EXTENSION NEWSLETTER

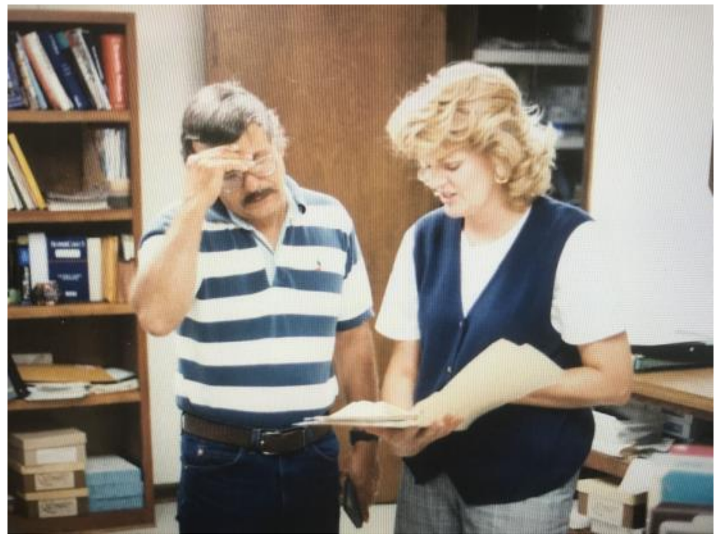
Bill Hemstreet retiring after 34 years of exemplary service at the Alabama Fish Farming Center

Luke Roy, Alabama Fish Farming Center, Greensboro, AL

Bill Hemstreet has served west Alabama catfish producers as the Fish Health Diagnostician at the Alabama Fish Farming Center for 34 years. Originally from Lakeland, Florida, he graduated from Valdosta State College in 1970 and served with the U.S. Peace Corps from 1970-1972 in Malaysia. While in Malaysia, Bill taught high school and was in charge of the school's agriculture projects, one of which was managing a local fish pond. It was during this period that a profound interest in fisheries emerged. Upon returning to the U.S. he joined the laboratory of Dr. Bill Rogers at Auburn University to pursue a Master's degree and a career in fisheries. Bill's thesis project evaluated parasites in juvenile largemouth bass in West Point Reservoir. Bill completed his graduate work in 1978 and remained at Auburn until 1979 working in the laboratory of Dr. John Grizzle.

In 1985, Bill was recruited and hired by Auburn for the Fish Health Diagnostician position that was housed at the Alabama Fish Farming Center which had been established in 1982. Upon accepting the position, Bill and his wife Carolyn moved from Florida to west Alabama and settled in Greensboro. The biggest disease issue facing catfish producers in west Alabama at that time was ESC (enteric septicemia of catfish), which was causing large financial losses to catfish hatcheries. Columnaris was also a huge issue back then, as was winter kill, particularly in farms that were located north of Greensboro that had softer water. In the late 1980s and early 1990s the Fish Health Diagnostic Laboratory at the Fish Center typically logged in excess of 1,000 disease cases each year. In 2006, funding secured by the West Alabama Catfish Producers Association and other sources allowed the purchase of a Mobile Disease Laboratory, which is operated out of a recreational vehicle and is still in service at the Fish Center. Bill Hemstreet has been a steady presence and support for the west Alabama aquaculture industry throughout his career and has helped Alabama farmers contend with existing and emerging fish diseases. During his time at the Fish Center, Bill has logged thousands of farm visits and has helped many Alabama catfish producers stay in business through timely recommendations related to disease and water quality issues they have faced.

I first met Bill when I joined the staff at the Alabama Fish Farming Center in 2006 following completion of my graduate work at Auburn and have had the privilege of working with him for nearly a decade. He has served as a mentor both to myself and many others that have passed through the Fish Center over the years and could always be counted on to provide timely advice and guidance in any situation. Bill has served as a model of sacrifice and dedicated humble service to west Alabama catfish farmers. In short, his selfless work ethic and dedication to the commercial producer have served as an example and inspiration for younger fisheries professionals like myself. Bill plans to remain in Greensboro following retirement, where he is an active member of Greensboro First United Methodist Church and the Greensboro Lion's Club.



The intersection of virulent *Aeromonas hydrophila* and fish-eating bird harassment programs on commercial catfish farms

Luke Roy, Bill Hemstreet, Alabama Fish Farming Center, Greensboro, Alabama
Leah Moran Veum, USDA APHIS Wildlife Services, Greensboro, AL
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In 2018, there were 3.5 million pounds of catfish lost to virulent *Aeromonas hydrophila* (vAh) in west Alabama. These episodes of disease translated to large economic losses for Alabama catfish producers as has been the trend for the last decade since the emergence of this particularly problematic pathogen. While our basic understanding of vAh has improved, management of this disease at the farm level still presents unique challenges for commercial producers.

