COOPERATIVE EXTENSION PROGRAM
University of Arkansas at Pine Bluff

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Extension Contacts

Larry Dorman
Extension Fisheries Specialist
870-265-8055/870-489-1115
ldorman@uaex.edu
Martha Fitts
Extension Assistant
870-265-8055
mfitts@uaex.edu
Andy Goodwin
Extension Fish Pathologist
870-575-8137/870-540-7811
agoodwin@uaex.edu
David Heikes
Extension Aquaculture Specialist
870-575-8143/870-489-1083
dheikes@uaex.edu
Sathya Kumaran
Extension Associate
501-676-3124
skumaran@uaex.edu
Emily Marecaux
Extension Associate
870-575-8129
emarecaux@uaex.edu
Wes Neal
Assistant Professor, Small Impoundments
870-575-8136
wneal@uaex.edu
Steeve Pomerleau
Extension Aquaculture Specialist
870-575-8139/870-692-3709
spomerleau@uaex.edu
George Selden
Extension Aquaculture Specialist
870-512-7837/870-540-7805
gselden@uaex.edu
Nathan Stone
Extension Fisheries Specialist
870-575-8138/870-540-7810
nstone@uaex.edu
Hugh Thomforde
Extension Aquaculture Specialist
501-676-3124/870-692-3398
hthomforde@uaex.edu

Web address:
www.uaex.edu/aqfi/

Arkansas Bait and Ornamental Fish Certification Program Developed

Andy Goodwin, Extension Fish Pathologist
Nathan Stone, Extension Fisheries Specialist

Regulators in northern states are increasingly worried about the potential for shipments of wild baitfish to spread exotic plants, fish, mollusks, and diseases. These concerns were triggered by

- the discovery of the exotic Spring Viremia of Carp virus in farmed and wild fish in North Carolina, Virginia, Wisconsin, Illinois, Washington, and Missouri.
- the discovery of exotic VHS virus in the Great Lakes.
- the emergence of a new parasite, *Heterosporis*, in Wisconsin, Minnesota, Michigan, and Lake Ontario.
- increasing recognition of wild-caught baitfish as carriers of disease and aquatic nuisance species (zebra mussels, exotic plants, exotic fish, and snails).

These concerns have increased interest in the benefits of farmed baitfish, cultured under controlled conditions and subject to health inspections. In order to demonstrate the safety and superiority of their product, Arkansas fish farmers desired a means to distinguish their quality-controlled farm-raised bait and ornamental fish from wild fish. There was no existing program at the state or federal level that Arkansas farmers could use to demonstrate the safety and environmental superiority of their farmed product. In response to industry interest, a voluntary fee-based state certification program was developed to "…provide high quality, farm-raised bait and ornamental fish, free of certain diseases, undesirable plants, undesirable animals, and other contaminates deemed injurious to fish or fisheries."

The first steps toward this program occurred in 1995, when the University of Arkansas at Pine Bluff diagnostic laboratory became approved by USDA/APHIS to inspect fish for export.

Aquaculture/Fisheries Center fish health specialists held biosecurity and fish inspection education sessions for farmers, and participation in the health inspection program gradually increased. Large increases in participation occurred following disease outbreaks elsewhere in the U.S. In 2005, the Arkansas Bait and Ornamental Fish Growers Association worked with state officials to authorize a comprehensive certification program that included fish disease, aquatic nuisance species, and farm biosecurity. Over the following year, UAPB worked with industry and the State to develop the technical details of the program and to provide the needed training for farmers and Arkansas Department of Agriculture inspectors. By 2006, more than 85% of all Arkansas bait and ornamental fish production acreage was under semi-annual inspections for exotic pathogens through the UAPB laboratory under APHIS export program guidelines.

