EXTENSION NEWSLETTER

Catfish Update Meeting moved to Greensboro

The Alabama Catfish Conference 2019 (formerly known as the Demopolis Catfish Update Meeting) will be held on Tuesday, December 3, 2019, at the **Hale County College and Career Academy** located on Highway 69 North in Greensboro. This meeting will provide an update on research activities within the Alabama catfish industry. Lunch will be served and there will be a drawing for several door prizes. Registration begins at 8:00am and the meeting will conclude at 1:30pm.

Proper Use of Medicated Feeds in Catfish Aquaculture

Anita M. Kelly, Luke A. Roy, Alabama Fish Farming Center

Disease problems are a common occurrence in catfish aquaculture. The major diseases in west Alabama, Columnaris, *Aeromonas*, and ESC, are bacterial. Unfortunately, the industry only has three antibiotics, Aquaflor, Romet, and Terramycin 200, that can be used to combat bacterial diseases. Since it is unlikely that any new antibiotics for catfish will be approved soon, appropriate use of medicated feed is crucial. Here are the general steps to obtaining antibiotic feed. Your vet or local fish health specialist will examine your fish and determine which disease is present. If the fish health specialist makes a diagnosis, a report is written and sent to your veterinarian.

The veterinarian writes the Veterinary Feed Directive (VFD) and sends a copy to you and the feed mill. The feed mill makes the antibiotic feed and delivers it. This method of obtaining feeds containing antibiotics was changed to help reduce antibiotic resistance. In the good old days, you could go to the local farmers' coop and purchase many antibiotics over the counter. With the increase in the number of bacteria that are becoming antibiotic-resistant, the FDA changed the law requiring antibiotics in feeds to be obtained by a VFD from a licensed veterinarian. Having your fish diagnosed by a fish health professional or your veterinarian ensures that your fish are correctly diagnosed. Just like in human medicine, antibiotics do not work against viruses or parasites, only bacteria. Getting

the proper diagnosis, ensures that you do not purchase a medicated feed that is not approved or does not work for the disease the fish have. If your fish do have a bacterial infection, your vet will prescribe the appropriate approved antibiotic.

The extra-label use of VFD drugs is allowed in minor species in the United States. "Extra-label use" is defined in FDA's regulations as the actual or intended use of a drug in an animal in a manner that is not following the approved labeling. For example, feeding fish Romet for ten days instead of five days would be considered extra-label use. Another example is Aquaflor, approved for use in catfish with Columnaris disease, ESC, and Streptococcus infections (Table 1). For fish that have an *Aeromonas* infection, your veterinarian can prescribe Aquaflor but will only do so if Terramycin 200 failed to work.

Veterinary Feed Directives do expire. The veterinarian can write a VFD that is valid for up to 6-months, but once the VFD expires, the VFD feed cannot be fed.

Sick fish need the appropriate amount of antibiotics, so feed your fish the required amount and for the time recommended for the antibiotic used. For example, if your fish stop dying after feeding Aquaflor for four days, do not stop feeding them medicated feed. Short term feeding of antibiotics only enables the bacteria to develop resistance to that antibiotic. Eventually, the antibiotic will no longer work against the bacteria, resulting in higher fish losses and fewer antibiotics for use in fish.

Additionally, you want to feed your sick fish as much feed as your non-sick fish. Sometimes sick fish do not eat as vigorously as non-sick fish but feed them what they will eat. Do not limit the amount of feed to ½ or ¼ of the regular feeding amount to save money. Again, this promotes the development of antibiotic-resistant bacteria, and more fish will die because they did not have access to medicated feed.

It is also important to abide by the withdrawal times listed on the label of antibiotic feeds. The U.S. Department of Agriculture Food Safety Inspection Service (FSIS) monitors antibiotic residues in catfish flesh periodically using fish samples taken at processing plants. The harvest of fish that have been fed an antibiotic feed and not gone through the entire withdrawal period could result in detection of an antibiotic residue in your fish.

The way antibiotic feed is stored is important. The storage conditions for antibiotic feed are dry conditions at temperatures listed in Table 1. In Alabama, the ten-year average summer high temperatures from May to October are in Table 2, with the actual average monthly highs for 2019 (up to October 7, 2019). Based on a 10-year average, the months of June, July, and August have temperatures at or above 90^0 F. However, examining the monthly

Table 1. FDA approved antibiotics for use in catfish aquaculture.

Antibiotic	For Treatment of	Treatment and withdrawal periods	Storage conditions
Aquaflor	• Columnaris disease • Enteric septicemia of catfish (ESC) • *Streptococcus* infections	• Feed for 10 consecutive days • 15-day withdrawal period	Store at temperatures up to 77^0 F with occasional storage permitted to 104^0 F
Romet TC	• ESC	• Feed for 5 days • 3-day withdrawal time	Store dry at or below 77^0 F with occasional storage permitted to 99^0 F
Terramycin 200	• *Aeromonas* and *Pseudomonas* infections	• Feed for 10 days • 21-day withdrawal time	Store at room temperature (77^0 F)

temperatures in 2019, indicates that 90^0 F and above temperatures started in May and have lasted through September and into the first week of October. If you are storing feed outside in a feed bin or feed truck, chances are the temperature of the feed is going to equal or exceed that of the surrounding air temperature. Storing medicated feed longer than the recommended treatment period will likely lead to degradation over time. Only order what you need, and this will reduce or eliminate the need to store medicated feed and makes sure your fish get the amount of antibiotic required.

