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Two Join Aquaculture/Fisheries Center of Excellence at UAPB

Anita Kelly, Extension Fish Health Specialist

Dr. Luke Roy has joined the Aquaculture/Fisheries Center of Excellence at the University of Arkansas at Pine Bluff (UAPB) as an Extension Aquaculture Specialist. Dr. Roy graduated from Samford University in Birmingham, Ala., with a bachelor's degree in environmental science and geographical information systems. He received a Master of Science degree in soil and water science from the University of California, Riverside and received a doctorate in fisheries and aquaculture from Auburn University. Before coming to UAPB, Dr. Roy worked as an Auburn University research fellow where he was stationed at the Alabama Fish Farming Center in Greensboro, Ala. His responsibilities included coordination of research demonstration trials and the catfish yield verification program in west Alabama.

Dr. Roy brings more than six years of warm water aquaculture Extension experience including catfish research verification, and the culture of marine and freshwater species. Dr. Roy is stationed in Lonoke, Ark. and primarily provides assistance to producers in Central Arkansas.

Dr. Trace Peterson joined the Aquaculture/Fisheries Center at UAPB as an assistant professor of fish pathology. Dr. Peterson, who holds a Doctor of Veterinary Medicine degree from Louisiana State University, earned a doctorate degree in microbiology from Oregon State University while holding the National Institutes of Health Aquatic Animal Models Postdoctoral Fellowship. He also has a bachelor's degree in poultry science from the University of Arkansas.

In this position, Dr. Peterson will provide Extension diagnostic and research support for Arkansas aquaculture. He will oversee the four-lab diagnostic system in the state, including fish inspections necessary for certification.

Dr. Peterson will also develop an Extension educational program focused on fish health and biosecurity. He will develop a research program aimed at more effective diagnosis, treatment and prevention of fish health problems on fish farms. His responsibilities also include teaching and mentoring students.

Dr. Luke Roy

Dr. Trace Peterson

Upcoming Events

Catfish Farmers of Arkansas
January 16-17, 2014
Embassy Suites Hotel, Hot Springs, Ark.
Annual educational meeting sponsored by Catfish Farmers of Arkansas. For information contact Bo Collins at (870) 672-1716.

36th Midcontinent Warm Water Fish Culture Workshop
February 3-5, 2014
Holiday Inn Hotel & Suites, Council Bluffs, Iowa
This workshop provides practicing fish culturists, researchers, service and product suppliers an opportunity to network and discuss current trends in aquaculture. For more information contact Mike Mason mike.mason@dnr.iowa.gov

2014 Arkansas Bait and Ornamental Fish Growers Meeting
February 6, 2014
Lonoke Agriculture Center, Lonoke, Ark.
Annual educational meeting sponsored by Arkansas Bait and Ornamental Fish Growers Association. For information contact Sathya Kumaran at (501) 676-3124.

Aquaculture America 2014
February 9-12, 2014
Seattle, Wash.
The annual meeting of the U.S. Aquaculture Society, National Aquaculture Association and the U.S. Aquaculture Suppliers Association. For information contact the Conference Manager at (760)751-5505.

Effects of Twenty-Two Percent Protein Diets on Golden Shiners at Two Densities

Rebecca Lochmann, Professor, UAPB
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Nathan Stone, Extension Fisheries Specialist, UAPB
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Carole Engle, Professor, UAPB

The golden shiner is the main species cultured for bait in Arkansas. In recent years, high feed costs have greatly reduced profits for baitfish farmers. Cheaper alternative feeds with less soybean meal and more corn products have been tested in golden shiners with good results. These feeds contained at least 28% protein and were designed to be nutritionally complete for catfish, which have similar nutrient requirements to baitfish. However, even diets with cheaper ingredients like corn gluten feed now cost more than $400/ton. Because baitfish eat natural foods throughout production, it is possible that they could be reared profitably on supplemental diets that contain less protein than standard diets. Zooplankton is rich in protein and fat, and might supply the extra energy and amino acids (from protein) needed to sustain fish performance while using cheaper diets.