The state certification program was formally begun this spring. It includes disease inspection, biosecurity, and aquatic nuisance species provisions. More than 95% of all Arkansas bait and ornamental fish production acreage is undergoing the inspections needed for participation in this voluntary program. The Arkansas Commercial Bait and Ornamental Fish Certification Program provides assurances that products from participating bait and ornamental fish farms are free of the listed pathogens, plants, animals and other contaminants. The program serves as a

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model for other state and national programs designed to prevent the spread of exotic fish diseases. For more information on the Arkansas program, contact Andy Goodwin, agoodwin@uaex.edu.

Upcoming Events

Aquatic Sciences Day - September 27. High schools are invited to send students to experience a fun day of learning about biology, chemistry, engineering, mathematics, and nutrition careers through aquaculture and fisheries activities. Spectator and participation events include fish anatomy, pond sampling, water quality, fish identification, and fish as art. Aquaculture/Fisheries Center, University of Arkansas at Pine Bluff. Cassandra Hawkins-Byrd (870) 543-8123

Catfish Farmers of Arkansas, Mid-Year Meeting - October 4. Lake Village, Arkansas. Bo Collins (870) 672-1716 or (479) 437-3081

U.S. Freshwater Prawn & Shrimp Growers Annual Meeting December 7-8. Details available soon. Radisson Hotel, Opryland, Nashville, Tennessee. www.freshwaterprawn.org or (662) 390-3528.

Arkansas Aquaculture 2008 - January 31-February 2, 2008. Annual educational meeting. Sponsored by Catfish Farmers of Arkansas. Embassy Suites Hotel, Hot Springs, Arkansas. Bo Collins (870) 672-1716 or (479) 437-3081

Arkansas Bait and Ornamental Fish Producers - February 7, 2008. Annual educational meeting. Sponsored by Arkansas Bait and Ornamental Fish Growers Association. Lonoke Community Center, Lonoke, Arkansas. Hugh Thomforde (501) 676-3124

When Fertilizer Doesn't Work

Larry Dorman, Extension Aquaculture Specialist

Most fish producers have difficulty stimulating a bloom, and maintaining the bloom in a few of their fry or fingerling ponds. Reasons vary, and include cool water temperature, extended periods of insufficient sunlight, oxygen depletion, poor soil fertility, strongly acid soil, and high calcium hardness of the water. The difficulty of producing algae in water with high calcium hardness is the subject of this article.

Hardness is a measurement of the calcium and magnesium ions in water. Calcium is generally in a 2 to 1 ratio to magnesium in well waters in southeast Arkansas. Magnesium rarely causes problems. However, calcium ions seek to attach to phosphate ions, and form highly insoluble calcium phosphate. The phosphate, often added as a fertilizer, thus becomes "bound" and unavailable for the intended use. As a result, more fertilizer is needed to produce a bloom, and this costs more.

Many pond fertilizers are advertised for high solubility. Products which are more potent, or which dissolve more easily are more valuable. Some promotional literature suggests that as little as four pounds per acre is sufficient to establish a bloom. In some waters these do work as described. However, ponds with calcium hardness greater than 100 ppm require 4 to 8 times as much fertilizer to establish a bloom. Table 1 indicates fertilizer rates for Arkansas ponds, based on varying water calcium hardness.

The test for calcium hardness is simple. Ask for assistance from a consultant, or any of our specialists whose names and phone numbers appear on the front page of this newsletter. If you have difficulty establishing a bloom, give consideration to the water hardness.

Table 1. Recommended Fertilizer Rates

Fertilizer Type	Water Calcium Hardness Low <50 ppm	Medium 50-100 ppm	High >100 ppm
liquid (gallons/acre) 11-37-0	1/2 - 1	1 - 2	2 - 4
powder (pounds/acre) 12-52-4	4 - 8	8 - 16	16 - 32
granular (pounds/acre) 0-46-0	4 - 8	8 - 16	16 - 32

Sonar for Control of Duckweed in Small Cattle Ponds

George Selden, UAPB Extension Aquaculture Specialist
Darrin Henderson, UA Extension Agent/Staff Chair, Madison County