To properly use antibiotic feed, remember to get the correct diagnosis, use the right antibiotic, feed the animals the prescribed amount for the required time, and do not store antibiotic feeds for long. Following these guidelines will save money and prevent antibiotic-resistant bacteria on your farm.

Table 2. Ten-year average monthly temperatures and actual average monthly temperatures for western Alabama, as reported by the National Weather Service.

Month	10-year Average Temperature	Average Temperature for 2019
May	84	90
June	91	91
July	93	92
Aug	93	93
Sept	88	96
Oct 1-7	78	97

Management of off-flavor in commercial catfish ponds before winter water temperatures arrive

Luke A. Roy, Anita M. Kelly, Alabama Fish Farming Center

Off-flavors are a big problem in the summer months in west Alabama and this year has been no exception. Prolonged high pond water temperatures throughout the summer and into early October this year have created a situation in which blue-green algae, which are the primary cause of off-flavor in catfish, have been able to thrive. The Fish Center had a much larger than usual number of farms reporting issues with blue-green algae this summer and fall.

The management of blue-green algae that produce off-flavors is complex and can be expensive. While a small number of farms elect to use a proactive approach to prevent blue-green algae, most catfish producers typically treat problematic ponds as off-flavor issues arise in the few weeks just prior to harvest. If fish sampled from a commercial pond before harvest are determined to be off-flavor, treatment of pond water with algicides (such as copper sulfate, Diuron, and others) can be an effective strategy to eliminate the odor-producing algae that cause off-flavor in catfish.

An important thing to remember is that water temperature and the fat content of the fillet both influence how fast off-flavors can be purged from catfish. Early fall is a good time to check the status of off-flavor in your ponds. If off-flavor is detected there is still time to kill problematic blue-green algae while there is warm water available to effectively purge the odorous compounds from the catfish. If off-flavor issues are not dealt with prior to the onset of colder winter water temperatures, the problem may persist throughout the winter and make it difficult to sell your fish. If you have any questions regarding the management of off-flavor at your farm contact the Alabama Fish Farming Center.

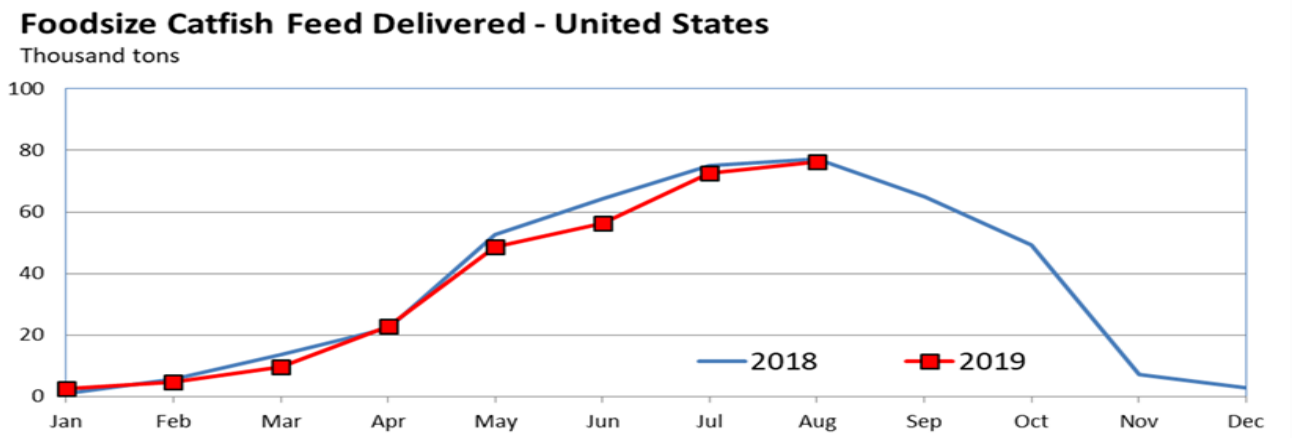
US Farm-Raised Catfish Industry Update

Dr. Terry Hanson, AU SFAAS

The US farm-raised catfish industry is doing well in feeding this year and producers are receiving higher prices for fish. The following is a brief update on the feed delivered to the US and Alabama catfish industries. Following that is a brief update on the US catfish processing sector, including prices paid to producers and quantities processed.

Feed Delivered

Through August 2019, the US and Alabama farm-raised catfish industries have fed foodsize catfish at 94%, and have fed fingerlings and broodfish catfish at 128% of the 2018 levels. At the US level, 293,451 tons of foodsize catfish feed has been delivered and 32,132 tons of fingerling and broodfish feed has been delivered through August 2019. In Alabama, 78,653 tons of foodsize catfish feed has been delivered through August.



