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Black Carp on the Injurious Species List

Steeve Pomerleau
Extension Aquaculture Specialist

Current Status

The U.S. Fish and Wildlife Service (USFWS) has issued the final rule adding all forms of black carp to the injurious species list of the Lacy Act. Black carps have been used primarily in Arkansas, Missouri, Mississippi, and North Carolina as a biological control agent for nuisance snails. As a result of the new rule, which became effective on November 19, 2007, it is illegal to transport any live black carp or eggs across state lines. This also means that catfish farmers will be in violation of the Lacy Act if a black carp is accidentally mixed with a load of catfish being hauled to a processing plant out of state. This listing is federal and applies only to live fish transported across state lines. Thus, the Lacey Act does not apply to transport or possession of black carp within states.

In Arkansas, triploid black carp is an approved aquaculture species. Arkansas fish farmers can continue to use triploid black carp in their ponds to control trematode infestations. Diploid black carp is a restricted species that require a separate permit from the Arkansas Game and Fish Commission (in addition to the fish farming permit required for all fish farmers).

Regarding enforcement actions under the Lacey Act, the USFWS says: "[…] the Goverment focuses its resources on investigating and prosecuting those who act without taking steps to comply with the law."

Solutions

Farmers who have stocked triploid black carp in their catfish ponds should implement the following recommendations to prevent the insertion of black carp in shipments of food size channel catfish shipped across state lines to a processing plant.

- Maintain stocking records demonstrating that triploid black carp in food size catfish ponds scheduled for harvest are of a sufficient age and size to be readily identified and removed. Ponds that have been recently stocked with triploid black carp smaller than or equal in size to the catfish to be harvested should not be harvested for shipment across state lines.
- When loading catfish out of a pond containing triploid black carp, at least one employee should be assigned to visually inspect the fish as they are being dipped into the loading basket. If the employee sees a triploid black carp in the loading basket, it should be removed before any more fish are loaded into the basket.
- At least one employee should be assigned to visually inspect every basket of catfish as they are lifted out of the water before they are unloaded onto the truck. If a triploid black carp is identified in the loading basket, that fish will be removed from the basket before it is unloaded onto the truck.
- When loading catfish onto a truck, at least one employee should be assigned to visually inspect every basket of catfish as they are being unloaded into a live haul tank on the truck. If a triploid black carp is identified, that fish will be removed from the tank before any more basket is unloaded into that tank.

Farmers must prevent loading black carp on trucks hauling catfish out of state.

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Upcoming Events

2008 Missouri Natural Resources Conference
January 30 to February 1, 2008
Tan-Tar-A Resort, Osage Beach, MO
For information contact Donna Baldwin at 573-522-4115 ext 3111.

Arkansas Aquaculture 2008
January 31 to February 2, 2008
Embassy Suite Hotel, Hot Springs, AR
Annual educational meeting. Sponsored by Catfish Farmers of Arkansas. For information contact Bo Collins at (870) 672-1716.

2008 Fish Farming Trade Show
February 7, 2008
Washington County Convention Center, Greenville, MS
Annual trade show and conference. Sponsored by Alabama Catfish Producers, Catfish Farmers of Arkansas, Catfish Farmers of Mississippi, Louisiana Catfish Farmers Association, and The Catfish Journal. For information contact Mike McCall at (601) 206-1600.

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

Aquaculture America 2008
February 9-12, 2008
Coronado Springs Resort, Orlando, FL
National conference and exposition. Sponsored by U.S. Aquaculture Society and the National Aquaculture Association. For information (760) 751-5005.

2008 Annual Meeting of the Mississippi and Arkansas Chapters of the American Fisheries Society
February 20-22, 2008
Sam's Town Casino, Tunica, MS

Catfish Farmers of America Annual Convention
February 29 to March 2, 2008
Omni San Diego Hotel, San Diego, CA
For information contact Mike McCall at (601) 206-1600.