Introduction

Duckweed (*Lemna sp.*) is a small, floating aquatic plant that is very common in Arkansas. It thrives in quiet waters with high levels of nutrients. Its ability to reproduce both sexually and asexually allows it to grow and spread quickly under optimal conditions. This can lead to the formation of dense mats of duckweed that entirely cover small ponds. The herbicide fluridone (brand name, Sonar) provides excellent control of duckweed but at a relatively high price. Another herbicide, diquat (brand name, Reward), is also available in Arkansas, but generally requires multiple treatments to eliminate duckweed.

Sonar is classified as a systemic herbicide, meaning that the herbicide is absorbed by the plant and moved to other areas of the plant. The herbicide works by preventing the formation of carotene pigments which protect the chlorophyll. Sunlight then causes the rapid degradation of the chlorophyll, leading to starvation of the plant. Sonar requires a minimum of 45 days of contact for maximum effectiveness, and typically takes 30 to 90 days to achieve control. This makes it an impractical herbicide in flowing waters, but ideal for ponds that have no outflow. Cattle watering ponds tend to be small and nutrient-loaded, making them prime duckweed habitat.

Materials and Methods

During the summer of 2006, three cattle watering ponds were selected in Madison County for a demonstration project involving Sonar AS for duckweed control. Ponds were randomly selected for treatment at (a) the highest labeled rate (90 ppb active ingredient), (b) the lowest labeled rate (45 ppb active ingredient), and (c) no treatment, as a control. All ponds were located in pastures and used by cattle throughout the summer. A GPS unit was used to determine the surface area of each pond. Application rates were based on estimated depth and volume. The herbicide was measured using a graduated cylinder, mixed with water in a handheld pump sprayer, and then applied while walking around the perimeter. The ponds were treated on 19 April 2006.

The high rate pond was approximately 0.22 acres, with average depth of 5 feet. The rate was calculated as 8.5 ounces of Sonar AS. The low rate pond was approximately 0.21 acres with an average depth of 5 feet. The rate was calculated as 4.2 ounces of Sonar AS. The control pond was of similar depth and area.

Sonar, low rate (45 ppb), early spring.

Sonar, low rate (45 ppb), late summer.

Results

Ponds treated at both the low rate and high rate stayed clear of duckweed all summer. During the same period, the control pond had abundant duckweed.

Discussion

This demonstration confirms previous work, showing that Sonar gives effective season-long control of duckweed in small ponds. Like all aquatic herbicides, Sonar is expensive. In the past, one gallon was the smallest amount that could be purchased and was upwards of $2000. At that price, it would cost $133 at the highest labeled rate and $66 at the lowest labeled rate to provide a summer of duckweed control. Sonar is now available in smaller containers, which lowers the initial purchase price, though the price per ounce is somewhat higher. As a comparison, Reward costs about $300 for a 2.5 gallon container. At its label rate of one gallon per surface acre, a single treatment would cost $30, but often repeat treatments are required due to lower efficacy. All things considered, we consider Sonar as competitive with Reward. Cattle are allowed to drink immediately from ponds treated with Sonar. However, cattle must be kept away from ponds treated with Reward for one day following treatment. Furthermore, Reward is restricted by the Arkansas State Plant Board for use only by persons with a restricted-use pesticide license.

This demonstration indicates that Sonar is an effective and economical herbicide for duckweed in standing-water cattle ponds

Research Round-up

Nathan Stone
Extension Fisheries Specialist

This column presents short summaries on a range of research studies at the UAPB Aquaculture/Fisheries Center, from catfish production to natural fisheries. For more information on each topic, please contact the researcher(s) directly.

Experimental pond with barrier in place. A fine mesh screen along the barrier kept feed from moving between cells.