Foodsize Catfish Feed Delivered - Alabama: 2018-2019

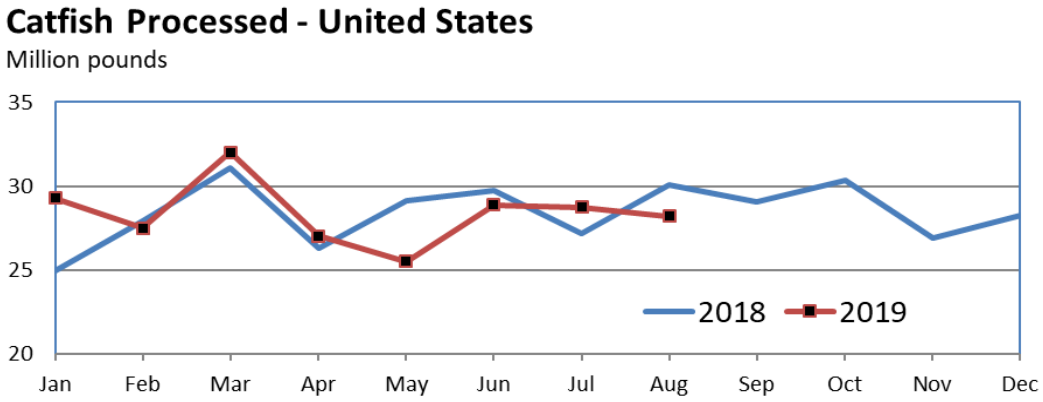
[Blank data cells indicate estimations period has not yet begun.]

Month	By month		2019 as a percent of 2018	Cumulative		2019 as a percent of 2018
	2018	2019		2018	2019	
	(tons)	(tons)	(percent)	(tons)	(tons)	(percent)
January	457	1,211	265	457	1,211	265
February	2,483	2,372	96	2,940	3,583	122
March	3,597	2,856	79	6,537	6,439	98
April	5,116	4,667	91	11,653	11,106	95
May	12,245	12,577	103	23,898	23,683	99
June	16,337	15,633	96	40,235	39,317	98
July	23,366	19,778	85	63,601	59,095	93
August	20,472	19,558	96	84,073	78,653	94
September	17,048			101,121		
October	12,726			113,847		
November	2,566			116,412		
December	1,433			117,845		

Catfish Processing

Cumulative January through August 2019 processing quantities were equal for the same period in 2018 at 227 million pounds.

Farm-raised catfish processed during August 2019 totaled 28.2 million pounds round weight, down 6 percent from August 2018.

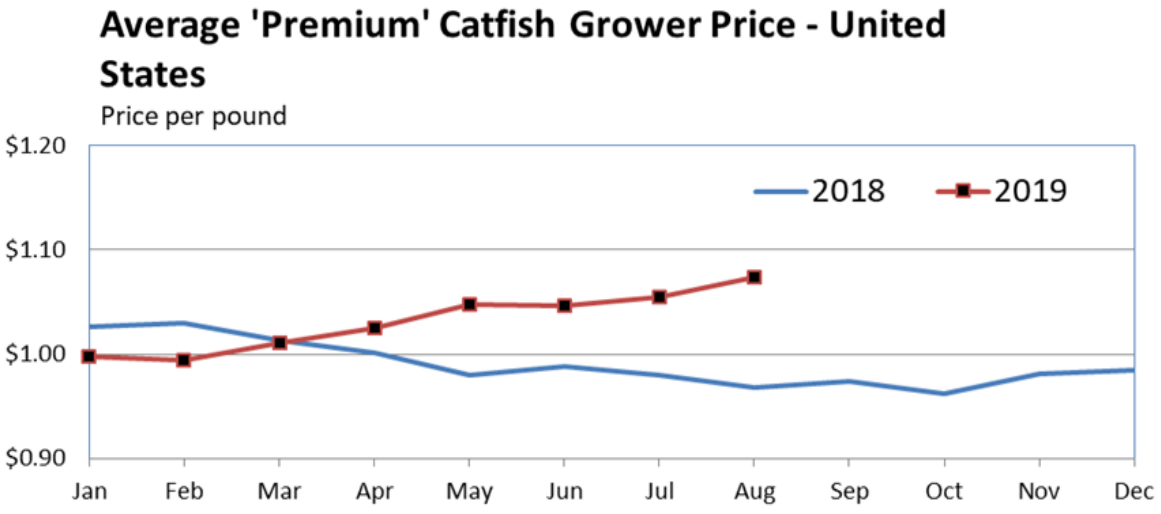


Prices received for August 2019

- Industry-wide catfish prices were up.
- Over all catfish size categories, the price received was 104.1 cents per pound.
- "Small" fish (< 1 pound) received an average price of 106.6 cents per pound, up 7.1 cents per pound from August 2018, and up 1.5 cents from July 2018. "Small" sized fish made up 6.8 percent (1.9 million lb) of all processed fish.
- "Premium" sized live fish (1 to 4 pounds) received an average price of 107.3 cents per pound, up 10.5 cents per pound from August 2018, and up 1.8 cents from July 2018. "Premium" sized fish made up 83.4 percent (23.5 million lb) of all processed fish.
- "Large" fish (4-6 pounds) received an average price of 90.3 cents per pound, up 35.0 cents per pound from August 2018, and down 2.1 cents from July 2018."Large" sized fish made up 7.1 percent (2.0 million lb) of all processed cat-fish.
- "Very Large" fish (6-8 pounds) received an average price of 38.7 cents per pound. "Very Large" sized fish made up 1.9 percent (0.5 million lb) of all processed fish.
- "Extra-Large fish (greater than 8 pounds) received an average price of 20.3 cents per pound. "Extra Large" fish made up 0.8 percent (0.2 million lb) of all processed fish.