The presence of fish-eating birds on catfish farms is a problem all commercial producers face (Fig. 1). Farms can apply for depredation permits to take certain species through the U.S. Fish and Wildlife Service (administered through USDA APHIS Wildlife Services) while also implementing traditional, non-lethal harassment programs to try to minimize losses from fish-eating birds. Despite these efforts, economic losses due to birds are still a reality each year.

Recent research from Mississippi State University and the USDA Wildlife Services National Wildlife Research Center has confirmed what many researchers suspected early on regarding the role of fish-eating birds in spreading vAh (Jubirt et al. 2015, Cunningham et al. 2018). These studies revealed that when double-crested cormorants, wood storks, American white pelicans, and great egrets consume fish infected with vAh they can serve as a reservoir for this disease. Following consumption of vAh infected fish, these bird species shed viable vAh in their feces.

Since there is real potential for fish-eating birds to spread vAh from one pond to another (or one farm to another) during an outbreak, it is important for commercial producers to actively harass birds from ponds experiencing an outbreak. In many instances when there is a disease outbreak, the tendency is to not worry about harassing or lethally taking birds that are consuming fish that are sick or dying in the pond. Unfortunately, management of this problem at the farm level is not easy. Further field studies evaluating the transmission of this disease on commercial farms could help us better understand the dynamics of how vAh is spread.

Fig 1. Fish-eating birds on a catfish farm in Mississippi (photo credit: Dr. Les Torrans). Fish-eating birds will often congregate on the banks of ponds experiencing outbreaks of disease.

Further Reading:

Jubirt MM, Hanson LA, Hanson-Dorr KC, Ford L, Lemmons S, Fioranelli P, Cunningham FL. 2015. Potential for great egrets (*Ardea alba*) to transmit a virulent strain of *Aeromonas hydrophila* among channel catfish (*Ictalurus punctatus*) culture ponds. *Journal of Wildlife Diseases*. 51:634-639.

Cunningham FL, Jubirt MM, Hanson-Dorr KC, Ford L, Fioranelli P, Hanson LA. 2018. Potential of double-crested cormorants (*Phalacrocorax auritus*), American white pelicans (*Pelecanus erythrorhynchos*), and wood storks (*Mycteria Americana*) to transmit a hypervirulent strain of *Aeromonas hydrophila* between channel catfish culture ponds. *Journal of Wildlife Diseases*. 54(3):548-552.

Controlling blue-green algal blooms in aquaculture ponds using hydrogen peroxide

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Excessive blue-green algae (i.e., cyanobacteria) can harm aquatic organisms, including farmed fish. Although algal populations may be beneficial as they acquire excess nutrients, including potentially toxic forms such as nitrite and ammonia, and produce oxygen through photosynthesis, large algal blooms may lead to anoxia as decaying cells are decomposed by bacteria. In addition, some select strains of blue-green algae may produce chemicals that harm fish health (e.g., microcystins, nodularins) or cause fish filets to taste muddy (i.e., geosmin, 2-methylisoborneol). Both situations can cause significant economic losses to fish farmers around the world.

As our understanding of nuisance algal blooms continues to grow, so too do the means to combat these events. Developed methods can often be placed into the groupings of chemical, biological, and physical controls. Of these, chemical controls have been used to great effect; however, there is concern that some approved algaecides may persist in the environment for extended periods of time and, in certain situations, are too broad-spectrum in their toxicity to be practical. Consequently, alternative chemicals are actively being researched. And, although many algaecides exist, hydrogen peroxide (H_2O_2) has proved quite effective at reducing blue-green algae (Kay et al. 1982), and is currently an approved FDA aquaculture drug (FDA 2007). This contribution assesses the utility of H_2O_2 as an algaecide, its application rate, and other factors which may impede its effectiveness.

Hydrogen peroxide is an effective oxidizer, capable of reducing algal blooms. Moreover, as hydrogen peroxide breaks down to water and oxygen, it leaves behind no chemical residuals. Thus, it is considered a relatively environmental-friendly alternative to existing chemical treatment options. Research on the use of H_2O_2 in aquaculture indicates that it selectively reduces odor and toxin producing blue-green algae to low concentrations while having a negligible effect on beneficial types of algae (Fig. 1). A recent study describing a 7-day field mesocosm experiment conducted by the lab of Dr. Alan Wilson at Auburn University's School of Fisheries, Aquaculture, and Aquatic Sciences (http://wilsonlab.com/) indicated that a treatment of ~7 mg/L H_2O_2 immediately reduced cyanobacteria (measured as phycocyanin; Fig. 1B), yet caused a slight increase in other phytoplankton, including green algae (also called chlorophytes; measured as chlorophyll a, Figure 1A). Other studies have also shown that fast-growing green algae often quickly dominate algal communities following a H_2O_2 application (Drábková et al. 2007b, Sinha et al. 2018).

