percent and he has worked to develop best management practices for the baitfish industry.

Dr. Stone was instrumental in the inception of the first research verification program in aquaculture and in the development of the Arkansas Baitfish Certification Program, an initiative that provides biosecurity protection for farms, consumers and natural resources against the spread of disease and aquatic nuisance species.

He currently serves as a member of the Invasive Species Advisory Committee to the National Invasive Species Council and the Arkansas Aquatic Nuisance Task Force.

He has received many awards related to Extension activities. These include the Joseph McCraren Award from the National Aquaculture Society for outstanding contributions in promoting the growth of aquaculture, the Excellence in Extension Award-1890 Region, Excellence in Extension Award of Merit and the Service Award from the Arkansas Bait and Ornamental Fish Grower's Association.

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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.