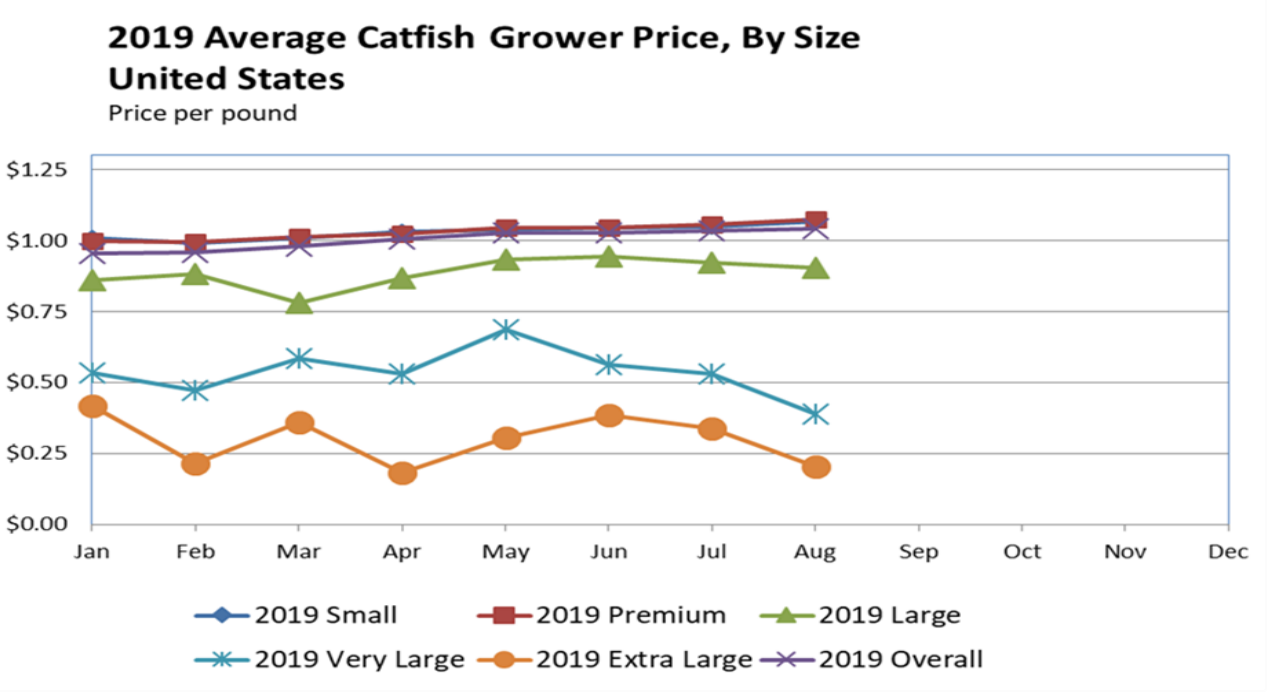
Note: the average price paid to producers includes charges for any services provided by the processing plant, such as seining and hauling.

Comparing 2018 and 2019, "Premium" sized catfish prices by month shows an upward trend in 2019, a good sign for producers.



Catfish prices by size category for January through August 2019 show “Small”, “Premium” and “Overall” sized catfish were priced closely together. “Large” sized fish have received lower prices but much closer to small and premium than the larger sized fish categories (“Very Large” and “Extra Large”).

Small is less than 1 pound; Premium is 1-4 pounds; Large is 4-6 pounds; Very Large is 6-8 pounds; Extra Large is greater than 8 pounds; and Overall is the price weighted by quantity and price from each size category. Fillet sizes coming from <1 lb live catfish range from 2-3 ounces; from 1-4 lb fish, fillets range from 3-12 ounces; from 4-6 lb fish, fillets range from 12-16 ounces; from 6-8 lb fish, fillets range from 16-22 ounces; and from >8 lb fish, fillets range above 22 ounces.



Reminder to Obtain 24(c) Labels

Anita M. Kelly, Luke A. Roy, Alabama Fish Farming Center

It is that time of year when producers should be obtaining the 24(c) labels for 2020 for Karmex® DF, Karmex® XP, or Direx® 4L, all of which contain the active ingredient diuron. These brands were not originally approved by the EPA for use in aquatic environments. However, a FIFRA Section 24(c) special local needs registration is available for producers to legally use these brands for controlling off-flavor. For catfish producers to legally use these chemicals they must have the 24(c) labels in their possession at the time of application. Alabama catfish producers can obtain a copy of the labels from the Catfish Farmers Registration Corporation. To qualify for the label 1) you must have a current Alabama Private Applicator permit, 2) you must sign and submit the Acknowledgement and Release form and 3) you must be a member of the Catfish Farmers of America.

The Catfish Farmers Registration Corporation is required to report the usage of these chemicals every year. Since you are filling out the form prior to purchasing the chemical, you will be asked to estimate your usage for the year. This estimate should be based on the application rate as stated on the supplemental labels (0.5 oz per acre foot for Karmex® DF and Karmex® XP and 0.8 oz per acre foot for Direx® 4L) and prior use experience. Remember that these chemicals can only be used once every seven days, but no more than nine applications per year. You should have received a letter with all the necessary paperwork to obtain the labels for 2020. If you have any questions, please feel free to contact the Alabama Fish Farming Center.

