Thad Cochran National Warmwater Aquaculture Center Newsletter

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Contents

A Message from the Director, Mississippi Agricultural and Forestry Experiment Station, MAFES

Vance H. Watson

We are honored to have recently dedicated the Thad Cochran National Warmwater Aquaculture Center (NWAC). The NWAC, which is a state-of-the-art research facility located in the heart of the commercial catfish industry, currently houses 17 state and federal scientists whose mission is to provide solutions to the most pressing problems of the catfish industry through basic and applied research, extension programs, and diagnostic services. Research is being conducted on catfish nutrition, genetics, water quality and off-flavor, diseases, behavior, and harvest technology.

The NWAC is administered by MAFES and serves as a single point of coordination and communication for aquaculture at Mississippi State University. Responsibility for the aquaculture program and for the NWAC have been assigned to Stoneville researcher Ed Robinson. Ed will continue in his research role and will serve as Coordinator for the NWAC.

Responsibilities include coordination of aquaculture program planning and implementation as well as to continually monitor and focus aquaculture research activities. He will also serve as an intermediary between scientists, administrators, and the catfish industry to facilitate effective information transfer.

We feel that the establishment of the NWAC and appointment of leadership to focus research, extension, and diagnostic programs as well as to provide a point of communication between researchers and the catfish industry should greatly benefit the catfish industry. We pledge to work hard to provide research and education programs that will help keep the farm-raised catfish industry viable. We appreciate the support of the catfish industry for we recognize that industry support is essential to the continued success of our aquaculture program.

Thad Cochran National Warmwater Aquaculture Center Newsletter is edited by Craig S. Tucker and Edwin H. Robinson.

This publication is bi-annual and is available free upon request.

NWAC Coordinator's Comments

Ed Robinson

Welcome to the introductory issue of the NWAC Newsletter which replaces "For Fish Farmers" previously published by the Mississippi State University Extension Service. Since NWAC serves as the point of communication for both research and extension aquaculture programs, it seemed logical that the newsletter should emanate from the Center. Our intentions are to publish the newsletter twice a year and to provide information on research and education programs that are pertinent to the aquaculture industry. We will strive to keep you apprised of developing technologies and changing production practices applicable to commercial fish culture. We will also try to keep you abreast of events such as seminars, workshops, etc., that may be of interest.

We need your input to provide a newsletter of benefit to the aquaculture industry. Please visit or call (601-686-3242) with any comments, suggestions, or topics for future articles.

The Southern Regional Aquaculture Center

Craig S. Tucker, Director

One of the programs housed in the Thad Cochran National Warmwater Aquaculture Center is the Southern Regional Aquaculture Center (SRAC). The SRAC program, which is accountable to the aquaculture industry across the southeastern United States, has become an important part of the aquaculture scene in Mississippi.

In this article, I will summarize the structure and function of the Center. I will also use future issues of this newsletter to keep you posted on SRAC activities. You can also keep abreast of SRAC activities through our web site at http://www.msstate.edu/dept/srac. The web site contains, among other items, a complete list of all SRAC publications (which can be downloaded and printed), updates on the status of SRAC projects, and links to many other sources of information on aquaculture.

The Southern Regional Aquaculture Center is one of five Regional Centers established by the United States Congress in 1985 and administered through the USDA Cooperative State Research, Education and Extension Service. The Centers are located in the northeastern, southern, north-central, western, and tropical Pacific regions of the country. The Centers were established to provide a mechanism for assessing regional aquaculture industry needs and developing regional research and extension projects to meet those needs.

Projects supported by Regional Centers are unique in three important ways: (1) Center projects are to be driven solely by regional industry needs; (2) projects resolve, by team effort, problems that are too costly in manpower or funds for a single institution to attack; and (3) results of projects are to be made quickly available to the industry in an accessible, understandable format.

The thirteen states and two territories included in the Southern Region are Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, Puerto Rico, South Carolina, Tennessee, Texas, U.S. Virgin Islands, and Virginia. Mississippi State University serves as the Host Institution for SRAC, and the Administrative Center is located at the Thad Cochran National Warmwater Aquaculture Center in Stoneville. Craig Tucker is the Center Director and Sarah Harris is the Administrative Assistant.