Aquatic Science Day
September 18, 2008
University of Arkansas at Pine Bluff
Pine Bluff, AR
Annual educational event for high school students. For information contact Cassandra Hawkins-Byrd at (870) 575-8123.

Aquaculture/Fisheries Field Day
October 2, 2008
University of Arkansas at Pine Bluff
Pine Bluff, AR
Biennial educational event. For information contact Nathan Stone at (870) 575-8138.

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- If during the course of loading the live haul truck, a triploid black carp is observed anywhere on the truck or in the tanks, that fish will be removed before the truck is allowed to leave the farm.
- Maintain records of all these efforts.

HACCP Plan

The USFWS strongly advises fish farmers to develop and implement a complete HACCP (Hazard Analysis and Critical Control Point) plan to prevent the inadvertent transport of live black carp across state lines. A HACCP plan describes the production process, identifies hazards (risks), determines where hazards can be controlled, and describes procedures to remove the hazards identified. The HACCP plan also develops written documentation to verify that all specified procedures were followed, including documentation of the training of farm personnel.

Extension aquaculture specialists of the UAPB Aquaculture/Fisheries Center will have a generic HACCP plan available to fish farmers in late January 2008. Farmers who stock black carp are urged to obtain the plan and implement it on their farms. Extension aquaculture specialists at UAPB will provide assistance as needed in adapting the plan to individual farms, in training of farm personnel, and in plan implementation and recordkeeping. For information, contact Steeve Pomerleau at spomerleau@uaex.edu or 870-575-8139.

For additional information in HACCP planning, farmers may visit the USFWS HACCP web site (www.haccp-nrm.org), which provides examples of HACCP plans, manuals, and a downloadable HACCP planning wizard.

Fact-finding Mission Related to Production of Channel Catfish in China

Carole Engle, Professor
David Heikes, Extension Aquaculture Specialist

Dr. Carole Engle and Extension Specialist David Heikes traveled to China from October 17 through the 28th to learn and acquire facts about their channel catfish production. Starting in Jiangsu Province they toured farms raising channel catfish in ponds, hatcheries, and processing plants that raise and export channel catfish to the United States. In Hubei Province they met with aquaculture scientists of the Fisheries College of Huazhong Agricultural University and interviewed farmers in several locations throughout the province. In Hubei, channel catfish are raised primarily in cages in reservoirs that were constructed for hydroelectric power and water supplies for cities and municipalities. Engle and Heikes visited a 24-hour live fish wholesale market in Wuhan and observed live sales of channel catfish in restaurants and supermarkets in various locations. In Shanghai they visited faculty at Shanghai Fisheries University and toured the Oriental International Fisheries Market, the largest wholesale fish market in China that sells primarily frozen marine fish products.

Overview of Development of the Catfish Industry in China

China is a country with an extensive geographic area, a large population, and an economy that is growing at a rapid rate. Chinese people have a history of working communally to achieve dramatic engineering objectives. The opening of China to market forces has unleashed an entrepreneurial spirit to accompany a sense of organization and joint work. The rapid economic growth in China is accompanied by rapid increases in both

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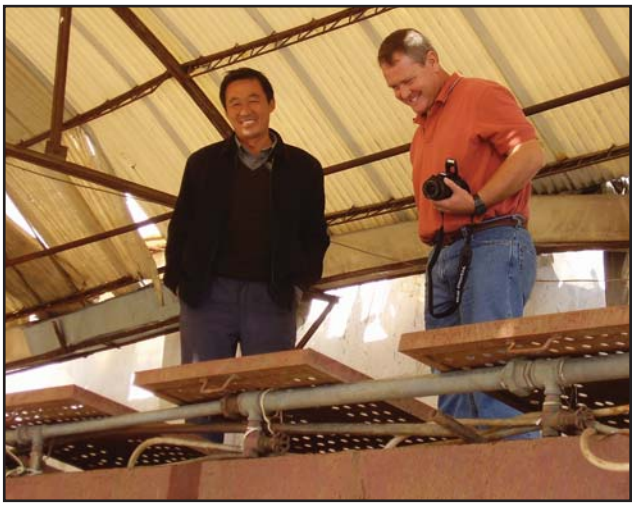
housing costs and incomes. While wage rates remain low, there is clear upward pressure on wage rates, incomes, and costs. It is difficult to predict how quickly costs will rise.