Recommended treatment rates for H_2O_2 vary in the literature. Barrington et al. (2011), who worked with wastewater effluent ponds that often contain high concentrations of organic matter (thus making them a good comparison to productive farm ponds), recommended using 1.1×10^{-4} g H_2O_2 per 1 µg/L of chlorophyll, equating to 44 mg/L H_2O_2 used in the experimental treatment. This study found large reductions in all phytoplankton (-70%), including blue-green algae (-57%). However, such a dosage is arguably too high to be applied to aquaculture ponds as chlorophyll values can exceed 370 µg/L during the growing season (Buley and Wilson; unpublished raw data), which would calculate to a very high dose of 41 mg/L H_2O_2. These concentrations may be too costly or have damaging effects on farmed fish, although short-term doses of H_2O_2 (50-1000 mg/L) are approved for use as a therapeutic treatment (Syndel 2018). Moreover, recent research has shown that much lower H_2O_2 concentrations will reduce algal blooms. For example, Matthjis et al. (2012) showed 2 mg/L H_2O_2 quickly reduced the abundance of blue-green algae by 99% after 7 weeks; however, there was a noticeable H_2O_2 effect on green algae. Finally, the previously mentioned experiment by Yang et al. (2018) showed that a ~7 mg/L H_2O_2 dose promoted a shift in the phytoplankton community of an aquaculture pond from blue-green algae to green algae and flagellated crytophytes.

Various environmental factors may influence the effectiveness of H_2O_2 against blue-green algae. For example, sunlight contains UV radiation that causes hydroxyl (OH) and hydroperoxyl (OOH) radical production (i.e., the main drivers of algal cell degradation). Drábková et al. (2007a) found a 10x difference in the deterioration abilities of H_2O_2 with and without

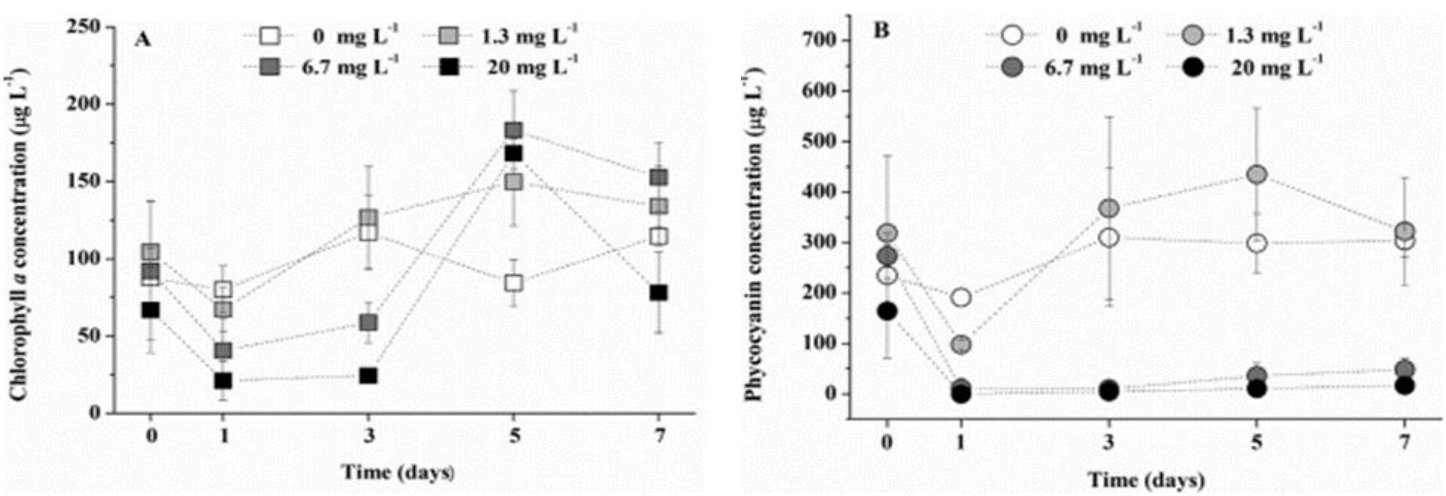

Figure 1. Concentrations of (A) phytoplankton (measured as chlorophyll *a*) and (B) blue-green algae (measured as phycocyanin) during a 7-day field, mesocosm study conducted at Auburn University that assessed various concentrations of hydrogen peroxide (data from Yang et al. 2018). Results are expressed as the daily treatment mean ± 1 standard deviation.

in the deterioration abilities of H_2O_2 with and without light. In addition, iron also facilitates radical production, and systems with high iron (specifically Fe^{II}) may need lower concentrations of H_2O_2 to achieve the same desired effect (Drábková et al. 2007a). Bloom resurgence may also occur, especially if H_2O_2 is applied at low doses (Matthijs et al. 2012). Repeated applications of H_2O_2 may be needed, but should done carefully as to not cause hypoxic conditions through the degradation of organic matter. Lastly, applying H_2O_2 or any other algaecide to treat blue-green algae may result in lysed compounds (e.g., toxins and off-flavor) into the water column. For instance, Yang et al. (2018) observed an increase in extracellular microcystin one day after treatment with a ~7 mg/L dose of H_2O_2, but found that microcystin concentrations reduced after a 7-day period. These and other factors should be taken into account before applying H_2O_2 to active production ponds.