Hybrid catfish aquaculture: Dads really do matter

Jaelen Myers, Rex A. Dunham, and Ian A.E. Butts, School of Fisheries, Aquaculture & Aquatic Sciences, Auburn University, Nagaraj Chatakondi, USDA-ARS Warmwater Aquaculture Research Unit, Stoneville, MS

Fish populations, both wild-caught and farmed, depend upon high-quality gametes (sperm and eggs) for production of viable offspring. Maternal contributions (from mom) to the progeny are the product of both genetic material and non-genetic, environmentally influenced material (the yolk supply). In many fish species, the yolk acts as the primary energy reserve from fertilization of the egg to first feeding. These yolk reserves, arising during development and maturation of the eggs, have been shown to influence the size of fry at hatch, age at first feeding, starvation tolerance, and survival rates during the first-feed transition. On the contrary, paternal contributions (from dad) to the offspring are solely the product of nuclear-genetic material. Only a limited number of studies have demonstrated that paternal genetic effects contribute to variation in morphology and performance during the early life history stages (i.e. egg to early juveniles) of fish. This is mainly because researchers often pool milt from multiple males, and thus, those studies are not equipped to detect potential paternal differences. However, when properly designed to test for paternal effects, many experiments have shown that paternity can, in fact, account for a significant portion of variation in phenotypic expression and survival.

Given this knowledge, in our recent work we wanted to assess how much mom and dad actually contribute to offspring during important early life stages for hybrid catfish production. Here, blue catfish males and channel catfish females were paired to create 20 unique hybrid families. Offspring from each family were then split into 2 temperature-controlled environments and followed over time (Figure 1), based on conditions that mimic early (80 ^{o}F) and late (90 ^{o}F) seasonal temperatures. Embryonic survival, hatch success, as well as fry morphology and deformities were quantified at hatch, during

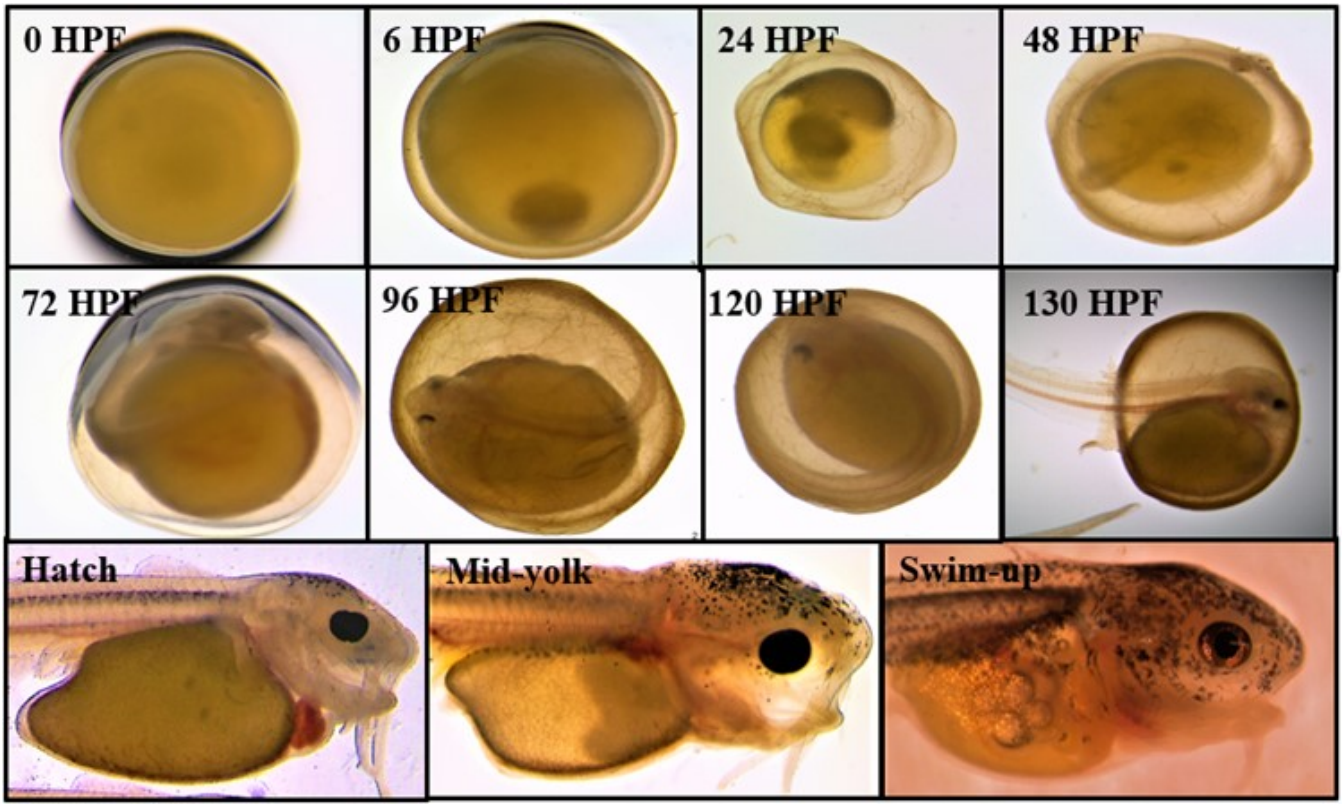


Figure 1. Timeline of the various stages of early development for hybrid catfish. Embryonic stages are denoted in hours post-fertilization (HPF) at 80 °F, followed by the three post-hatch stages we analyzed before first feeding.