Confinement System for Catfish Production

Commercial catfish ponds are large - typically 10 to 15 acres in size. Making sure that all the fish get to the feed and catching them at harvest are two challenges farmers face. Graduate student Neil Pugliese, working with David Heikes and Dr. Carole Engle, has been evaluating an inexpensive barrier system for catfish ponds. Wire mesh barriers that separated off a third of each pond were installed in five, 0.25-acre ponds. Two pond studies were conducted. In the first, catfish fingerlings were stocked within the barrier and larger catfish in the remaining two thirds of the pond to determine if separating fingerlings from food-fish would improve fingerling growth as compared to control multiple-batch ponds where fish sizes were mixed. A second trial of the barrier system stocked only 0.25-lb fish in either the one-third portion of the pond with the barrier, or in an open pond, at 4,500/acre.

Bottom Line: In the first study, net yield of fingerlings was significantly higher (by an average of 34%) when grown separately from food fish. There was no difference in the yields of the larger fish. In the second trial, stockers in the open pond ate more feed, grew faster, had a lower feed conversion ratio, had a higher yield, and reached a larger size at harvest. However, seining efficiency was higher in the barrier pond than in the open pond. There were no measurable differences in water quality between the barrier ponds and the control ponds. The barrier system is currently being tested on a commercial farm, and the economic tradeoffs are being determined. For more information on this research project, contact David Heikes at dheikes@uaex.edu or (870) 575-8143.

Largemouth Bass Populations in the Arkansas River

Based on tournament catch data, there have been concerns over largemouth bass populations in the Arkansas River. Speculation as to the cause has included largemouth bass virus, which was detected in healthy bass from Pools 5 and 9. In order to determine the current status of the bass population in the lower Arkansas River, graduate student Ben Batten, under the direction of Dr. Mike Eggleton and with the assistance of Dr. Steve Lochmann, has been conducting an intensive stock assessment of largemouth bass populations in the lower eleven pools over the past two years. Results indicated that the bass size structure varied among pools and years, but that lengths of bass of the various age classes were what one would expect in similar impounded river systems.

Bottom Line: Study results point towards a quality bass fishery in the lower Arkansas River. For more information on this research project, contact Dr. Eggleton at meggleton@uaex.edu or (870) 575-8100.

A Substitute for Wheat in Fish Feed?

Increases in the prices of ingredients such as wheat or corn can cause the price of fish feed to climb, so use of replacement ingredients could help keep feed costs at a minimum. Cuphea is a new oilseed crop that is currently under domestication by plant breeders. Seed shattering has been one problem that has kept cuphea from commercialization, but new research shows promise for overcoming unfavorable traits. Post-doc-

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toral research associate Dr. Todd Sink and Dr. Rebecca Lochmann conducted an 8-week study in which channel catfish fingerlings were fed a control diet (with wheat) or experimental diets with 7.5% or 12.5% cuphea meal. There were no differences in growth or survival among the diets, but fish fed the cuphea meal did have significantly higher whole-body protein levels.

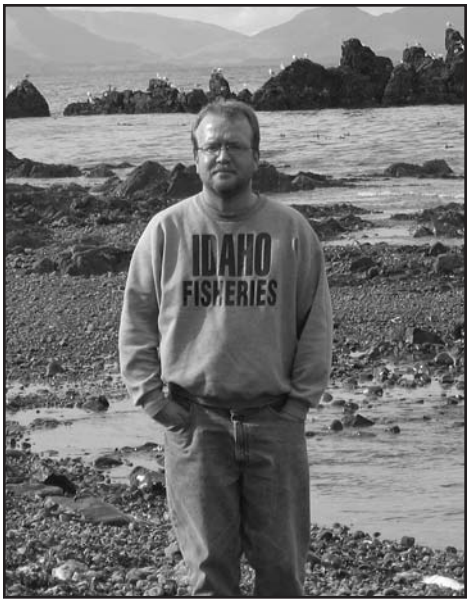
Bottom Line: Cuphea meal shows promise as a substitute ingredient in catfish feeds. For more information on this research project, contact Dr. Sink at tsink@uaex.edu or (870) 575-8174.