Channel catfish eggs have been imported into China a number of times from 1984 through 2007. The purpose of the introduction of eggs has been to develop broodstock and a future source of supply of fry and fingerlings. The introductions were done systematically from different sources and different strains to increase the overall gene pool of channel catfish. Channel catfish are not an anomaly. Chinese scientists have imported a large number of species for development as future broodstock for future fry production. This is also true for other segments of plant and animal agriculture in China. There now are several channel catfish hatcheries that have ample stocks of broodstock and are well equipped to supply large numbers of fingerlings for catfish production.

Catfish are produced in both ponds and cages in China. Some catfish are raised in small-scale polyculture ponds for sale in local markets. However, the majority of catfish production is large-scale that is targeted towards export to the U.S. The pond farm visited had large ponds, used aeration, and achieved yields similar to those in the U.S. Production is seasonal of single sizes of catfish in single batch. This farm was located in Jiangsu Province, where the government is actively encouraging settlement of new lands being created by sedimentation from the Yangtze River. The government is actively encouraging the development of companies to farm these lands and produce crops for export. The model seen is one of a company that dictates basic management practices, provides fingerlings, and provides 70% of the working capital at no interest charge to tenant farmers. Cages are being used in reservoirs and lakes. The general consensus is that cage-raised fish are of higher quality because there is less off-flavor. However, increasing concerns over water quality have resulted in some restrictions in access to reservoirs for cage production.



David Heikes inspects a transport truck in Huaian, Jiangsu Province that was delivering channel catfish to the plant for processing.

Catfish Marketing, Processing, and Export

There are native catfish of several species that are sold and eaten in China. Channel catfish are also being sold in restaurants and supermarkets in a number of cities in China. Channel catfish are priced as a mid-priced fish, higher than carps, but lower than the prices of the more preferred carnivorous species.

The catfish processing companies visited were both food processing and export companies that also processed crawfish. Given that crawfish are harvested and processed from March through August, processing catfish from September through February complements the crawfish processing schedule. These companies all had prior experience with export of processed food products to the U.S.

Effects of FDA Requirements for Testing

Catfish prices have decreased in China as container loads of fish have been held in U.S. ports for testing. Farmers are looking for other options, and processors have suffered losses. In response, the government has initiated a testing program in which farmed product is tested twice a year on the farm for nine different substances. One processing facility has begun construction of their own testing laboratory to check fish. At the same time, there is little apparent control over the availability and use of antibiotics and other chemicals used for aquaculture. A number of compounds sold for use in aquaculture are not approved for use in the U.S.

Water Supplies

Water supplies observed in China in use for fish production were surface water, from rivers and lakes. China is struggling with serious environmental problems of air and water quality. These problems will make it difficult to prevent contamination of fish products. There is increasing concern over the quality of water in the reservoirs, primarily because these reservoirs constitute the drinking water supply for many cities.

Engle and Heikes compiled detailed information on production and processing methods being used to produce channel catfish in China as well as price and cost information. A series of articles is planned for *The Catfish Journal* to make this information available.

Using Farm Bills to Evaluate Pumping Plant Efficiency

George Selden
Extension Aquaculture Specialist
Phil Tacker, UA Extension Engineer

In order to keep raising fish, the producer needs to make a profit. As a result, the producer should routinely evaluate production inputs. Pumping cost is a production input that should be evaluated to determine if it is higher than it could or should be.