the mid-yolk sac transition, and swim-up stages of development. Variation in early performance traits were then partitioned to mom and dad as well as family x environmental interactions. Embryonic survival by 120 hours post-fertilization showed substantial variability between families from 45-93% and was not impacted by incubation temperature. Instead and not surprisingly, maternal effects were responsible for large amounts of the variation (50%) but dad's contribution also became apparent during later stages (7%). High temperatures above the recommended values proved to be the enemy for hatch with a significant reduction at 90 ^{o}F (from 40% to 32% hatch). Therefore, we conclude that temperatures at the start of the spawning season yield higher hatch success, which is certainly preferable in any hatchery. Also, mom and her egg/yolk quality were very important for hatch (65% of variation), and dad continues to play a determining role (12%) for hatch. Like we saw in the embryos, hatch varied drastically between families (14-71%). More negative news regarding 90^{o} F: fry had smaller body sizes at each developmental stage due to earlier time to hatch. Matching the embryonic and hatch results, morphology indices were also influenced by the parents with mom's influence highest on yolk-related traits (up to 80%) and dad peeking through (up to 29%). Family × environmental interactions were also observed across our data spread because the extent of fish variability differed within each rearing temperature.

CONCLUSIONS - This information showed the importance of environmental conditions, parentage, and their associated interactions on hybrid fry during early development. Because of the variability between individual fish, isolating indicators of male/female quality would be particularly useful in order to develop parameters for broodstock selection. Results can also be applied to improve hatchery incubation conditions for long-term sustainable development of hybrid catfish. Although research usually gives the female component all the limelight, clearly both maternal and paternal effects (and their interactions!) are important factors influencing early offspring performance. Therefore, studies should also consider the "male" factor (i.e. sperm with genetic material) so that the best breeders from both sides can be selected for reproduction.

RESEARCH ROUND-UP

Highlights of research activities from SFAAS and USDA ARS

Applied research activities at the Alabama Fish Farming Center

Luke A. Roy, Anita M. Kelly, Alabama Fish Farming Center

The mission of the Alabama Fish Farming Center is to provide diagnostic, Extension, and research support to commercial fish farmers in west Alabama. In order to fulfill the research component of our mission, Fish Center personnel are actively coordinating or collaborating on a number of projects to carry out applied research on commercial farms.

In collaboration with Dr. Joe Tomasso (AU) ,a research project was initiated this year to evaluate stunning protocols used during catfish processing. This project was funded by the Alabama Agricultural Experiment Station (AAES) Production Agriculture Research (PAR) program. Fish Center personnel are collabor-ating on a USDA NIFA Aquaculture Initiative grant on management of toxic algae led by Dr. Alan Wilson (AU) and a project evaluating age and economic cost of big fish to the Alabama catfish industry (funded by AAES PAR; collaborators include Dr. Terry Hanson and Dr. Steve Sammons, AU). A USDA Southern Regional Aquaculture Center project will be initiated this winter with Dr. Terry Hanson (AU), Mississippi State, and Virginia Tech to carry out an economic impact assessment and monitor the progress of technology adoption in the U.S. catfish industry. Finally, funding has been secured via USDA ARS in collaboration with Dr. Ben Beck (USDA ARS Aquatic Animal Health Laboratory, Auburn, AL) for integrated research to improve aquaculture production and aquatic animal health in warmwater aquaculture in west Alabama (includes both catfish and shrimp).

The Fish Center is also working with Dr. Allen Davis at Auburn University on alternative ingredients (such as kaolin clay) for commercial catfish feeds to improve immunity and decrease overall feed cost by using supplemental amino acids.

The majority of research carried out at the Fish Center is to support the west Alabama catfish industry. However, a number of funding sources have been garnered recently for projects with shrimp. A water bird project was secured (in collaboration with Dr. Mark Smith, Forestry and Wildlife – AU and Dr. Brian Dorr, USDA APHIS National Wildlife Research Center) to evaluate bird depredation impacts on farmed shrimp in Alabama. Other shrimp projects include a USDA NIFA Small and Medium Rural Farms project for development and optimization of an economical salt formulation for inland rural shrimp production (grant involving Kentucky State University, Purdue University, and Allen Davis from AU) and an Alabama Experiment Station (AAES AgRSEED program) project evaluating thermal tolerance of shrimp in low salinity water (in collaboration with Dr. Jim Stoeckel, AU). The Fish Center is actively working with scientists from the USDA ARS Aquatic Animal Health Laboratory (Dr. Ben Beck and others) on a number of production and health related issues to support inland shrimp and crawfish farmers in west Alabama.

In order to increase Auburn University's capacity to carry out research in west Alabama a new research building will be constructed in the next year at the Fish Center facility in Greensboro. This new addition will allow for small-scale controlled research and is being built to support Dr. Kelly's research program in aquatic animal health. In addition to the projects discussed in this article, a number of grants have been submitted in 2019 to address different problems faced by the commercial catfish industry.