Marcella Melandri, assisted by Greg O'Neil, is shown here setting up the chillers and heaters in each aquarium for the temperature study.

Effect of Temperature on the Growth of Golden Shiners

Fish size is an important element in baitfish marketing, and we know that temperature plays an important role in fish growth. But exactly what is the relationship between water temperature and growth in golden shiners? Graduate student Marcella Melandri, working with Dr. Nathan Stone and with assistance from Dr. Rebecca Lochmann, has conducted two, 10-week trials to determine the growth response of juvenile golden shiners to temperature. Golden shiners (trial one, 0.5 g; trial two, 1.0 g) were held in a flow-through system at four temperatures (15, 20, 25, and 30 $\pm$ 1.5 C) and fed twice daily to satiation. Quadratic equations were derived to predict growth rate based on temperature.

Bottom Line: Golden shiners gained the most weight at temperatures of 24 to 27 C (75 to 80 F). For more information on this research project, contact Dr. Stone at nstone@uaex.edu or (870) 575-8138.



Alf Haukenes, Assistant Professor

New Staff Member

Following an exit from dairy farming in the mid 1980s I've spent the past 20 years working in aquaculture and fisheries. I took a path common to many fisheries professionals by entering the Peace Corps as an aquaculturist. I followed that experience by working on Idaho trout hatcheries and got caught up in the research arena in 1990 working on salmon health in the Pacific Northwest.

In 1997 I began a research program in South Dakota examining the physiological stress response in walleye, yellow perch, sturgeon and paddlefish. I have remained active in physiology and endocrinology of fish ever since. Before I came to Arkansas I worked on applied research for the Alaska commercial fishing industry - characterization of the annual reproductive cycles in rockfish, defining the impact of physiological stress on survival of crab caught as bycatch, and illustrating the interactions between fillet quality and capture stressors in salmon.

At UAPB I am responsible for applied research in reproductive physiology of fishes on questions and problems that arise from the Arkansas aquaculture industry. Additionally, I will teach courses in fish physiology, fish hatchery management, and genetics. I've enjoyed my introduction to Arkansas and look forward to continued opportunities for conversations and collaborations with the Arkansas aquaculture industry.

VHS Update

Andy Goodwin, Extension Fish Pathologist

In an earlier article I described the discovery of an exotic strain of VHS virus in Lakes Erie, Ontario, St. Clair, and Huron. The virus has now been found in Lake Michigan and in inland lakes of New York, Wisconsin and Michigan. The virus has caused major fish kills over a broad range of species including important sport and baitfish. To prevent the spread of the VHS virus, in October and November 2006 the federal government (USDA-APHIS) enacted a broad emergency order blocking transport of all susceptible fish species out of the eight Great Lakes states unless those fish are inspected to a rigorous standard, are headed for scientific or diagnostic destinations, or are going to a processor that disinfects all holding and processing effluents.

In response to the VHS threat, many state governments are enacting new fish health inspection regulations. The most difficult and comprehensive are those of New York, but several other states have instituted new regulations or are in the process of doing so. If your business relies on shipping live fish, especially to the northeast and Great Lakes regions, it is critical that you keep up to date on the changing rules. If you are unsure, contact one of the UAPB fish health laboratories for advice and inspections. Arkansas producers interested to receive periodic e-mails from me concerning new regulations are invited to send me a note at agoodwin@uaex.edu. Those who bring live fish into Arkansas must also be aware that the Arkansas Game and Fish Commission recently enacted new regulations with strict inspection requirements for all live fish coming to Arkansas from the Great Lakes states.

Most new state regulations focus on VHS and other viruses, although some jurisdictions are writing more restrictive rules that include parasites and bacteria. Farms participating in the Arkansas Commercial Bait and Ornamental Fish Certification Program (described elsewhere in this newsletter) will easily meet any new virus regulations, and avoid delays of up to 3 weeks which would otherwise be required to conduct testing. Any additional tests for bacteria and parasites can be completed in about 3 days.