Pumping cost is basically composed of three parts. The first is water management, which is determined by the producer. Reducing the total volume pumped reduces the total cost. The second component is the price of energy which farmers have little or no control over. However, in some areas electrical rates might be structured to offer lower rates at certain times of the year. By filling ponds during these times, some savings might be realized. The ability to purchase diesel in bulk can also help reduce the cost per gallon in most cases. The third component is related to the pumping plant performance. The efficiency of the well also plays a part, but it is largely determined by the design and construction of the well. If the screen or gravel pack are poorly designed or constructed, lower flow and a greater drawdown result, and very little can be done to improve a poorly constructed well.

The pumping plant performance can be evaluated if a producer can access certain information such as discharge rate, pressure at the pump, pumping depth, depth of water applied, acres of ponds filled, fuel cost, and total fuel bill. This information can be used with some published guidelines to calculate efficiency, and determine whether or not to repair or replace a pumping plant.

Many farmers also run electric aerators on the same electrical account as their well pumping plants. In these cases, it would be more accurate to do an analysis like this for pumping done during the winter or other times of the year when the aerators are not in use.

There are many causes of excessive energy use associated with pumping plants. The following procedure is only a relative indicator of total pumping plant performance. It does not indicate the source or sources of the excessive fuel use. Low efficiency may be due to excessive pump clearance, worn impellers, or changes in pumping conditions since the pump was installed. Engines, gear heads and the components of the well (screen, gravel pack etc.) can also contribute to poor performance. In some cases it might not be possible for the producer to perform his own pumping plant evaluation. Another alternative may be to contact a well driller or irrigation dealer to see if they can conduct a pumping plant evaluation.

Step 1: Determine the discharge pressure at the pump (PSI). Pressure is typically measured in pounds per square inch (PSI). Pressure head should be measured with a good quality, liquid-filled pressure gauge. Gauges that have been in the field for several years may not be reliable.

Step 2: Determine the total pumping depth or lift in feet (ft). The depth to water in a running well can be measured in two ways. The first method consists of lowering a rusty steel measuring tape between the well column and casing. A watermark will remain on the rusty tape upon retrieval and the distance from the watermark to the pump discharge can be measured as the depth. If a new steel tape is used, it is usually possible to apply carpenter's chalk to the tape so the water line can be determined. The second method involves using the water to complete an electrical circuit. A battery and ammeter are connected in series with an insulated wire lead connected to the metal well casing. A second insulated wire lead is lowered into the well. When the lead contacts the water, the electrical circuit is completed and a current flow is indicated on the ammeter. If the well casing is not metal then both wire leads can be lowered into the well until they both hit water to complete the circuit. Depth to water is obtained by measuring the electrical lead length.

Step 3: Determine the system discharge rate in gallons/minute (GPM). This is best measured with a flow meter installed on the system. If a flow meter is not available then a plumb bob method can be used to measure the discharge rate. The plumb bob method is discussed in the *Rice Production Handbook* available from the Cooperative Extension Service. http://www.aragriculture.org/soil_water/irrigation/crop/Rice/pumpflow.htm

Step 4: Determine the total dynamic head in feet (TDH). Total dynamic head (TDH) is the total hydraulic resistance against which the pump must operate. Total dynamic head (in feet) is usually estimated by adding the total pumping depth or lift, and discharge pressure at the pump. Pressure is typically measured in PSI, so PSI is converted to feet of head by multiplying PSI by 2.31.
TDH= (ft + (PSI *2.31))

Step 5: Determine the water horsepower (WHP). The water horsepower is the amount of work done on the water. It is the product of the total dynamic head (TDH) in feet and the discharge rate (GPM) in gallons per minute divided by a standard factor for proper unit conversion.
WHP = TDH * (GPM/3960)

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Table 1: Selected Capital Recovery Factors (CRF)