Conclusions

Hydrogen peroxide has been shown to be a strong algaecide alternative in aquaculture given that it has been effective against blue-green algae and promoted beneficial phytoplankton taxa at relatively low concentrations. Based on prior studies (Yang et al. 2018), we suggest the use of a ~7 mg/L dose of H_2O_2 under high ambient sunlight to treat highly productive aquaculture ponds experiencing blooms of blue-green algae.

Further Reading

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Disease Survey Report: 2018

Bill Hemstreet, Alabama Fish Farming Center, Greensboro, AL

The 4th Annual Disease Survey for commercial catfish farms was sent out to all Alabama catfish farmers in early November 2018. from the Alabama Fish Farming Center. The following tables summarize the results based on the replies of 76 commercial catfish farms in west Alabama. The survey also shows a continued significant discrepancy in the number of acres reported to the National Agricultural Statistics Service (NASS) survey (15,100 acres) in 2018 and the Fish Center survey (17,151 acres).

Number of Farms Reporting	76
Total Number of Acres	17,151
Total Number of Ponds	1,519
Number of Acres of Hybrids	2,619
Average Stocking Rate (weighted avg)	7,584

Table 1. Structure of the Alabama catfish industry in 2018.

	2016	2017	2018
Number of Producers Reporting	85	77	76
Total Number of Acres	17,536	17,036	17,153
Total Number of Ponds	1,547	1,552	1,519
Number of Acres of Hybrids	2,290	2,911	2,619
Average Stocking Rate (weighted avg)	7,480	7,765	7,584

Table 2. Comparative data from 2016, 2017, and 2018 Disease Surveys. The 2018 survey indicated a loss in the number of farms but the water acres and number of ponds in production appears to be stable and would indicate a consolidation of farms.

COUNTY	NUMBER OF FARMS	ACRES	% OF TOTAL WATER ACRES
Hale	31	6,932	40.4
Dallas	8	3,551	20.7
Greene	13	3,404	19.8
Perry	13	1,781	10.4
Sumter	4	640	3.7
Marengo	5	540	3.1
Pickens	2	303	1.8
TOTAL	76	17,151	

Table 3. The number of farms, water acres, and percent (%) of total water acres by county in west Alabama.

CAUSATIVE AGENT	NUMBER LOST	POUNDS LOST
Virulent Aeromonas hydrophila	3,501,725	3,507,200
Columnaris	3,274,800	1,576,610
Edwardsiella ictaluri & piscicida	702,600	431,650
Hamburger Gill (PGD)	1,346,000	852,500
Toxic Release	214,200	214,600
Other	130,000	110,000
TOTAL	9,169,325	6,692,560

Table 4. Causative agents of reported fish loss by number and pounds in 2018.

CAUSATIVE AGENT	2015	2016	2017	2018
Virulent Aeromonas hydrophila	3.20	3.40	3.40	3.50
Columnaris	1.70	2.40	1.60	1.60
Edwardsiella ictaluri & piscicida	0.68	0.58	0.53	0.43
Hamburger Gill (PGD)	1.00	0.10	0.09	0.85
Toxic Release	0.31	0.87	0.69	0.21
TOTAL	6.89	7.35	6.31	6.59

Table 5. Causative agents of reported fish loss by millions of pounds from 2015-2018.

Lost Pounds of Fish @$0.95/lb	$6,357,362
Medicated Feed Cost	$707,363
Chemical Treatments	$677,017
Lost Feeding Day Costs (2:1 conversion)	$1,955,100
TOTAL	$9,696,842

Table 6. The estimated cost of disease losses to the west Alabama catfish industry in 2018. This estimate is based on direct cost of lost pounds, treatment costs, and indirect costs of lost feeding days. The estimated loss was greater in 2016 (approximately $13.2 million) and 2017 (approximately $12.1 million) which were based on $1.15/lb fish price. If the 2018 estimate were based on $1.15/lb price, the 2018 losses would be approximately $11 million.

Figure 1. A fish kill in west Alabama in 2018 caused by Ich.