UAPB conducted a feeding trial with golden shiners to determine the effects of diets with 22% protein and soybean meal or alternative ingredients on fish performance and production economics. The alternative ingredients were corn distillers dried grains with solubles and corn gluten feed. A control diet with 28% protein and soybean meal as the main protein source was included for comparison. The diets were formulated and pressure-pelleted as 1/8-inch pellets in the nutrition lab at UAPB. Some farmers use a meal form of feed instead of a pellet, so one of the treatments (22% soybean) was also offered both as a pellet and a meal. The relative cost of the low-protein diets (compared to the control) is shown in Table 1. The costs were calculated from the cost of individual ingredients because these were not commercial diets.

It is well known that golden shiner growth is affected by stocking density, and that fish grow more slowly at a high density. Therefore we also included density as a variable in the study. Each diet was fed to fish stocked at 100,000 fish/acre or 300,000 fish/acre, to determine density effects on performance independently of diet effects. Golden shiners (initial size = 2000/lb) were stocked in four outdoor tanks (35.5 ft^2) per treatment and fed the diets for 9 weeks. Fish were fed to satiation twice daily on weekdays and once daily on weekends. Subsamples of fish in each tank were weighed every 3 weeks to track growth and adjust feed weights. Chlorophyll a and zooplankton were measured and/or identified once a month to gauge natural foods.

At harvest, all fish were counted and bulk-weighed. Individual lengths and weights of fish from each tank were measured to determine relative weight. The body composition of these fish was also analyzed. Results for the

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Table 1. Alternative diets used for a feeding trial with golden shiners.

Diet	Description	Relative Cost ($/ton compared to control)
28% Soy	Traditional - mainly soy (control)	Baseline
22% Soy*	↓ protein, ↓ soy & ↑ corn grain	- 22.76
22% Corn gluten feed	↓ protein, ↓ soy & ↑ corn gluten feed	- 34.48
22% Distillers grains	↓ protein, ↓ soy & ↑ distillers grains	- 17.98

* Offered as a pellet or meal

Table 2a. Performance of golden shiners at a low density (100,000 fish/acre).

Diet	Weight gain (grams)	Feed conversion	Survival (%)	Gross yield (lbs/acre)	Relative weight
28% Soy	1.5	1.5	91	339	102.5
22% Soy	1.3	1.5	92	298	101.5
22% Corn gluten feed	1.4	1.3	92	315	98.9
22% Distillers grains	1.4	1.5	90	316	97.5

Table 2b. Performance of golden shiners at a high density (300,000 fish/acre).

Diet	Weight gain (grams)	Feed conversion	Survival (%)	Gross yield (lbs/acre)	Relative weight
28% Soy	0.8	1.8	100	620	105.5
22% Soy	0.8	1.8	97	553	105.0
22% Corn gluten feed	0.7	1.8	99	521	98.3
22% Distillers grains	0.7	1.8	98	513	99.9

pelleted diets are shown in Table 2 (a & b). Results for the meal diet were the same as for the pellet except for FCR, so the FCR is included in the text and other results for the meal were omitted.

Weight gain was higher in fish at the low density regardless of diet. Presumably, there was more natural food available per fish at the low density, which could have resulted in higher growth. Final fish size at the low density ranged from 250-300 fish/lb. Fish at the high density ranged from 400-500 fish/lb. Weight gain was also higher in fish fed the diet with 28% protein than other diets at either density. Relative weight (a measure of fish condition or "plumpness") was higher in fish at the high density and higher in fish fed any of the soy diets compared to those fed either corn diet. The soy diets contained more digestible energy than the corn diets, leading to better fish condition. Survival was higher at the high density, and there were no diet effects. Gross yield was higher at the high density and in fish fed the 28% soy diet. Feed conversion ratio was better at the low density and better in fish fed the 22% soy pellet compared to the 22% soy meal. Better feed conversion of fish at the low density is probably due to more natural food being available per fish. Better feed conversion of fish fed the pellet may be explained by fish expending less energy to capture fewer larger particles (the pellet) to reach satiation compared to the meal. Nutrient leaching also may have been higher in the meal form of the diet. Body fat was higher in fish at the low density and there were no diet effects. Again, fish at the low density might have had access to more natural food than fish at the high density, which could lead to increased fat storage. It is not known how differences in fish condition and body fat might affect profitability. These traits may be beneficial under post-harvest conditions where fish are not fed. Additional trials simulating transport or retail display are needed to address this issue.