Length of Loan or Length of Useful Life	Annual Interest Rate (%)				
	5	7	10	12	15
2	.5378	.5531	.5712	.5917	.6151
3	.3672	.3811	.4021	.4163	.4380
4	.2820	.2952	.3155	.3292	.3503
5	.2310	.2439	.2638	.2774	.2983
7	.1728	.1856	.2054	.2191	.2404
10	.1295	.1924	.1627	.1770	.1993
15	.0963	.1098	.1315	.1468	.1710

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Step 6: Determine the total hours of pumping (HR). If the total hours of pumping (HR) have not been recorded, they can be estimated with the following formula:
HR = D *Ac/(GPM/450)
HR = hours of pumping
D = depth (in inches) of water applied
Ac = acres of ponds
GPM = system discharge rate (Step 3)
450 = constant related to the fact that 450 gpm is equal to 1 acre-inch/hour

Step 7: Determine the Nebraska Performance Criteria (NPC). The Nebraska Performance Criteria (NPC) is a guideline for the performance of a properly designed and maintained pumping plant. It can be used as a guide for estimating pumping plant energy requirements in WHP-HRS per unit of fuel.

Energy Source	*Nebraska Performance Criteria*
Diesel	12.50 WHP-HRS/gallon
Propane	6.89 WHP-HRS/gallon
Natural Gas	61.70 WHP-HRS/MCF
Electricity	0.885 WHP-HRS/kilowatt-hour

Step 8: Estimate Hourly NPC Fuel Use (FU). The hourly fuel use (FU) of an efficient pumping plant can be estimated by dividing the water horsepower of the pumping plant (WHP) estimated in Step 5 by the Nebraska Performance Criteria (NPC) selected in Step 7.
FU = WHP/NPC

Step 9: Estimate Seasonal NPC Fuel Cost (SFC). The seasonal fuel cost (SFC) of an efficient pumping plant operating according to the Nebraska Performance Criteria can be estimated with the following formula:
SFC = FU * HR * Cost
SFC = seasonal fuel cost if pumping plant was operating at NPC
FU = fuel use (Step 8)
HR = hours of operation (Step 6)
Cost = $/fuel unit

Step 10: Determine Excess Fuel Cost (EFC). Excess fuel costs (EFC) can be thought of as an annual payment to cover the cost of pumping plant repair or replacement, or the excess cost of running an inefficient pumping plant. The excess fuel cost is the actual fuel cost (AFC) in dollars estimated from your bills minus SFC from Step 9.
EFC = AFC – SFC

Step 11: Calculate Annualized Repair Cost (ARC). The investment required to repair or replace the pumping plant can be annualized when multiplied by the capital recovery factors (CRF) from Table 1.
ARC = Investment * CRF
If the annualized repair/replacement cost (ARC) for the interest rate and return period selected is less than the excess fuel cost (EFC), the investment to repair or replace the pumping unit is merited. In some cases where the ARC is larger than the EFC, the replacement or repair may still be justified if the benefits of the replacement or repair will last longer than the length of the loan. The producer could estimate the useful life of the repair and use that length of time, rather than the length of a loan, to get the CRF number from Table 1 for the ARC calculations.

Step 12: Determine the Justified Upgrade Cost (JUC). The excess fuel use could also be divided by the CRF (table 1) to indicate the amount you could justify spending on upgrading the pumping plant.
JUC = EFC/CRF
If the investment is less than the JUC for the interest rate and return period selected, the investment to repair or replace the pumping unit is merited.

Catfish Trematode Project - Year Two Update

Larry Dorman
Extension Aquaculture Specialist
Andy Goodwin, Professor

As a follow-up to the 2006 statewide catfish trematode survey, a new survey was conducted in Arkansas throughout the summer of 2007 to look at the prevalence of trematodes on 63 farms across the state.