Status and permitting for double-crested cormorants

Leah Moran Veum, USDA/APHIS/Wildlife Services, Greensboro, AL

The status of obtaining a Migratory Bird Depredation Permit (MBDP) for fish-eating birds (American White Pelicans, herons and egrets), including Double-crested Cormorants, has not changed since 2016. The depredation permits used before 2016 (Aquaculture Depredation Order & Public Resource Depredation Order) are still rescinded. A completed U.S. Fish & Wildlife Service Form 3-200-13 (https://www.fws.gov/forms/3-200-13.pdf), a Form 37 issued by Wildlife Services (call WS Greensboro Office at 334-624-8711) and an application processing fee of $100 made payable to the U.S. Fish & Wildlife Service is needed to legally take cormorants and other fish eating birds in Alabama.

As before separate applications are needed, one for Double-crested Cormorants and another for all other fish-eating birds. Please note, the Form 37 is only a **recommendation** from Wildlife Services that a permit be issued; the U.S. Fish & Wildlife Service

Service only approves and determines the total number of birds allowed for lethal take for each permit. Numbers for lethal take will continue to be on the conservative end, though Wildlife Services has requested that farmers have a higher amount of take compared to last year. The MBDP issued to Wildlife Services, conversely, will have a smaller amount of take for continuation of roost dispersal on rivers as conducted in previous years.

The status of birds for the late 2018 and early 2019 season seems to show lower number of cormorants in West Alabama compared to previous years, estimated from aerial surveys conducted in early February.This will most likely change come early spring, with migration of cormorants from further south. Roost dispersal is still being actively conducted to help mitigate depredation from cormorants on commercial fish ponds and will continue until birds migrate north to their breeding grounds in late spring.

For questions and/or for the issuance of Form 37's please feel free to contact the Wildlife Services, Greensboro office at 334-624-8711.

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Evaluating the age of "big fish" and the economic cost to the west Alabama catfish industry

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The Alabama catfish industry in 2018 is facing a serious oversupply issue that has negatively impacted both commercial farms and catfish processing plants. Compounded on to this problem is an overabundance of "big fish" currently on farm inventories in Alabama, which typically utilize watershed ponds that are deeper and can be more difficult to harvest. Catfish processors have defined "big fish" as fish greater than 4 pounds. Once this threshold weight has been achieved, the catfish are too large for the mechanized lines at the processing plants and must be hand filleted at the expense of more labor.

Fig. 1. Big catfish that escape harvest year after year can result in financial losses for commercial producers.

Fig. 2. Catfish otoliths were extracted at the E. W. Shell Fisheries Research Station in Auburn, Alabama.

Currently, catfish processors in Alabama are paying only half price(~$0.50/pound) for fish between 4 and 6 pounds. Catfish farmers, in some cases, are not receiving compensation for fish larger than 6 pounds, which are simply deemed unacceptable and logged as "weigh backs". Much of these problems can be tracked back to inefficiencies related to seining in addition to holes and depressions in the pond bottom allowing fish to escape the seine. (Fig. 1)

Despite the widespread adoption of hybrid catfish, there has been no scientific documentation of age as it relates to growth within the catfish industry, with large hybrids being reported to exceed 50 lbs in some instances. In addition, there is scarce data in the scientific literature documenting age and growth of large channel catfish on commercial farms. To age the catfish, we collected otolith bones from 153 channel catfish and 131 hybrid catfish from different harvest events. The catfish collected for the study ranged from 1.2 – 34 lbs (Fig. 2). The oldest channel catfish sampled weighed 9.6 pounds and was 7 years old. The biggest channel catfish collected were fish that were leftover in ponds when it was switched from raising channels to raising hybrids. Hybrid catfish have faster growth rates compared to channel catfish and can become oversized quickly. The average weight of a 3 year old channel catfish was 6 pounds compared to 13 pounds for a hybrid catfish of the same age. During the study, hybrid catfish collected could gain up to 10 pounds per year when they escape harvest with some hybrids weighing up to 34 pounds at 4 years old.

These "big fish" present a problem to farmers by consuming more feed than market sized fish leading to increased feed costs and increased food conversion ratios. The "big fish" also receive a reduced price at the processing plant because they have to be filleted by hand. Every pond sampled had some percentage of "big fish" when harvested leading to lost revenue that would have been paid to the farmer if the fish were market sized. The next stage in this study will be to determine economic ways to reduce the number of "big fish" in catfish ponds allowing the farmers to become more profitable.

Preliminary Report on the Big Fish Project Funding Provided by the Alabama Catfish Producers

Greg Whitis, Alabama Fish Farming Center, Greensboro, AL

Since receiving funding from the Alabama Catfish Producers in December of 2017, I have made the following observations and discoveries.

Acquiring samples of large catfish fillets for experimentation is not a constant. Harvest Select (HS) has been very cooperative in my endeavors to find solutions to this problem. I have noted that when HS harvests fish from just their company farms, they have a harder time filling my requests for big fish. Reading between the lines, this tells me that ponds that are frequently seined in a multiple batch production scheme may have lesser amounts of jumbo-sized fish. Hence maybe some part of the industry suffers from “multiple batch denial.”

