CATFISH FARMING IN WESTERN ALABAMA

Based on a Survey Questionnaire Administered in August, 2005

By Mike Polioudakis

INTRODUCTION

This report was prepared to assist the Alabama Catfish Producers (ACP), the World Wildlife Fund (WWF), and the Alabama Farmers Federation (ALFA). This report was based on results of a questionnaire administered to farmers in Western Alabama in August of 2005. Aaron McNevin of WWF provided the questionnaire.

Dr. Mike Polioudakis interviewed the farmers and wrote this report. He is a social anthropologist. He originally trained in ecological anthropology and evolutionary theory. He worked about eight years with rural people in Thailand, including about four years with shrimp farmers. Pronouns that refer to the writer refer to him.

I thank all the catfish farmers and everybody at the Greensboro Fish Center.

This report has these objectives:

(1) Briefly remind readers of what a certification program entails.

(2) Briefly describes the environmental and social conditions of catfish farming in Western Alabama as they might be relevant to certification.

(3) List suggestions made by catfish farmers for issues relevant to certification; issues that they want to discuss in meetings.

(4) List suggestions from Mike Polioudakis for issues relevant to certification.

(5) Present the data from the questionnaire.

(6) In appendices, provide background on catfish farming.

I use the terms catfish “farmer” and catfish “producer” interchangeably.

The original research specification called for interviewing hatchery operators as well as catfish producers. It was not possible to interview hatchery operators because of the short time available for research and because many producers who also used to raise fingerlings have now stopped. Most fingerlings are now provided by large operations that are distinct from producers so that a study of hatcheries should be conducted separately.

The sample size is small (about 25), with considerable variance often nearly equal to the mean, so readers should be cautious about the statistical significance of results.

The time and financial constraints given me by the WWF indicated that I should try to do two interviews per day. The time constraints on farmers meant about 2-3 hours per interview. Aaron McNevin and Claude Boyd requested that I ask the farmers if they had any questions about the certification process. The farmers wanted to know about certification and the role of the WWF, so that I had to use a considerable amount of time explaining those topics. I consider that time well spent. Thus it was not possible to get detailed answers to the many questionnaires in the time frame given. I had to focus on areas where a change in practice might be needed. I found little need for change, perhaps because I had little time to ask (see below). A better study might be warranted after farmers are more familiar with the program, so that attention can be focused on the questions.

(1) CERTIFICATION

Farmers wished the meaning of “certification” to be clear. If the meaning of certification is not as described here, the farmers need to know.

“To be certified”, means to be inspected by an objective agency on the basis of a set of rules and verification procedures, and to pass the inspection.

“To be certified”, does not mean that producers must simply conform to the standards of an outside agency such as the WWF.

In a case such as this, the “stakeholders” are all the people concerned with the producing of a particular good, such as catfish. The stakeholders include the producers, the employees of the producers, local citizens, organizations such as ALFA and ACP, the WWF, and anybody else who has a reasonable cause to be involved. Stakeholders should be able to explain their involvement.

All the stakeholders together make their own set of standards through a series of public meetings.

The stakeholders also have to make a set of procedures whereby conformity to the standards can be objectively verified (such as by keeping adequate records).

For credibility by consumers, no stakeholder (not the producers, nor WWF, nor anybody else) can dominate the third-party outside inspection agency. The third-party outside inspection agency must remain objective.

The WWF consults with the producers and other stakeholders during development of the standards and the verification procedures so that the certification will have maximum credibility with whatever the target audience that is desired. The WWF can suggest appropriate third-party inspection agencies.

A label of some kind usually marks successful certification. In the case of food products, the label usually attaches to the packaging for the food products. In the case of catfish, one version of the label would attach to the boxes leaving the processing plant, and another version of the label would attach to the “cello-wrapped” packages in a retail store or to the bin that held the loose catfish in the retail store. If any other retail products are developed from catfish, such as frozen products, the label should attach to those as well.

(2) OVERALL SUMMARY

Catfish farming is not like shrimp farming, salmon farming, trout farming, and many other kinds of aquaculture. Preconceptions about those kinds of farming cannot be applied to catfish farming. When assessing catfish farming, people should be ready to learn about catfish farming.

Catfish farmers likely have little to change in their methods so as to present a case that they are environmentally sound and socially sound producers of a clean product.

The primary change in the behavior of catfish farmers will be to keep reasonably detailed records on the issues of concern expressed in the questionnaire: water use, chemical use, stocking rates, fish diseases, response to bird predation, cleanup of dead fish, safety, employee relations, and new pond construction. Most farmers already keep records of this kind. Records for the purpose of certification need to be standardized between farms.