Center projects are developed through the coordinated activities of the three components of the SRAC program: the Board of Directors (currently chaired by Dr. Rodney Foil of Mississippi State University), the Industry Advisory Council (currently chaired by Lester Myers of Mississippi) and the Technical Committee (currently co-chaired by Dr. Larry Wilson of the University of Tennessee and Dr. Michael Masser of Texas A&M University).

The SRAC website can be accessed at: http://www.msstate.edu/dept/srac

The Board of Directors is the policy-making body for SRAC. Board membership provides a balance among administrators from State Agricultural Experiment Stations, Cooperative Extension Services, and 1890 Institutions in the region. The Industry Advisory Council (IAC) is composed of representatives of state and regional aquaculture associations, aquaculture producers, aquaculture marketing and processing firms, and other interests or organizations as deemed appropriate by the Board of Directors. The IAC provides an open forum for input from diverse private and public sector interests. The Technical Committee (TC) is composed of representatives from research institutions and state extension services, other state or territorial public agencies as appropriate, and nonprofit private research institutions. Membership of the TC includes research and extension scientists from all states in the region. Projects funded by SRAC are developed through the joint effort of the IAC and TC. Priority problems are identified by the TC from a scientific perspective and the IAC from an industry perspective. Projects must address a problem of fundamental importance to aquaculture in the region and must involve participation by two or more states or territories in the Southern Region. Generally, projects are developed that complement and enhance ongoing extension and research activities.

Some of the past projects supported by SRAC were:

- **Analysis of Regional and National Markets for Aquaculture Products Produced for Food in the Southern Region**
- **Performance of Aeration Systems for Channel Catfish, Crawfish, and Rainbow Trout Production**
- **Improving Production Efficiency of Warmwater Aquaculture Species Through Nutrition**
- **Characterization of Finfish and Shellfish Aquaculture Effluents**
- **Food Safety and Sanitation for Aquacultural Products**

Once the priority area is identified and approved by the Board of Directors, the project is developed through a deliberative process that involves the participation of the most qualified personnel in the region. These experts develop a proposal to solve the problem, which is then widely reviewed by other experts across the United States. The proposal that is ultimately developed thus represents the best possible approach to solving the problem, as judged by the most qualified people in the country.

The results of past SRAC projects have had significant impacts. For example, the results of the "Effluents" project were the foundation of comments sent to the US Environmental Protection Agency in response to that agency's proposal to regulate aquaculture effluents. Nutrition projects funded through SRAC were also highly successful in that they have had significant impacts on feed costs.

In future issues of this newsletter, I will summarize current SRAC projects. Two of these projects should be of considerable interest to the industry because of the attempt to address two issues that are important to catfish farmers: off-flavor and management of aquaculture effluents.

Research to Improve Catfish Spawning Success

Jeffery Silverstein and Brian Brazil

Spawning success of channel catfish in broodfish ponds varies widely from year to year and even pond to pond within years. However, it is generally believed that spawning rates in broodfish ponds average 30 to 50%. This requires fingerling producers to carry a large surplus of broodfish to obtain a sufficient number of spawns. The reasons for the relatively low spawning rates in broodfish ponds are not well known, though age/size of the broodfish, water quality, water temperatures, weather, and even the kind of spawning container can all influence spawning rates.

One of the research goals of the Catfish Genetics Research Unit is to improve the spawning success of broodfish. We are working to improve reproductive traits through selective breeding, and to determine the biological reasons that reproduction in ponds is poor.

There are two time periods for sexual development that need to be investigated at the outset. The first is early sexual development of the fish. If the broodfish have not undergone any early sexual development and produced eggs, we would need to focus on the period during the winter and spring before spawning. If early sexual development and egg development are adequate then the problem may be with final maturation, just prior to spawning. During final maturation, eggs that were produced and developed over the preceding months are brought to ripeness and spawning occurs. Finally, behavioral factors and the appropriate male/female interactions must also take place.

In one series of experiments begun during the 1998 spawning season to investigate early sexual development, a group of 2 year old females were examined for spawning potential. This study focused on ovarian development and hormonal changes through the use of ultrasound imaging and blood sample collection. Females were individually marked and evaluated by ultrasound imaging in December 1997, February, April and August 1998. Blood samples were drawn at each time point to measure changes in hormone levels and yolk deposition and these fish were stocked in ponds during the spawning season and spawns collected.