Greater abundance of natural foods was the presumed reason for better weight gain and higher body fat in fish at the low density. Rotifers dominated the zooplankton samples, but only transient diet or density effects were observed in all groups. The plankton was only sampled twice for logistical reasons. This may not have been enough to demonstrate plankton effects on fish performance.

Enterprise budgets for golden shiner production were updated with 2012 costs and used to compare the economic effects of the diets. The base budget was developed using results for the control diet (28 Soy), which was assigned a price of $349/ton - the 2012 cost of a floating pellet with similar ingredients. None of the low-density

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treatments in this study were profitable because yields were all below the breakeven yield (442 lbs/acre). In the high-density treatments all diets were profitable because all yields were above the breakeven yield. The 22% protein diets were less expensive than the 28% protein control diet. However, the significantly lower yields of the 22% protein diets caused reduced revenue that more than offset the reduced feed costs.

In summary, highest gross yield was obtained in fish at the high density fed the 28% protein traditional diet. The most economically beneficial diet in this tank study was also the 28% protein diet. However, other factors may affect diet performance and yield in commercial ponds. Therefore, feed choice must also be determined within the context of a farm's overall business model. Reduced growth was the main effect of the 22% protein diets, so these diets would not be adequate when fast growth is needed. However, survival was high on the lower-protein diets, indicating a possible use for maintenance when fish reach market size and must be held in good condition until they are sold.

Golden shiner. Photo by Nathan Stone.

Unusual Fish Losses Observed by Arkansas Baitfish/Sportfish Farmers During the Winter of 2012/2013

Luke A. Roy, Extension Aquaculture Specialist, UAPB; Anita M. Kelly, Extension Fisheries Specialist, UAPB; Carole R. Engle, Professor, Economics and Marketing, UAPB; Nathan Stone, Extension Fisheries Specialist, UAPB

Fish farmers in Arkansas reported substantial losses of fish in the spring of 2013 when they began to harvest their ponds. The largest losses were observed by farmers raising fathead minnows, golden shiners, and bream (redear sunfish, coppernose bluegill, hybrid bluegill, and native bluegill). Other fish affected to a lesser degree included goldfish, grass carp, largemouth bass, and hybrid striped bass.

An initial investigation by Extension personnel revealed that the scope and extent of the winter fish loss problem was more severe than was assumed initially. In June of 2013, the Aquaculture/Fisheries Center at UAPB developed a questionnaire for producers to document losses and to examine different theories regarding the winter loss of fish. After talking with several catfish producers, as well as some farmers who raise both baitfish/sportfish and catfish, it was determined that no out of the ordinary losses were observed on Arkansas catfish farms during the winter of 2012/2013, with the exception of some pelican problems in the Southeastern portion of the state. Since catfish producers did not report any unusual winter fish losses, the questionnaire was developed to focus specifically on baitfish and sportfish producers.

Several different theories might explain the winter loss of fish. These theories include increased predation by ducks (particularly lesser scaup), abnormally high temperatures in the fall of 2012 (Figure 1), large fluctuations in water temperature observed in the fall of 2012, and insecticides and fungicides associated with increased corn and other row crop production. Some farmers also speculate that reduced feeding at their farm during the fall months due to increased feed prices, coupled with a colder and longer than normal spring, could have been a contributing factor.