Fish health research updates for 2019

Benjamin Beck[1], Craig Shoemaker[1], Mediha Aksoy[1], Dunhua Zhang[1], Troy Bader[1], Eric Peatman[2], Miles Lange[1], S. Adam Fuller[1], and Mark Liles[2]

[1]United States Department of Agriculture, Agricultural Research Service, Aquatic Animal Health Research Unit, Auburn, AL 36832, USA

Mortality due to hypervirulent *Aeromonas hydrophila* (vAh) has resulted in over $70 million in losses since 2009 with outbreaks still prevalent particularly in west Alabama and east Mississippi. Since it was first described in US catfish, investigators have spent a substantial amount of time attempting to reproduce the disease under laboratory conditions, which is essential to develop control strategies. Scientists with the USDA ARS Aquatic Animal Health Research Unit (AAHRU) in Auburn, AL pioneered research demonstrating that wounding, feeding status (fed fish are more susceptible than unfed fish) and restricting iron from vAh all contribute to disease progression and mortality. These studies resulted in better laboratory models to infect catfish and have opened the door for the testing of vaccines and other alternative vAh control strategies.

USDA ARS AAHRU scientists, along with colleagues from the Auburn University School of Fisheries, Aquaculture, and Aquatic Sciences demonstrated that a simple formalin killed vAh preparation protected hybrid catfish following immersion vaccination. In this study, the research team dipped 3-4" fingerling catfish into a bath containing the killed vAh for 1 hour. After 1 hour, the catfish were returned to their tanks where they could build immunity. A subset of catfish was removed every few weeks and exposed to lethal doses of vAh, with the survival percentages as follows (vaccinated versus not vaccinated): 3 weeks, 91% vs. 52%; 5 weeks, 88% vs. 60%; 7 weeks 93% vs. 62%. In addition, statistical testing revealed that the unvaccinated fish were about 5 to 6 times more likely to die from vAh.

The effectiveness of immersion vaccination with a simple killed vaccine prompted the question: Can formalin killed virulent *Aeromonas hydrophila* delivered orally protect catfish from motile *Aeromonas* septicemia caused by vAh? Historically, commercial catfish vaccines were delivered by immersion to catfish fry around 7-12 days post hatch at time of transfer from the hatchery to grow out ponds. However, it is unclear how long protection can last when fish are vaccinated at such a young age, and it is unlikely that protection would last through an entire production cycle from fry stage to harvest.

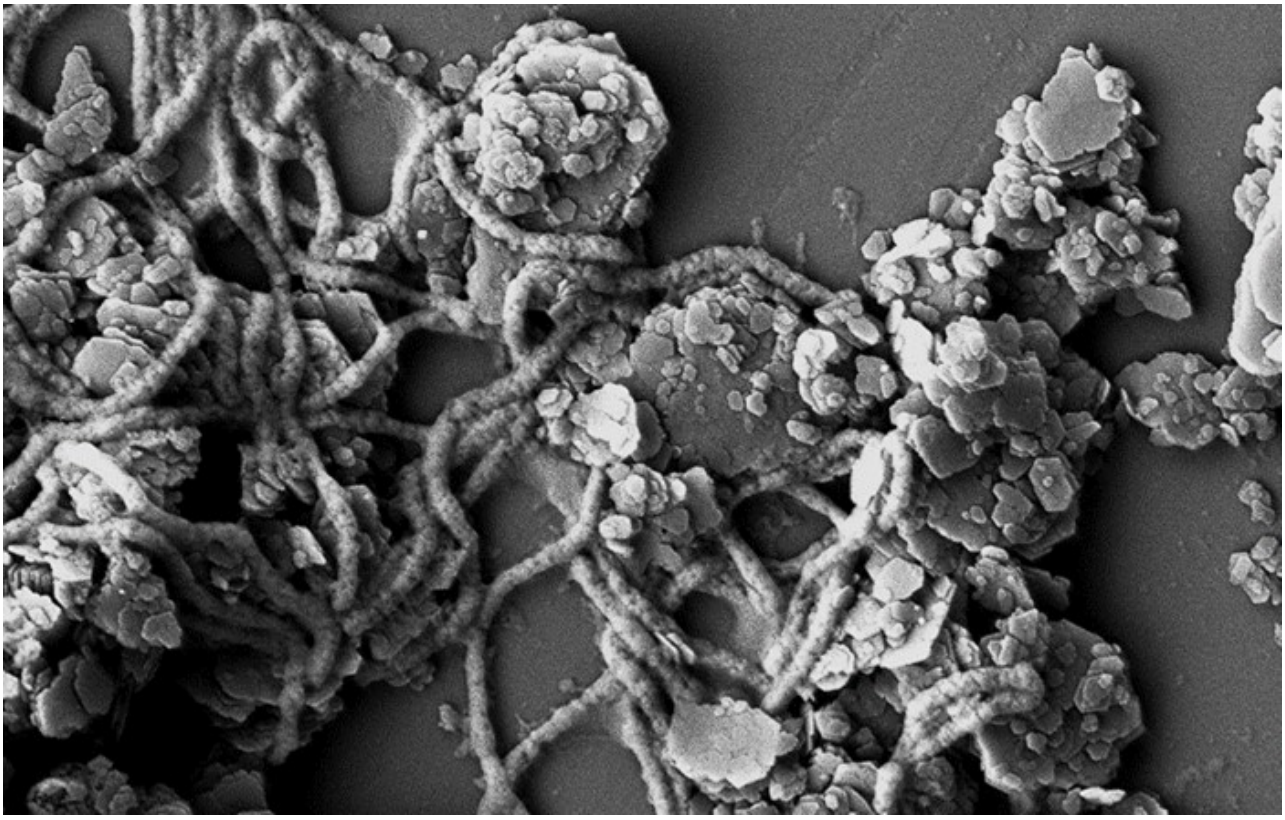


Figure 1. Kaolin particles binding disease causing bacteria.