During final maturation, a hormonal signal from the brain (luteinizing hormone releasing hormone) stimulates the pituitary to secrete another hormone called luteinizing hormone. These steps are the beginning of a cascade of hormonal events that lead to egg ripening and ovulation. Recently we have found that in catfish there is an inhibitory factor in the brain, dopamine, which normally slows or blocks secretion of both luteinizing hormone releasing hormone and luteinizing hormone and may limit spawning success. We have developed techniques that can stop dopamine from blocking the final maturation cascade and promote spawning success. This past summer several spawning induction trials were conducted using the dopamine blocker. With this technique, 95% of females spawned compared to 55% of the fish in other treatments. This technique appears especially promising for collecting early spawns (see table at right).

We plan to conduct trials in larger ponds in 1999 to evaluate the feasibility and success of this technique on a larger scale. Work on these and other projects to improve spawning success is continuing and should lead to higher spawning rates and lower costs per spawn.

Percent spawn with each of four treatments.

Treatment	% spawn
Dopamine blocker + LHRH	95
Dopamine blocker only	57
LHRH only	52
Control	47

Reproductive Performance and Evaluation of Three Spawning Can Types in Commercial Catfish Ponds

William R. Wolters and C. Douglas Minchew

Channel catfish reproduction in commercial culture is most commonly done by the open pond method during the natural spawning season. In this method, male and female broodfish are allowed to mate randomly in large ponds supplied with spawning containers. Spawning containers are checked periodically during the spawning season. Eggs are usually removed to a hatchery for artificial incubation and training newly hatched fry to accept formulated diets.

The open pond method is the most practical method for obtaining large numbers of eggs. This method is more successful than spawning catfish in pens or tanks. The spawning season can last 1-2 months depending on weather and water temperatures, and generally 30-60% of the female broodfish spawn in commercial ponds. Spawning containers marked with floats and placed along the sides of broodfish ponds during the spawning season simulate the way catfish spawn in lakes and rivers by providing a “nesting” site for the catfish to spawn and deposit eggs.

A wide variety of different spawning can types have been used successfully. Traditionally, producers have used milk cans and ammo cans but drums, tiles, buckets, and wooden boxes have also been used. Milk cans were commonly used in the past and generally thought to be an ideal container, but they are currently expensive and not widely available. Surplus metal ammo cans have also been widely used, but are relatively heavy with limited availability.

Recently many producers have used plastic containers, particularly new or used herbicide drums, weighted with metal strapping, and with a 6-8 inch hole cut in one end. These plastic drums are widely available and relatively inexpensive ($5-8 per drum). We evaluated spawning success in three different can types in 1997 and five different types in 1998 in three broodfish ponds on a commercial farm (see table at right). Milk cans, metal ammo cans, and white plastic and blue plastic herbicide (Roundup®) drums, and a molded gray plastic spawning can were alternated along the sides of three broodfish ponds during the catfish spawning season.

Number and date of spawn were recorded for each can type in every pond. There were significant differences in overall spawning success between 1997 and 1998. The percentage of females spawning on this particular farm was higher in 1997 than 1998. For the 1997 spawning season, results showed no significant difference in spawning success and/or preference for milk cans, ammo cans, or the white plastic drums. The spawning percentages for the entire spawning season for the different can types were milk cans, 36.2%; ammo cans, 32.6%; and white plastic drums, 31.3%.

For the 1998 spawning season, there were significant differences in spawning success between the different cans. The spawning percentages for the different can types was milk cans, 22.1%; ammo cans, 26.0%; white plastic drums, 19.1%; blue plastic drums, 18.1%; and gray plastic cans, 14.6%.

Milk cans and ammo cans had the highest percentage of spawns in both 1997 and 1998. However, milk cans and metal ammo cans are becoming extremely difficult to find and purchase. Based on these results, farmers can successfully utilize fabricated plastic drums for spawning channel catfish.

Spawning cans used in study.

Summary of farm spawning data presented as yearly average values over the three broodfish ponds with the range in parenthesis.