In the future, if the VHS virus is found in Arkansas, local producers will have to meet the same stringent requirements which farmers in the Great Lakes states already struggle to follow. This will cause few problems for Arkansas bait and ornamental fish farms participating in either APHIS export inspections or the new Arkansas Commercial Bait and Ornamental Fish Certification Program. However, farms without an inspection history will face shipping delays of at least 30 days while VHS testing of their fish is conducted. This will apply to all types of fish recognized to be susceptible to VHS, including catfish and all the most important bait and sport species. We must continue to monitor changing state and federal regulations. APHIS is expected to put into force the VHS Interim Rule sometime in the next few months. The details of those regulations remain unknown, but will certainly require stringent inspections of live fish leaving states where VHS is known to be present.

Invasive Snail Alert

Hugh Thomforde
Extension Aquaculture Specialist

The channeled apple snail, *Pomacea canaliculata*, native to South America, was formerly sold by the US aquarium pet industry. Interstate commerce is now illegal, but they have already invaded ponds, irrigated fields and wetlands in Florida, Louisiana, and Texas. Alarmingly, pet stores in Pine Bluff, Little Rock, and Jacksonville sold these snails as recently as April 2006.

Distribution: Their natural habitat is lakes and swamps. They feed on algae, azolla, and succulent leafy plants, including rice. They survive dry conditions by burying in soil.

Biology: Channeled apple snails tolerate temperatures near freezing. Egg laying starts in spring when water temperature reaches 64 F. Egg clusters are laid every 2-3 weeks, always above water. Clusters have 200-300 strawberry-colored eggs, and turn white before hatching. Young snails feed aggressively when they reach the size of corn seed. In 2-3 months they are the size of ping-pong balls and are sexually mature. The shell is round, thin, dark-brown or golden-brown, with a thin operculum.

Problem: The channeled apple snail is a serious threat to rice production and wetlands. Rice production in the Dominican Republic fell by 70% in 3 years following introduction of this snail. It was introduced to Taiwan in 1980 with the mistaken belief that it would be a useful supplement for animal and human diets. By 1990 channeled apple snail was the top rice pest in the Philippines, and remains a major pest.

Control: Do not release aquaria-kept animals. No chemicals will selectively eliminate these snails. Notify me (870-692-3398) if you see red or pink egg masses above the water surface.

Watch Out for Pond Turnovers

Wes Neal, Assistant Professor, Small Impoundments

Pond turnovers occur during warm summer weather - typically following thunderstorms. Generally, when someone mentions a *turnover*, the first thing that comes to mind is dead fish.

You may ask, "Why do turnovers occur?" To answer this, we must understand some basics about water. The weight of water varies at different temperatures, and is densest at 39 F. Colder water is lighter. Warm water is also lighter. In fact, you may have noticed while swimming that the water at the surface is warm, but at your feet, it is cold. This horizontal layering of different water temperatures is called *stratification*.

During spring, the surface of the pond heats up and stratification begins. Layers of warm water form at the surface, and colder layers are found deeper in the pond. These layers usually resist mixing, and the lake will remain stratified until fall when cooler temperatures cause surface layers to cool and gradually mix with layers below.

In the surface layers, oxygen is produced by photosynthesis of tiny plants, or plankton. Oxygen is also entering the water by exchange with the air. Because of stratification, this oxygen does not enter the deeper layers where it is too dark for plants. Also, dead plants and animals sink into the deep layers, where they decompose and deplete oxygen. You end up with a pond with plenty of oxygen, plants, and fish in the shallow water, and no oxygen, plants, or fish in the deep water (Figure 1, page 8).