Multiple batch production works more efficiently if ponds are seined frequently. However in the perfect world of catfish farming, we will always have big fish. That’s just the nature of the beast.

Market Development of New Products*:*

Fried Catfish Strips from Large Fillets

I used 12-16 ounce fillets from 4-6 pound catfish and personally stripped them in-house in two catfish restaurants. Fried strips from these fillets were served as free appetizers and then the customers filled out survey cards. A large majority of these customers did not have any issues with eating fillet strips from these catfish. Although price points and labor costs for in-house stripping still need to be quantified, there may be a demand for the larger fillets if cost savings can be passed on to the restaurant.

I have also demonstrated feasibility of using large catfish fillets in the catering industry. Chris Wilton of Wilton’s Catering in Lee County regularly uses large and jumbo-sized fillets in his very popular catering business. Chris and I are scheduled to conduct one more catering demonstration using large fillets in 2019.

I demonstrated the feasibility of using fillets from 4-6 pound catfish at the Sunbelt Expo. We conducted a taste comparison using premium fillet strips and large fillet strips. Most of our tasters did not prefer one over the other. Some even preferred the larger fillet strips!

Catfish Boudin and Catfish Breakfast Sausage

The aforementioned caterer, Chris Wilton, is also experimenting with jumbo fillets and nuggets from six pound and up fish. He has admirably demonstrated the feasibility of using jumbo nuggets and is steadily working on a catfish boudin and catfish breakfast sausage. These two products were showcased at the most recent Sunbelt Expo in Moultrie.

Smoked Catfish

Using funds from the Alabama Catfish Producers grant, I acquired two electric smokers capable of smoking about eight large fillets at a time. After sixteen batches and basically wearing out the first smoker, I have developed a procedure for smoking large fillets. This procedure includes brine strength and time, brine ingredients including salt and seasonings, air drying time, smoking temperature and duration. I’m happy to report now that I think the procedure can be adopted commercially. I still have work to do on certifying actual salt content in the finished product. The federal government mandates a certain level of salt. I need to accurately quantify that this salt concentration is still considered favorable to the average consumer.

I formally demonstrated smoked catfish in the fall of 2017, at the annual Western Supermarket Food and Wine Festival in Mountain Brook. Just about everyone who tasted, raved about it and preferred it over smoked salmon which was offered several booths down the aisle. Executives from Western asked me when it might become commercially available. They have six supermarkets in the Birmingham area.

I have also perfected a recipe for smoked catfish dip for those fillets that don't pass the visual grade test but can still be used in a value added product.

I also visited a Wisconsin company that makes commercial smokers. They will be assisting me in developing a business plan for a commercial catfish smoking business. In case anyone is interested at this point, one commercial smoker capable of smoking 67,000 pounds of fish annually costs about $100,000.

Catfish Jerky as a Human Snack Food and/or Pet Treat

On my desk, is a 4 ounce package of smoked salmon jerky dog treats. It cost $4.99. That's about twenty bucks a pound retail. I purchased a heavy duty dehydrator and have already made several batches. Most dehydration literature recommends against using catfish because of the fattiness but I have found that using deep skinned jumbo fillets will work. Again, price points need to be worked out since there is a lot of waste in the deep skinning process plus the loss of weight during dehydration.

On the production side of things: Electroshocking Big Fish

I firmly believe that the bigger catfish in our ponds "learn" to avoid the harvest seines. I suspect they hunker down in those craters created by the paddlewheels and escape capture. If you doubt catfish have the ability to learn then why do they even respond to the noise of a feed truck?

In August, I coordinated with SouthFresh Farms, Thed Spree of Boligee, and the Alabama Department of Natural Resources. I recruited one of their biologists to bring their shocking boat out to West Alabama. With a loaded johnboat at the ready with a seine, we shocked the deep area of the pond by the drain pipe and the paddlewheels and then let the harvesting commence. My intention was to compare harvest data before and after multiple seinings but Murphy's Law got in the way and this will have to be repeated on another day. Suffice it to say, we were successful in actually shocking fish up but not killing them at the outset. More work needs to be done in this area. My thinking here is we might be able to shock the large "smart" fish out of those holes, get them disoriented and then capture them before they get any bigger.

I have since been in contact with experienced fish biologists that are proficient in removing large flatheads, channels and blues from lakes and streams. It can be done. They're more than willing to share their expertise.

Anyway, my work here is still progressing and I appreciate your patience.

2017-2018 Research Update on Vaccine Tests

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In 2017, a collaborative research project between the Alabama Catfish Producers (ALFA), Alabama Catfish Feed Mill, Williamson Cattle Company, Auburn University School of Fisheries, Aquaculture, and Aquatic Sciences, Kennebec River Biosciences, and the USDA ARS Aquatic Animal Health Research Unit was initiated to evaluate performance of catfish grown in commercial ponds and vaccinated with a combination vaccine. This effort was built on research that had been conducted in 2015 and 2016 using in-pond raceway systems (IPRS) that would maintain experimental groups of fish separate from one another in the same pond. Commercial size ponds undergo changes in environment and exposure to pathogens that are difficult to replicate in pond research studies.