Variable	1997 Average	1998 Average
Pond size (acres)	8.0±1.0 (6-9)	6.0±1.7 (3-9)
Pounds broodfish/acre	1,053±38 (1,015-1,129)	1,079±12 (1,056-1,100)
Total # broodfish/acre	290±30 (260-349)	365±28 (310-400)
Broodfish size (pounds)	3.22±0.01 (3.21-3.25)	3.00±0.25 (2.75-3.00)
Number cans/acre	27±1.0	—
Number spawns/acre	82±7 (69-92)	90±15 (60-106)
Pounds of spawns/acre	96±9 (79-107)	90±19 (54-118)
Spawning success (%)	61.4±10.5 (40-73)	25.2±5.2 (16-34)
Estimated number eggs/acre (millions/acre)	1.09±0.097 (0.90-1.22)	1.04±0.19 (0.69-1.34)
Estimated number fry/acre	916,697	867,704
Percent of spawns in different can types		
Milk cans	36.2±1.5	22.1±0.5
Ammo cans	32.6±6.0	26.0±2.3
White plastic drums	31.3±5.7	19.1±1.4
Blue plastic drums	—	18.1±1.7
Gray plastic cans	—	14.6±0.9

Optimum Concentration of Dietary Protein for Catfish

Edwin H. Robinson and Meng H. Li

The concentration of dietary protein needed for optimum growth of farm-raised catfish is currently a relatively controversial subject that is under debate by catfish producers and research scientists alike. The debate centers around the proposal to reduce the dietary protein level of commercial catfish feeds from the "standard" 32% to 28%. Originally the debate was kindled by research reports that the dietary protein level used for the grow out of farm-raised catfish could be reduced to 28% without detrimental effects on fish production as long as the fish are fed as much as they would eat on a daily basis. Research data from more recent studies continues to support this contention. However, adding fuel to the debate are anecdotal reports that fish fed a 28% protein feed may not grow out quite as well and that processing yields may be reduced.

In regard to whether catfish gain weight efficiently on 28% protein diets, numerous research studies have demonstrated that there are no differences in feed consumption, feed conversion, or weight gain of fish fed a diet containing 28% protein compared to diets containing higher levels of protein. Fish that have been used in these studies were typically 60-70 lbs per thousand and were raised in small earthen ponds at a density of 5,000 to 10,000 fish per acre. The fish were generally fed to satiety (all they would consume) on a daily basis. Feeding rates rarely exceeded 120 lbs/day.

In addition to research in small ponds, we conducted a 3-year feeding study in 4 acre ponds using a multiple-batch (topping) cropping system and were unable to show a difference in production or processing yield of catfish fed either a 26, 28, or 32% protein diet. Also, some commercial catfish producers have been feeding the 28% protein diet for several years without detrimental effects on fish production.

In regard to the effect of dietary protein on processing yields, fat deposition is increased in catfish as dietary protein is reduced. Increased fattiness can negatively affect carcass yields if sufficient fat is deposited in the visceral cavity. On the other hand, an increase in fillet fat has been reported to increase fillet yields. However, the increase in body fat between fish fed a 28% protein diet versus those fed a 32% protein diet is generally not significant and appears to have little effect on processing yields.

There are numerous factors aside from diet that can affect processing yields, which make it difficult to assess the accuracy of anecdotal reports. One particular problem with observations made on production facilities is that the observations are often made based on comparison of fish production during different years. Although this may seem to be a valid comparison, environmental conditions (which dramatically influence feed consumption) are seldom the same from one year to the next. Even observations concerning fish performance on a particular diet made on catfish farms within the same growing period are often misleading because of inherent differences between ponds. This is not to say that the reports are inaccurate, but it is highly improbable that small differences in fish production on various diets can be picked up in commercial ponds and can not be demonstrated in controlled replicated studies.

Since the dietary protein requirement is affected by several factors including fish size, water temperature, diet composition, and management practices and since management practices (particularly feeding rates) vary greatly throughout the catfish industry, it is difficult to make a blanket recommendation as to the efficacy of a particular diet. The choice of the dietary protein level that is best has to be based on the management strategy of the individual catfish producer. For example, if feed is severly restricted, higher protein diets may be more appropriate. However, if feeding rates are rather liberal (cut off not below 90-120 lbs/day) one should be able to use a 28% protein diet without negatively affecting fish production or processing yields.

Although research has shown that a 28% protein diet can be used from stocking to harvest, it may be advantageous to catfish producers that choose to use the diet to start the fish on a 32% protein diet in early spring when temperatures are relatively cool and the fish are feeding with less vigor, and as the temperature warms and the fish are feeding vigorously change to the 28% protein diet. This strategy may be particularly appropriate for catfish producers that understock with smaller fingerlings (less than 60 lbs/thousand).