This can become a problem if the water in the pond mixes suddenly, which is called a *turnover*. When a turnover occurs, the water mixes and the oxygen in the water may become too low for animals to survive. Larger fish usually suffocate first. You may observe fish at the surface trying to get oxygen. They will scare away temporarily, but will quickly return to the surface. All species of fish will die during a pond turnover (see photo). Some smaller fish may survive by breathing at the surface where oxygen is diffusing into the water.

Fall turnovers happen every year in most ponds, and are typically harmless if they occur gradually. Summer turnovers are usually much more harmful. These are typically the result of heavy thunderstorms, which produce several inches of cold rain. The cloud cover and cold winds also cool the surface layers, and the rush of cold rainwater causes the surface layers to mix with the water below. The oxygen is quickly used up by decomposing materials, and fish start to suffocate. Summer turnovers happen from about May until October, and are usually caused by changing weather conditions.

Is there anything you can do to prevent a turnover? Yes. Electrical aeration systems can be used to prevent stratification, or devices can be attached to standpipes to remove stagnant water from deep in the pond. Reducing nutrients that go into the pond will lower the density of algae blooms, and provide less dead material to consume oxygen. Do not overfertilize or overfeed, and keep excess animal wastes out of the pond. These practices lessen the bad effects of turnovers.

If you notice that a turnover is occurring, and you catch it before many fish have died, there may be emergency steps you can take to save fish. Provide emergency aeration if possible. Spray water across the surface using a pump and hose, or use an outboard motor to create a *rooster tail* of water across the pond. Anything that will mix air and water and provide an oxygenated refuge may help save some fish.

Dead and dying channel catfish, largemouth bass, bluegill, and gizzard shad following a heavy August rain event. Many small fish survived the fish kill and repopulated the pond.

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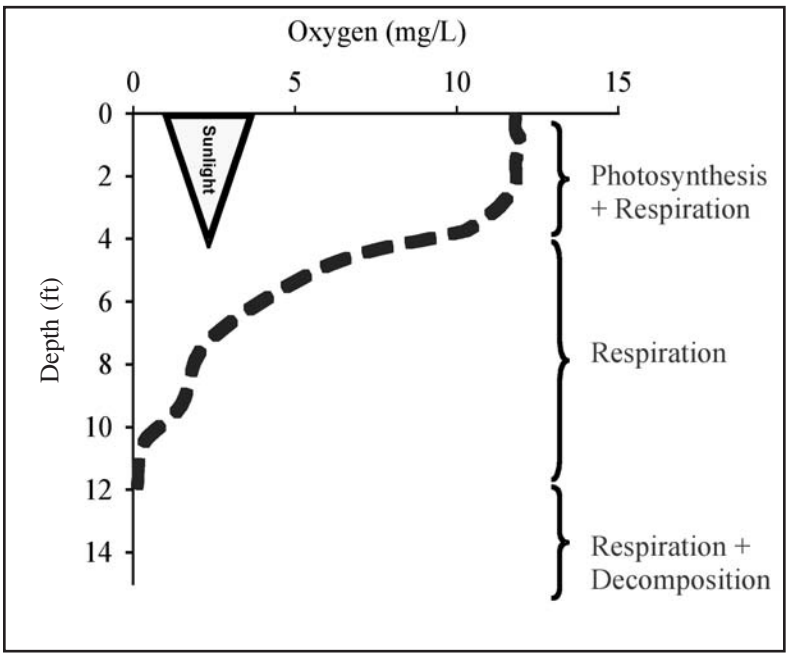

Figure 1: Vertical oxygen profile from a typical Arkansas pond in mid-summer. Oxygen is high in the surface layers with ample sunlight because production of oxygen by photosynthesis outweighs use due to respiration. Oxygen in much lower or absent in deeper water because no production is occurring (no sunlight) while respiration and decomposition use up oxygen.

Dr. Hugh Thomforde
Extension Aquaculture Specialist
Technical Editor

County Extension Agent

Debbie Archer
Communications Specialist
Layout and Design

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