Therefore, oral vaccination may be a viable additional strategy due to ease of delivery and the potential for mass vaccination. This is supported by recent studies from colleagues at Mississippi State University who demonstrated the effectiveness of vaccines delivered through the feed using a modified live *Edwardsiella ictaluri* vaccine. Therefore, AAHRU and AU researchers are currently examining the effectiveness of top-coating feed with vAh, specifically we are moving forward with a killed, attenuated vAh strain that has shown excellent promise as a vaccine candidate. Early trial data show that catfish that consume feed coated with killed, attenuated vAh are 3 times more likely to survive than control fish in infectivity trials using lethal strains of vAh. Data also suggest that survival improves when fish are vaccinated again within a few weeks after the initial vaccination, a concept called "boosting". The length of protection from oral vaccination is currently being explored by this joint research team. The potential to orally deliver the inactive *A. hydrophila* bacteria to catfish enhances our ability to vaccinate larger fish and can also allow for booster vaccination of catfish prior to conditions conducive to disease such as mid- to late summer temperatures and/or following seining in partial harvest operations. At present there are no licensed vaccines against vAh in catfish aquaculture. These findings are important first steps in the development of commercially available platforms for robust fish protection.

In recent months AAHRU and AU investigators determined that the clay mineral kaolin (Imerys product called AkuaPro) was highly effective at preventing vAh infections when mixed in the water just prior to adding a large dose of vAh. Kaolin was found to strongly bind the vAh bacteria (and also columnaris disease causing bacteria; Figure 1) and prevent it from entering the catfish and initiating the disease. Trials are planned for summer 2020 to determine if this clay-based platform could be scaled up for field use; however, it is important to note that kaolin clays are relatively inexpensive but can cause a milky white turbidity that could impact ponds. For the past 10 years we have routinely reported from anecdotal evidence that "large fish are the most affected by vAh infection"; however, recent work by AAHRU staff found that advanced fry, fingerlings, and larger fish between ½ to ¾ lb were equally susceptible to vAh infection (90%, 83%, and 73% mortality respectively; not statistically different). Due to space limitations, we haven't tested fish >1 lb, but the initial trend seems to point that size may not drive this disease.

Catfish Health, Production and Economics

Terry Hanson, AU SFAAS

Fish health is important and Columnaris disease is a chronic killer of catfish. At the E.W. Shell Fisheries Station, Auburn, AL, we are conducting a Columnaris vaccine trial study in ten 0.1-acre ponds. Five ponds were stocked with 800 channel catfish each, after being immersed in a Columnaris vaccine, and five ponds were stocked with 800 catfish receiving no vaccine. The ponds were stocked in April 2019 and harvest is planned for late October or early November 2019. Monthly samplings of 30 fish from each pond has occurred. Fish were weighed and their length measured. Average fish weights were calculated for each pond at each sample date. Thirty and ninety days after stocking, blood samples were taken from 10 fish from each pond. The blood will be analyzed using an ELISA test which will measure for Columnaris antibodies. We are hoping to see a difference in survival among the two treatments and possibly an increase in growth from the vaccinated catfish.

The second catfish project I am working involves "Big Fish". It is being conducted by a Master of Science student, Daniel Creel, and being supervised by myself, Luke Roy and Steve Sammons. We are finding seven-year old fish in some west Alabama catfish ponds. Since catfish are usually harvested when they are two to three years old, we are seeing fish that have escaped harvest for 4-5 years. These fish consumed a lot more feed during these years and have also cost the farmer dearly in reduced prices for their oversized fish. The project Daniel is working on is important as results from the survey he conducted with catfish farmers in West Alabama gave him information to use in developing cost-efficient ways to control or reduced "Big Fish" in your ponds. Daniel will present these findings at the December 3 Catfish meeting to be held in Greensboro, AL.

Aquatic Animal Nutrition Laboratory

D. Allen Davis, AU SFAAS

The laboratory is dedicated to research and teaching efforts to improve technologies for the culture of freshwater (catfish and tilapia) and marine (Florida pompano, red drum, red snapper, white seabass, California yellowtail, and Pacific white shrimp) species for stock enhancement and aquaculture. Our primary activities have emphasized, graduate student education, the development, and improvement of commercial feeds and feed management strategies, as well as providing continuing education opportunities to the industry. This year we have hosted three major meetings/training programs, including the Fish Feed and Nutrition Workshop. My laboratory conducted around 35 independent experiments supporting the improvement of nutrient requirement data and feed management. With regard to catfish nutrition, we have been working to improve the amino acid balance of feed formulations. By refining amino acid nutrition and defining the effects of dispensable amino acids, we feel we can reduce the level of protein or improve the retention of protein. All in all, reducing the cost of the feed per unit of production. Other work with catfish includes the use of hydrolyzed feather meal in fish feeds and the use of enzyme supplements to improve digestion in catfish feeds. All designed to help reduce production costs. Other projects include developing practical feed formulations for marine species and looking at passive acoustic feedback for automated feeding systems in shrimp.

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