An effort was made to contact the vast majority of baitfish and sportfish producers in Arkansas. Thirty-four baitfish and sportfish farmers were interviewed in June and July of 2013 by phone or a farm visit by UAPB Extension personnel. Of the farmers interviewed, 79% reported unusual fish losses during the winter of 2012/2013. Unusual fish losses were defined by losses in excess of what would normally be expected to occur on their farm in a typical year. In total, baitfish and sportfish farmers in Arkansas reported unusual fish losses on 7,224 water acres.

Unfortunately, winter losses were catastrophic on a large number of farms in Arkansas. In many instances farmers reported losing more than 50% of their crop. Fathead minnows, golden shiners, and bream were the fish species most affected by unusual fish losses during the winter of 2012/2013 (Table 1). There are currently 16,072 acres of baitfish (minnows) in production in the state of Arkansas. The combined losses (5,785 acres) in fathead minnows and shiners alone amounted to 36% of the baitfish production (in terms of water acres) in the state. While some losses were reported with other species (goldfish, largemouth bass, grass carp, hybrid striped bass), the amount of acres affected were much less. Losses were noted by farmers during harvest in the spring of 2013 with most of the

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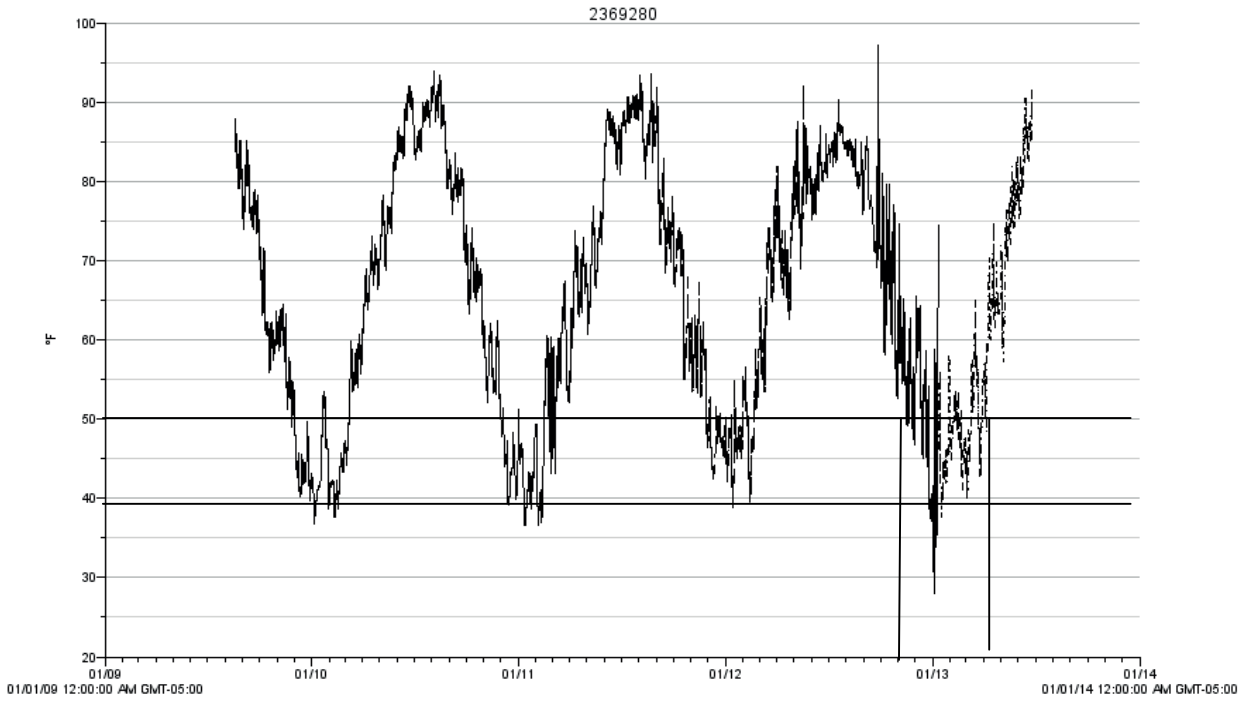