On each farm, a random sample of ponds representing 20 to 40% of the farm water acreage was inspected for the presence of the catfish trematode. Fish were collected by seine hauls near the permanent aerators or well discharge using a 60 foot seine with a ½ nylon mesh material. The desired sample size was 30 fish from each pond, or a maximum of three seine hauls. Trematode infestation was evaluated and ranked by counting the number of trematodes on each captured fish. Fish having 1 – 10 trematodes was considered light infestation, 11 – 20 trematodes moderate, and 21 and higher as high infestation. Additionally the presence of the rams' horn snail, vegetations, and levee condition was noted.

Statewide, 389 ponds were surveyed from June 12 to August 15, 2007. This consisted of 41 ponds on seven farms in Northeast Arkansas, 12 ponds on four farms in Southwest Arkansas, and 336 ponds on 52 farms in Southeast Arkansas. Small rams' horn snails (around 5 mm in diameter) were found in Northeast and Southwest Arkansas. However, no catfish trematode was found in those two regions.

In Southeast Arkansas, the catfish trematode was present in 24% of the ponds and 46% of the farms surveyed. Although the catfish trematode is scattered throughout the Chicot/Ashley County area, the problem area appears to be south of the Jenny – Portland Road (Jenny Cut-Off as it is locally called) extending west just past the Ashley/Chicot County line and running south to the Louisiana border. This coincides with good habitat for white pelican including Bayou Bartholomew, Lake Wilson, Lake Enterprise, Mallard Brake, Hubbard Brake, Lafourche Lake, Overflow National Refuge, and numerous sloughs and reservoirs.

Results from the 2007 trematode survey are similar to the results obtained in 2006. Throughout the summer of 2006, a total of 326 ponds across the state were inspected for the presence of catfish trematodes. No catfish trematodes had been found in Northeast and Southwest Arkansas. However, the catfish trematode was present in 22% of the ponds and 50% of the farms surveyed in Southeast Arkansas in 2006.

Table 1. Incidence of catfish trematode on a selected catfish farm before and after stocking black carp.

Pond	Before black carp		After black carp	
	Fish sampled	Fish with trematode	Fish sampled	Fish with trematode
A	35	0	36	3
B	30	0	30	0
C	32	7	30	0
D	36	17	32	0
E	30	3	40	0
F	30	11	30	0
G	30	0	30	0
H	36	15	34	4
I	30	6	30	1
J	30	0	30	5

Is There Hope?

Stocking the black carp looks encouraging. When black carp are stocked at a rate of 20 per acre, sufficient control of the rams' horn snail is achieved. Farmers who stocked black carp in 2006 are reporting fewer problems with the catfish trematode and are reporting improved fish feeding.

Table 1 compares the incidence of catfish trematode on a selected farm in 2006 before stocking black carp and in 2007 after stocking black carp. From this particular example, one can see that the proportion of fish infected with trematodes decreased in six of the 10 ponds after black carp were stocked. In fact, trematodes appeared to have completely disappeared in four of those ponds. However, trematode numbers increased in two other ponds even after stocking black carp.

Black carps are not a cure for the problem, but likely a good management tool. With the recent U.S. Fish and Wildlife Service declaration of black carp as an "injurious species" it is a must to prevent loading black carp on the trucks hauling catfish to processing plants out-of-state.

A final report on the catfish trematode surveys should be published in 2008. The authors thank the Arkansas Catfish Promotion Board for funding the study and thank the following interns for their help with pond sampling: Jay Porter, Philip Davis, Nick Kelley, Chad Hayden, Quentin Gayfield, M. J. Sartin, and Jacob Dorman.

New Extension Specialist at UAPB Lonoke Laboratory

Dr. Anita M. Kelly is the new Fish Health Extension Specialist at the UAPB Lonoke Fish Disease Diagnostic laboratory. Dr. Kelly came to Arkansas from Southern Illinois University, where she taught and conducted research in various aquaculture topics. Anita has eight years of experience in the private sector as the manager of two private fish farms. As a result, Anita has experience working with a variety of aquatic organisms including channel catfish, blue catfish, trout, white suckers, largemouth bass, fathead minnows, various sunfish species, grass carp, freshwater shrimp, walleye, yellow perch, striped bass, white bass and hybrid striped bass.