In regard to understocked fish, it is logical to assume that the smaller less aggressive fish would not get much feed and thus would benefit from a higher dietary protein level, but in practice this may not be the case. It is true that smaller fish do need a higher protein diet and that the larger more aggressive fish consume the majority of the feed. However, since the larger fish do not benefit from the higher protein diet, it is not economical to feed the more expensive diet in an attempt to get a little more protein to the smaller fish. Also, since the smaller understocked fish are underfed because they cannot effectively compete with larger fish for feed, once the larger fish are removed from the pond and the smaller fish are able to feed fully they will grow more rapidly than normal. This rapid growth is due to compensatory growth that occurs in animals that have been starved or fed at a restricted rate.

Research is continuing on the use of low protein diets for grow out of catfish. As additional data become available, they will be published in future issues of this newsletter.

Ten best waveforms.

Frequency Hertz	Pulse Width Millisecond	Sweep Time Second
15H	10-0	10
15	10-0.5	12
15	4-0.2	6
20	12-0.6	6
20	8-0.4	6
20	6-0.3	10
12-120	500	12
10-100	500	8
6.0-60	1	8
6.0-60	2	4

Preliminary Testing for Development of an Electric Seine for Increased Harvest Efficiency of Channel Catfish

Kenneth K. McDill and C. Douglas Minchew

Catfish are known to respond to electricity. However, it has not been shown that an electrical field can be effective in increasing harvesting efficiency. The aim of this study was to determine an effective waveform and electrode array that can be used in field tests to determine if electrical seining is feasible and can improve harvesting efficiency.

The study was conducted in concrete tanks that were 20 feet long, 4 feet wide, and 3 feet deep. Tests were conducted at a water temperature of 70°F with water quality that was typical of Delta catfish ponds. Catfish used in the study weighed about 1.7 pounds on average and ranged between 0.25 to 5 pounds.

A Smith-Root Model 12-B Backpack Electrofisher was used to provide the pulsed direct current waveforms. Five different types of output waveforms were tested including standard pulses, gated bursts, wide to narrow varying width pulses, high to low varying frequency pulses, and low to high varying frequency pulses. Standard pulses turn on and off in a repeating cycle. Gated bursts are waveforms with a group of rapid pulses followed by a short off-time. The wide to narrow varying width pulses cycle down from longer pulse periods to shorter periods, while holding the pulse frequency constant over a set cycle period. The high to low varying frequency pulses start at a higher frequency and cycle down to a lower pulse frequency during a set cycle period, while the duration of the pulse remains constant. The low to high varying frequency pulses cycle from lower to higher frequencies over the set cycle duration, while the pulse width is held constant.

Initially, the electrical field was held stationary and the catfish were driven toward it. As the scope of the search was narrowed, the electrodes were attached to poles and the field was moved toward the fish to simulate seining. During all tests, observations of the reactions of the fish to the field were made to determine the effectiveness of the waveforms. Finally, ten of the most promising waveforms were selected (table at left). Using these waveforms, the electrode placement was altered to determine the best array.

The two grid arrays tested had two horizontal electrodes and either three or five vertical electrodes in place. Also tested were arrays with only the vertical electrodes in the arrangement. Next, an array with the horizontal electrodes moved closer together and the vertical electrodes removed was used. Finally, the anode was removed from the poles and allowed to drag on the bottom behind the cathode.

Based on the waveforms tested and the different electrode arrays used, a low to high varying frequency waveform with a 2 millisecond pulse width and a 6.0-60Hz sweep over 4 seconds appeared to be the most effective waveform. The combination of this waveform and two horizontal electrodes spaced between 12 and 18 inches apart provided the best results and is the one that will be field tested.

Considerations for Determining Treatment Strategies to Control Bacterial Infections in Channel Catfish

David Wise

Control of ESC related mortalities can be achieved with the use of medicated feed and restriction of feeding to every other or every third day. Pond and laboratory studies have demonstrated a significant relationship between feeding frequency and disease resistance to ESC.