Figure 1. Pond temperatures at 2 foot water depth in production ponds in Lonoke, Arkansas. Temperatures between the horizontal line at 50 °F and 39 °F are where fish metabolism is higher than feed intake. In the winter of 2012/2013, fish were in this temperature zone for approximately 5 months (marked with vertical lines). The vertical line spikes (high temperature spikes) in 2013 resulted from temporary exposure of loggers to the air and should be disregarded.

reductions in production ranging from 50-90% of expected harvest, although there were a few exceptions of farms reporting fewer losses. Most farmers did not observe any dead fish in their ponds (79%) over the fall and winter months and did not become aware of these losses until harvest in the spring of 2013.

Fathead minnows were the fish species most severely affected by winter fish losses in 2012/2013 with a reported loss of 3,242 water acres (Table 2). Golden shiners and bream were second and third with reported losses of 2,543 acres and 1,168 acres, respectively. Of the bream species, the largest number of losses was of redear sunfish. Farmers reported unusual losses of other fish species, but the losses were not nearly as substantial as those observed in fathead minnows, golden shiners, and bream. A total of 271 acres of production were reported affected by winter losses by farmers raising goldfish, largemouth bass, hybrid striped bass, and grass carp (Table 2). While these losses were not as pronounced as with the other species, for some farmers they were still a serious and significant loss of

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Table 1. Acres of fish production by species that experienced unusual fish losses during the winter of 2012/2013.

Fish Species	Number of acres
Fathead minnows	3,242
Golden shiners	2,543
Bream*	1,168
Goldfish	135
Largemouth Bass	66
Grass Carp	50
Hybrid Striped Bass	20
Total	7,224

*Includes redear sunfish, coppernose bluegill, hybrid bluegill, and native bluegill

Table 2. Summary table of selected questions asked to farmers in the winter fish loss questionnaire. A total of 34 farms were surveyed.

Question	Yes (%)	No (%)
Have you had any unusual fish losses this winter?	79	21
If you experienced losses, did you notice any dead fish?	21	79
Were there any corn fields close to ponds where you experienced fish losses?	52	48
Were there any corn fields close to ponds where you did not experience fish losses?	50	50
Did you have a bird problem (too many ducks or other birds) last year on your farm?	100	0
Did you continue to feed late in the Fall (Oct. and Nov. 2012)?	97	3

income.

Summary and Plan of Action

Extension personnel and research faculty at UAPB, United States Department of Agriculture (USDA)-Wildlife Services, and USDA-Agricultural Research Service (ARS) Harry K. Dupree Stuttgart National Aquaculture Research Center are working as a team in a concerted effort to systematically investigate this problem. Several experiments will be carried out in the fall and winter of 2013/2014 to address different theories regarding the winter fish loss issue. Laboratory trials will be carried out in temperature controlled recirculating systems at the Lonoke Laboratory to address low winter temperatures and winter feeding. A field trial is also planned to examine different feed rates at several commercial farms raising fathead minnows, golden shiners, and bream. Finally, in conjunction with USDA-Wildlife Services, a study is planned to evaluate the diet of lesser scaup over the winter months to collect data on fish species and fish size consumed by ducks in an effort to support the listing of lesser scaup on future depredation permits after duck season. Ducks will be collected by UAPB extension personnel and USDA-Wildlife Services and brought to the Lonoke Laboratory for processing and dissection. This study is contingent on obtaining a migratory bird scientific collection permit from the United States Fish and Wildlife Service.

In addition to these studies, grants are being sought by research and Extension faculty at UAPB to provide further funding for this effort. The Arkansas Department of Agriculture provided $3,000 in August, 2013, to address the winter fish loss issue and funds are being used for the laboratory and field components of this research effort. An update of progress and the data from these studies will be provided at the annual meeting of the Arkansas Bait and Ornamental Fish Growers Association on February 6, 2014 at the Lonoke Agricultural Center in Lonoke.