The initial research plan called for vaccination of fingerling catfish (approximately 5 inch average) in May 2017, against columnaris disease, ESC, and virulent *Aeromonas hydrophila* using a combined (or multivalent killed organism) vaccine, stocking vaccinated fish in west Alabama IPRS units, and growing them to harvest size. In past studies, outbreaks of these three diseases were well documented not only in the open-pond fish where these research IPRS units were placed but also in the IPRS fish at the same time, making for a nice experiment for evaluating this vaccine combination. However, in 2017, no outbreaks of any of these three diseases were documented in significant levels to fully evaluate the field objectives of the project.

One proposal that we had been hearing from farmers since the research was initiated in 2015, was to allow the fish to grow for two growing seasons, as that is often how long it takes for channel catfish to reach market size. We agreed that this was a good year to try this approach and verify if these vaccines would provide protection over a two-year period, something that had not been done before in commercially grown catfish. However, a backup plan was put in place in case we had similar results of no disease outbreaks occurring in open ponds or IPRS units, which as chance would have it, no outbreaks were observed in the ponds while the study was carried out.

In order to carry out a laboratory trial, a sample of fish were removed from the IPRS units in west Alabama and transported to Auburn in the spring of 2018. The fish were held in large tanks and separated by treatment (treatment 1: not vaccinated and treatment 2: injection vaccinated with all three vaccines). The vaccine was produced by Kennebec River Biosciences. Two challenges were then performed with each organism (columnaris, ESC, and *Aeromonas*) separately over the summer of 2018.

In the laboratory challenges, there were no significant differences in the columnaris or ESC treatment groups in any of their respective challenges. In the *Aeromonas* trial, one challenge was invalidated due to extraneous circumstances but the other challenge yielded promising results: mortality was 95% in the control fish and only 50% in the vaccinated group, which was statistically significant (p-value = 0.0364). These results coincide with other *Aeromonas* vaccine challenges using killed bacteria but is the first demonstration of catfish being protected for more than a year after being initially vaccinated.

So what does all this information mean? In a nut shell, more research! Each of these bacteria cause disease in their own unique way and how we, as researchers, build and deliver vaccines to fish has to be investigated. We have to be able to match the most cost-efficient way to vaccinate the fish and maximize survival when they come in contact with these disease-causing organisms. This is no easy task especially when the uniqueness of the organisms and the length of time these animals are grown are taken into consideration.

Historically, injection of vaccines into catfish has not proven to be cost efficient given current husbandry and culture techniques in the US catfish industry. However, newer, advanced methods of vaccine delivery have been developed such as oral delivery through the feed and even immersion products that will aid in bringing costs down and improving efficiency. These methods should be evaluated under good research designs with commercial application in mind.

If you have any questions, please feel free to contact either the Alabama Fish Farming Center, Auburn University School of Fisheries, or the USDA ARS Aquatic Animal Health Research Unit for more information.

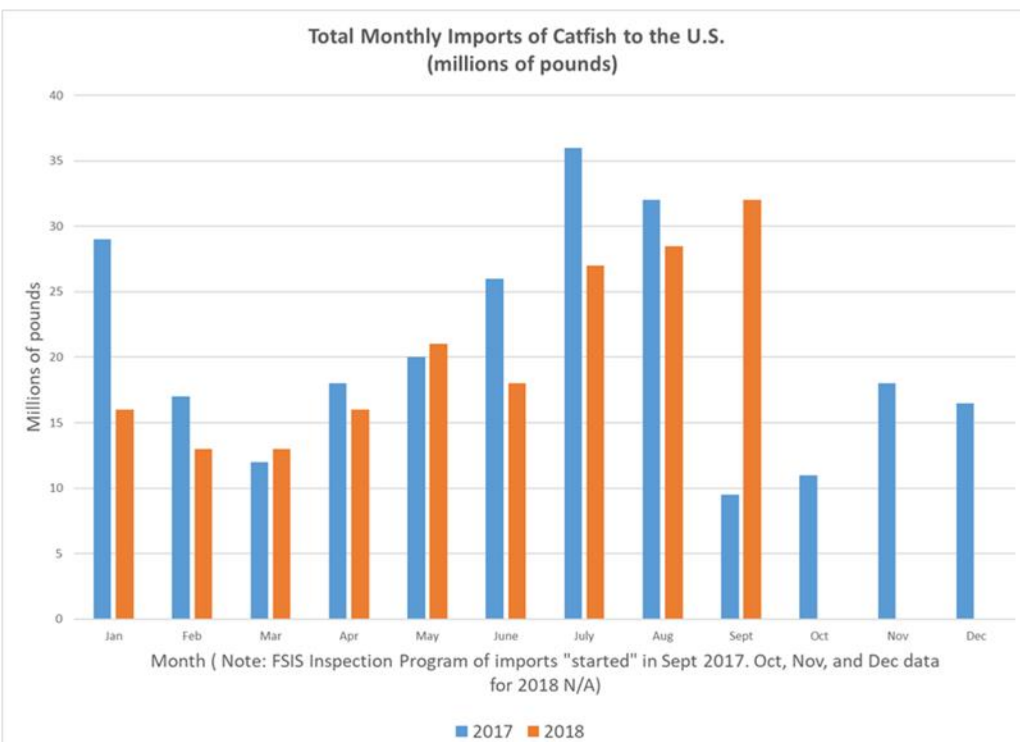
The First Year Impact of FSIS Inspections and "Equivalence" on Catfish Imports