Anita has served on several committees related to aquaculture which include serving as a member of the Task Force on Aquatic Nuisance Species, member of the Aquatic Chemicals Subcommittee, a member of the Technical Research Committee for the North Central Regional Aquaculture Center, and is a Past President of the Fish Culture Section of the American Fisheries Society. Her research interests have included investigations into alternative methods of snail control in aquaculture ponds, studies to gain FDA approval of chemicals used in aquaculture, the effect of feed ingredients on sex determination and spawning in fish, and examining the role of previous experience with predators and prey on the survival of stocked fish species.

In her new position at the UAPB Lonoke Laboratory, Dr. Kelly will be taking responsibility for the oversight of the Lonoke Diagnostic program and will be responsible for addressing a broad range of health and husbandry issues. You can contact Anita at akelly@uaex.edu or via phone 501-676-3124 or mobile 501-628-2807.

VHS Update

Andy Goodwin, Professor

The outbreak of Viral Hemorrhagic Septicemia (VHS) virus that began in the Great Lakes is still a significant problem. In 2007, the virus spread to Lake Michigan and was found in inland lakes in Wisconsin, Michigan, and New York. The virus has not been detected on any fish farms. Concern over spread of the virus is driving rapid changes in State and Federal fish health regulations. Arkansas now has a very comprehensive regulation designed to prevent the importation of VHS from the Great Lakes region. The USDA (APHIS) has not yet come out with the VHS Interim Rule, but it is expected to be released very soon. My guess is that the new rule will apply only to officially susceptible species shipped from officially positive states and that it will provide more detailed guidance regarding conditions and inspections needed for transport. This regulation is also likely to further complicate the movement of baitfish within and out of the Great Lakes watershed.

The Arkansas aquaculture industries are, as usual, out in front in their response to VHS. Arkansas farmers and associations have been prominent at national meetings regarding VHS policy and in crafting an industry response designed to promote the continued movement of safe Arkansas products. These efforts include support by the Catfish Farmers of Arkansas (CFAR) for additional APHIS funding for VHS control and indemnification, and recent active participation in a draft plan designed to prevent the interruptions of catfish shipments that would occur if Arkansas or Mississippi were declared VHS positive. That plan is currently under review by the CFAR and Catfish Farmers of America. In the bait and ornamental fish industries, strict adherence to more complex fish inspection programs, including the Arkansas State Bait and Ornamental Fish Certification Program, has clearly prevented a loss of markets that could have easily occurred in the post VHS world.

Arkansas farmers should be extremely careful about any importation of fish in any way linked to the Great Lakes region and to be sure that all fish brought into Arkansas have been inspected for VHS and other diseases. Check with your UAPB Fish Disease Diagnostic Laboratory for help in assessing the risk associated with a fish importation and in interpreting fish inspection reports provided by other farms. Farmers also need to keep a careful eye on changing interstate regulations. Updates are given regularly to those farms that provide an e-mail address to Andy Goodwin at agoodwin@uaex.edu.

For additional information on the APHIS VHS Emergency Rule and the APHIS VHS susceptible species list visit:
www.aphis.usda.gov/animal_health/animal_dis_spec/aquaculture/

Newsletter Changes

You will see a number of changes in *Arkansas Aquafarming* this year. Steeve Pomerleau, Extension aquaculture specialist at UAPB, is the new technical editor of the newsletter. To ensure that you receive the information in a timely fashion, the newsletter will be published quarterly instead of biannually.

Additionally, *Arkansas Aquafarming* has a new look and the electronic version (PDF format) of the newsletter is now accessible in color at the following address:
www.uaex.edu/aqfi/newsletters/

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Evaluate the performance of a pumping plant by following simple guidelines. See article on page 4.

Larry Dorman and his crew conducting a state-wide trematode survey. See article on page 6.

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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.