Conservation Culture of the Yellowcheek Darter at UAPB

Steve Lochmann, Associate Professor Fisheries, UAPB

In the spring of 2011, 60 small fish ended a journey in the Middle Fork of the Little Red River near Leslie, Arkansas. Until then, these fish had not spent a single day in an Arkansas stream, but their arrival was a noteworthy accomplishment for the species, and for researchers from the Aquaculture/Fisheries Center at the University of Arkansas at Pine Bluff (UAPB). The journey, and life, of these 60 fish began in an aquarium at UAPB. However, the journey of the yellowcheek darter began years earlier, when U.S. Fish and Wildlife Service scientists contacted UAPB researchers to ask for help culturing this troubled fish.

Yellowcheek darter. Photo by Steve Lochmann.

Trouble for yellowcheek darters began with construction of the Greers Ferry Dam in 1960. Greers Ferry Lake flooded a large portion of the habitat of yellowcheek darters. Habitat alteration led to declines of the four populations currently isolated by Greers Ferry Lake in the South, Archey, Middle, and Devils Forks of the Little Red River. The welfare of the yellowcheek darter has been a concern for the U.S. Fish and Wildlife Service, and recently resulted in this species being listed on the Federal Endangered Species List.

An endangered species recovery plan generally includes habitat restoration and conservation measures. The plan often includes use of hatchery reared fish to supplement declining wild populations. Therefore, culture of

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the yellowcheek darter was a priority for the U.S. Fish and Wildlife Service. Initially, yellowcheek darters from the Little Red River were sent to Conservation Fisheries, Inc., a Knoxville, Tennessee nonprofit organization specializing in propagation of rare fishes. Conservation Fisheries, Inc. was first to spawn yellowcheek darter in captivity, but their success in rearing yellowcheek darter larvae was limited.

Researchers from UAPB began working on yellowcheek darter at the Greers Ferry National Fish Hatchery in 2006. They were also able to spawn the fish in captivity, but ran into problems finding the right food for the very small yellowcheek darter larvae. In 2009, researchers used results from several earlier studies to design a unique feeding strategy for these larvae. The key to their success was to offer a range of live and prepared foods that progressively increased in size as the young larvae grew, and their mouth gape became larger. This feeding strategy worked well, and in 2010, more than 100 larvae survived through the free-swimming larval stage to become bottom-dwelling juveniles.

However, this success created a different problem, associated with maintaining the cleanliness of culture tanks. Daily siphoning of uneaten food from the tank bottom often resulted in the inadvertent siphoning of juvenile yellowcheek darters, which sometimes led to their death. Researchers re-designed the culture tanks with under gravel filters, which no longer necessitated daily siphoning to maintain tank cleanliness. Juveniles were trained to eat black worms, an item included in the diet of wild yellowcheek darter. Approximately 150 juveniles were produced from 12 adults the first year the new feeding strategy was employed.

Larvae hatched in June 2010 were approximately one inch long in February 2011. They looked and acted just like little adults. These fish were divided into three groups. One group was sent to the Greers Ferry National Fish Hatchery, where they formed the basis of a new breeding colony, separate from the colony at UAPB. A second group was maintained at UAPB to determine whether these fish would spawn in captivity as 1-year-olds (Note: researchers determined that 1-year-old fish did not spawn in captivity). A third group of fish became candidates for reintroduction.

Prior to reintroduction, these fish were marked to designate them as hatchery fish. UAPB researchers injected an inert elastomer under the skin of these yellowcheek darters. This marking procedure allows the hatchery yellowcheek darters to be identified, if they are recaptured after release. When a black light is shone on the fish, the mark fluoresces, making recognition easy. The 60 fish were marked and held two weeks to be sure the mark was permanent, and the fish survived the marking process.