Greg Whitis, Alabama Fish Farming Center, Greensboro, AL

I was hoping, upon the onset of the FSIS Inspection Program with the "Equivalence" provisions, that catfish fillet imports would be severely impacted. The "Producer Friendly" graph below indicates its first year impact. My interpretation includes the following:

- Imports peaked in July and August of 2017, before the inspection program officially started. Importers were filling orders as fast as they could before the new rules would be enforced.
- Imports were reduced slightly overall in 2018 compared to 2017. There were 245 total million pounds in 2017 and 185 million pounds in 2018. Remember the graph is not showing imports for the months of October, November and December in 2018.
- Imports one year later in September of 2018 were only 4 million pounds less than the July 2017 peak of 36 million pounds.

So, let's hope that the "Equivalence" provisions are truly enforced in 2019.



Dr. Anita Kelly joins the Alabama Fish Farming Center

Luke Roy, Alabama Fish Farming Center, Greensboro, AL

Dr. Anita Kelly has joined the faculty of the School of Fisheries, Aquaculture, & Aquatic Sciences and will be stationed in Greensboro at the Alabama Fish Farming Center. Dr. Kelly will be continuing the fish health diagnostic program established by Bill Hemstreet and will develop an applied research program in aquatic animal health that will complement existing programs on campus. Prior to joining the faculty at Auburn, Dr. Kelly was Interim Director of the University of Arkansas at Pine Bluff (UAPB) Fish Health Inspection Laboratory in Lonoke, Arkansas. In that role she served as an Extension Fish Health Specialist and Extension Unit Leader for UAPB's Cooperative Extension Program in Aquaculture and Fisheries. Dr. Kelly joined UAPB in 2007 and served as Associate Director of the Aquaculture/Fisheries Center from 2012 – 2019. In Arkansas, Dr. Kelly's research focus included laboratory and applied field work with baitfish, sportfish and catfish. Most recently, her research activities were directed at the practical use of kaolin clay to prevent Columnaris in sportfish/catfish hatcheries and evaluating the toxic effects of hydrogen sulfide on baitfish production.

Dr. Kelly received both a M.S. and Ph.D. in Zoology from Southern Illinois University at Carbondale and a B.S. in Biology from the University of Iowa. Previously, she has served on the faculty of both Mississippi State University and Southern Illinois University. In addition to jobs in academia, Dr. Kelly managed two commercial farming operations in the Midwest and served as an Instructor in the School of Field Studies on the Island of South Caicos in the British West Indies.

Queso Catfish

Recipe and photo from Allrecipes.com

Ingredients

- 4 (6 ounce) fillets catfish
- 1/4 cup lime juice
- 1/2 cup cheap beer
- 1/4 cup yellow cornmeal
- 1/4 cup finely crushed tortilla chips
- 1/2 teaspoon salt
- 1/4 teaspoon cayenne pepper
- 2 Tablespoons lime juice
- 2 Tablespoons canola oil
- 4 ounces processed cheese, cubed
- 1 teaspoon chili powder
- 1 teaspoon ground cumin
- 1/2 chipotle pepper, minced
- 2 Tablespoons chopped fresh cilantro (optional)

Directions

- In a shallow dish, stir together 1/4 cup of lime juice and beer. Place fish in the dish, and turn to coat. Marinate for 30 minutes.
- Preheat the oven to 400 degrees F. Coat a roasting rack with cooking spray and place over baking sheet
- Rinse fish with cold water, and pat dry. Discard the marinade. In one dish, stir together the cornmeal, tortilla chip crumbs, salt and pepper. In another dish, stir together 2 Tablespoons lime juice and canola oil. Dip fillets into the lime and oil, then into the cornmeal mixture to coat. Place the fish onto the roasting rack.
- Bake fish for 8-10 minutes, or until it flakes easily with a fork. While the fish is baking, combine the processed cheese, chili powder, cumin, and chipotle pepper in a small saucepan over medium-low heat. Cook and stir until melted and smooth.

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