In fingerlings, the most effective strategy for reducing losses to ESC is to withhold feed or feed Romet®-medicated feed on alternate days (every other or every third day). However, starvation severely compromises growth and long-term alternate-day use of Romet®-medicated feed is an off-label use of the drug and therefore illegal. Restricted use of medicated feed will also result in the development of antibiotic resistant strains of *Edwardsiella ictaluri*. Considering the lack of available drugs for use in aquaculture, prolonged use of medicated feed is considered a poor and irresponsible choice for controlling ESC related mortalities.

An alternative to the prolonged use of Romet®-medicated feed is the restriction of feeding (non-medicated feed) to every other or every third day. This feeding regimen appears to offer a good compromise between enhanced survival and reduced weight gain.

Additional studies indicate that the effect of withholding feed to increase disease resistance is immediate and is not related to the development of nutritional deficiencies in fish. Withholding fish from feed for 2 weeks before the development of infection is no more effective than withholding fish from feed immediately following bacterial exposure. These data indicate that restricted feeding schedules do not need to be implemented until pond water temperatures begin to enter the ESC temperature window (approximately 70-80°F) or until the occurrence of the disease. If a 5-day regimen of medicated feed is used to control *E. ictaluri* infections, it is important to use some type of restricted feeding program after the 5-day period of feeding medicated feed. If mortalities are minimal, feeding fish non-medicated feed every third day following the prescribed use of medicated feed should effectively minimize mortalities.

Disease treatment strategies are dependent on the causative agent of the disease, and other factors such as farm management practices, fish size, and previous history of the fish. Fingerlings are considerably more susceptible to bacterial infections; therefore, fingerling producers must routinely prepare for the occurrence of seasonal diseases such as ESC and Columnaris. This is particularly important during the fall disease season. These diseases should be anticipated and disease management programs implemented before the development of significant losses.

In many cases ESC losses in fingerlings can be significantly reduced by implementing restricted feeding practices. The best time to implement this practice is when pond water temperatures just begin to enter the ESC temperature window. This strategy should be considered as prophylactic and implemented in all ponds which are used for fingerling production. Restricted feeding should be effective in minimizing losses associated with ESC; however, this treatment is not 100% effective and some ponds will be more problematic than others. If mortalities begin to increase, the use of medicated feed followed by a period of starvation may be necessary. The length of time fish are withheld from feed is dependent on how quickly pond conditions improve. In general, fish are withheld from feed until mortalities are significantly reduced and then the fish are slowly brought back on feed over a period of several weeks.

Food fish operations are more difficult to evaluate due to mixed size classes of fish, the development of chronic type infections, and production goals unique to individual farmers. Prophylactic control of ESC in production ponds is generally not necessary since the occurrence of high mortality rates associated with bacterial infections are usually sporadic. Therefore, disease control in production systems is approached on a pond to pond basis as problems develop. Many times low grade infections do not require aggressive treatment since larger fish are generally more resistant to bacterial infections. In addition, optimizing survival is not always the most economical decision or compatible with production goals. In a production pond containing several size classes of fish, it may be difficult to justify a restricted feeding program or completely withholding feed if losses are occurring only in the small understocked fish. Under these conditions it may be more beneficial to continue feeding to achieve maximal growth rates of the larger fish. The development of chronic infections should also influence management decisions. Chronic type infections are a result of previous infections which can not be cleared from the fish and generally do not respond to treatment. If acute infections are not evident it may be difficult to justify treating "untreatable" fish. The only drawback to this philosophy is that often it is difficult to determine when low grade chronic infections may result in the development of acute type infections with higher mortality rates.

Regardless of the treatment strategy effective control is dependent on early diagnosis, since sick fish generally do not respond to treatment. Therefore, the target of any disease treatment is the population of healthy fish within the pond. For example, if 30% of the fish in a pond are sick, only 70% of that population of fish should be considered treatable.

Restricted feeding should be viewed as a tool to help reduce ESC related mortalities and must be incorporated into long term management strategies to be effective. In most cases, once significant mortalities develop disease intervention is difficult. Finally, accurate disease diagnosis is critical in determining a proper management strategy. It has been well established that withholding feed is effective for controlling ESC related mortalities. Unfortunately, this relationship does not hold true for mortalities associated with Columnaris infections. If Columnaris is determined to be the predominant etiological agent it is important that the fish (particularly first year fingerlings) are fed Terramycin® medicated feed. Withholding feed under these conditions, can significantly increase mortality rates.