On March 9, 2011, scientists and fisheries biologists from the U.S. Fish and Wildlife Service, the Arkansas Game and Fish Commission, and the Aquaculture/Fisheries Center met at a location on the Middle Fork of the Little Red River. The release site was approximately 26 miles upstream of the last site on the Middle Fork known to hold wild yellowcheek darters. With a bit of fanfare and excitement, the 60 fish were acclimated to the cooler water temperature in the River, and for first time hatchery yellowcheek darters were introduced to the wild. This work demonstrated the feasibility of using hatchery fish to supplement wild populations. Although the species recovery plan for yellowcheek darter is still under development, the use of captive propagation can be included as one aspect of the plan, thanks to the work of U.S. Fish and Wildlife Service scientists, and researchers at the University of Arkansas at Pine Bluff Aquaculture/Fisheries Center.

Stocking Ponds for Trophy Bass

Scott Jones, Small Impoundment Extension Specialist, UAPB

The largemouth bass is one of the most popular sportfish in the country. It serves as the primary predator for most waterways in the south, it is fun to catch and it's even quite tasty. When someone mentions trophy bass, thoughts of large reservoirs, deep water and heavy cover may come to mind. Truth is, Arkansas is loaded with potential to catch trophy bass, and you don't even need a boat.

Even small ponds can provide quality bass fishing. The trick is to stock the pond correctly and manipulate population balances to favor larger bass. The most well-understood predator/prey interaction known for ponds is that of largemouth and bluegill. Bluegill are frequent and prolific spawners that provide continuous forage for bass. When stocked together, both species can sustain themselves without input from the pond owner. However, the pursuit of a trophy bass fishery is just that, a pursuit. Every pond is different and needs attention and management to achieve trophy fish.

It is best to keep stocking simple with small ponds, especially if you desire a specific fishing experience, like trophy bass. In addition to largemouth and bluegill, it is often suggested to stock redear sunfish. These fish are similar to bluegill but they eat almost nothing but snails. Certain snails can be hosts to ugly fish parasites like yellow, white and black grubs. The redears keep snail numbers low, preventing the grubs from reproducing. Grass carp are also recommended if you believe vegetation problems may occur, or already exist in a pond. These fish do a great job of keeping ponds clear of vegetation, but they only eat certain types.

It's a good idea to provide additional forage fish to give your bass dining options and your bluegill a break from predation. Fathead minnow, golden shiner and threadfin shad are good choices for supplemental forage. Fatheads are an easy meal for bass. So easy that they usually do not survive more than a year in ponds and

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have to be restocked regularly. Golden shiners can reproduce well in ponds but have been known to eat eggs. For this reason, it is best to not stock golden shiner the first year so that your bass and bluegill get a chance to spawn at least once unhindered.

Threadfin shad are an excellent forage fish but shad, in general, have caused many problems in ponds. Shad are filter feeders by design which allows them to access a near limitless food supply in fertile waters. Also, it is very easy to mistake the much larger gizzard shad for threadfin. Gizzard shad are notorious for outgrowing the mouths of all but the largest of predators in ponds. It is best to hold off stocking shad until you have a healthy population of 2 to 5 pound largemouth in the pond. Stocking shad into a well-managed bass population can be like throwing gasoline on a flame for growing huge bass. But, it could absolutely devastate your pond if the shad are not controlled by the bass or winter die-off.

Species to avoid in your trophy bass pond include: Common carp, bullhead catfish, green sunfish, crappie and gizzard shad. Common carp and bullhead often cause muddy water because of their rooting-like feeding behavior. Though they do not always reproduce well in ponds, green sunfish and crappie compete with bass and bluegill for forage. As discussed previously, gizzard shad are risky. They are a larger forage fish that can be the last step to growing true "wall hanger" sized largemouth, but the bass population has to be large enough in size and numbers to keep the shad in check.

Published stocking rates are designed to establish a balance between size and numbers of largemouth and bluegill. To achieve a trophy bass pond, you must keep bass numbers lower and allow bluegill overpopulation and stunting. This provides each bass with less competition and all the food it needs to get big! For more information, check out the Extension publication MP360: Farm Pond Management for Recreational Fishing.

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The purpose is to advance aquaculture production in Arkansas by providing reliable, practical, timely information.