The Status of Simazine

Anita M. Kelly

Recently, at the Water Quality Field Day in East Mississippi, many fish farmers questioned why simazine is no longer labeled for aquatic use. This prompted the following query into the history and status of simazine as an algaecide.

Simazine, which is primarily used as an agricultural herbicide, is also used as an algaecide. Ciba-Geigy manufactured Aquazine®, which was labeled as approved for food fish use when used according to the label instructions. In 1989, the EPA classified simazine as a Group C possible human carcinogen. In August of 1993, the EPA conducted a risk assessment of simazine, which revealed unacceptable cancer and non-cancer health risks to children and adults exposed to water treated with simazine algaecides. EPA's risk assessment is based on laboratory animal studies. These studies indicate that short term exposure to simazine may result in weight loss and reduced red blood cell count (anemia), which are reversible effects when exposure is terminated. The studies also show that exposure to simazine poses a potential risk of cancer.

Only two chemical companies were registrants of technical simazine that was approved for aquatic use - Ciba-Geigy and Oxon-Italia. Both of these companies ceased supporting all aquatic uses of simazine prior to the EPA's risk assessment. The aquatic use cancellation for Ciba-Geigy products became effective on October 9, 1992. Therefore, simazine is no longer approved for use in food fish since it is no longer labeled for aquatic use. Since Ciba-Geigy willingly ceased supporting simazine for aquatic use, new labeling of simazine for aquatic use is not likely in the near future.

Automated Monitoring Systems and Water Quality

Jim Steeby

Recent advances in automated systems to control aerators in catfish ponds will probably change the management of catfish farms over the next few years. While individual farmers may not be interested directly in the type of data these systems can record, researchers are interested in the description of pond conditions fish are subjected to and the influence these may have on production. Examples of some of the first data taken from these systems are presented here. At this point we are unable to directly relate most of this information to fish production but perhaps we can in the future.

Temperature

Using temperature data gathered over the course of a summer we can compare last summer's water to the 15-year average and directly compare it in future summers.

A total of 48 temperature readings per day, taken every 30 minutes in a commercial catfish pond near Belzoni, MS were averaged, first by day and then by month for comparison to the 15-year average temperature as calculated from air temperatures.

Average monthly water temperature in degrees centigrade.							
	Apr	May	Jun	Jul	Aug	Sep	Oct
1997	18.7	23.8	27.5	28.3	28.4	26.9	22.3
1951-86 (Average)	20.5	24.0	28.0	29.6	29.2	27.3	23.2

From the data presented in the upper table, one can see that the 1997 spring was especially cooler than normal and that summer average temperature was slightly lower also. This was probably the single most important factor influencing fish growth for 1997. The much cooler spring delayed the onset of the normal feeding season which decreased the pounds of fish grown in the summer of 1997.

Dissolved Oxygen

Other interesting data collected for the 1997 season from typical foodfish ponds concern the number of hours that dissolved oxygen was below 3, 2 and 1 part per million. In the lower table, "DO drop" refers to the average decline in oxygen in ppm over the night time hours for that month. In August dissolved oxygen was below 3 ppm about half of the time (51.6%) and below 2 ppm around one third of the day (33.6%).

Total hours of low dissolved oxygen by month.							
	Apr	May	Jun	Jul	Aug	Sep	Oct
Hr DO<3	6	119	178	317	384	268	43
Hr DO<2	0	65	83	210	250	164	13
Hr DO<1	0	7	10	107	70	29	0
Nightly DO Drop	30	7.6	10.9	10.8	7.4	9.7	6.9

*April and June have 720 total hours, all other months have 744 hours.

To compute electrical savings by starting aeration at 2 ppm rather than 3 ppm, take August for example, 384-250=134 hr time saved. A 10 hp aerator uses approximately $1.00 of power per hour, so savings would be $134. If the pond contained two aerators of this size, savings could potentially be more than $200 per month per pond for August. Decline or drop in dissolved oxygen for August was lower than July or September. This is probably the result of lower dissolved oxygen highs for that month when temperatures are high and daylight hours are declining for the summer and nights are longer.

When other variables such as ammonia and nitrites can be monitored on a 24-hr basis we will have a better picture of why fish have good and bad days. All these variables combined with daily feeding records give a good idea of the total life-quality that catfish experience in their annual cycle of growth in ponds.