Other changes involve carrying out more systematically practices that farmers already do, such as repairing pond walls (see “My Suggestions” below).

Catfish farming in Western Alabama is done so that it integrates well with the environment. It causes little environmental impact at all, and almost no negative environmental impact. In some ways, catfish farming has benefited the environment.

Catfish farmers have changed the landscape somewhat but not drastically. They have somewhat returned the landscape to what it was before this area was drained and prepared for mono-cropping (cotton and row crops) and for cattle between 1820 and 1950. On the natural backdrop of rolling hills, catfish farmers have reinstated a mixture of ponds, small waterways, and stands of native hardwoods. They have probably enhanced the natural productivity of the region, including providing some habitat for birds and other animals. They have contributed to erosion control more than they cause any erosion.

Catfish farmers contribute very little effluent. Most of that is rainwater. The water effluent that they do contribute is not harmful.

By far the largest source of water for the ponds is rain. Ponds are not drained for harvesting; ponds are seined. Unless repair has to be done, ponds are almost never drained. Most ponds have not been drained in over 15 years. Nearly all farms have wells, but farmers do not pump water for pond use except in drought years or in rare cases of harsh summer dry spells when they pump only small amounts. The wells and pumping do not adversely affect the local water table now and do not cause water problems for other users.

Catfish farmers use chemicals conservatively now and have used them more conservatively over time. They use chemicals within guidelines recommended by local government experts. They do not use any dangerous chemicals. Farmers now likely do not overuse chemicals, and do not use chemicals in a way that hurts the environment or that hurts people. Chemicals do not usually enter the local environment but remain within the pond in small amounts, where they usually degrade or become locked in a manner that makes eventual release unlikely. The greatest use of chemicals is as herbicides to maintain the algae balance in ponds and to restrict the growth of the unwanted algae that produces poor tasting fish. Farmers have substituted natural algae controls – algae eating shad fish – for a noticeable amount of chemical use.

Now, the cormorant is the only widespread significant source of predation on ponds from birds. Farmers vigorously try to frighten birds away with various methods, including shooting, but farmers actually cause little bird death. The cormorant population has grown significantly during the time that catfish farming developed, so farmers are not a significant threat to its viability. Farmers need to be able to continue current practices in frightening birds, including shooting.

Death is a natural part of any farming, including aquaculture. Outside of periods of disease and temperature stress, very few fish die in a catfish pond. A minority of ponds on a farm experience large-scale fish death over a typical growing season, but even in those ponds rarely does a majority of fish die. It is not practical to remove the small numbers of normal dead fish that occur outside of periods of stress. Farmers need to develop guidelines for threshold numbers of dead fish when they should remove dead fish from ponds.

The majority of farms are owner operated, usually as true family farms with only family members participating.

Work on a catfish farm is difficult because it absolutely requires activity at all times of the day, especially for the early morning monitoring of water conditions in ponds. Although catfish farm work is well paid, because of its work hours, now few local people other than owner-operators and their families want work on catfish farms.

Most farms have 20 or fewer ponds. Usually only farms with 20 or more ponds can hire a permanent full-time worker. These workers used to be people who had worked for the family a long time. Often they got not only wages but a dwelling and transportation as well. Formal health care or retirement benefits were never a part of the socially expected relations between the farmers and their employees. Even so, farmers were committed to the welfare of their employees and quite often assumed health care costs of their employees and families as need required. Some large farms do offer formal health care. It is neither feasible nor culturally expected that farmers with less than about 30 ponds offer formal health care benefits to workers. Only very large farms could afford any formal retirement benefits.

Many farms hire students for summer work, providing pay and benefits on the basis of local cultural understandings. The money is considered good.

The generation cohort of long-term farm workers is now dying out, but is not being replaced by a new generation with a similar relation to the farms and a similar work ethic. Instead, most farms are switching to automated pond monitors that allows as many as 30 ponds to be run by a family alone, with only occasional summer help. This switch is warranted for cost-benefit reasons and by the difficulty of finding reliable workers for this kind of work.

As a result of these cultural, historical, and technical forces, relations between farms and the remaining workers are good. The relations are not considered exploitive, certainly not by local standards, and not by most prevailing standards for farm labor. It would be foolish to artificially impose other standards on the farms.

Despite the rigor of work on catfish farms, they seem safe. I recorded almost no accidents among the farms sampled. The only serious accidents on farms did not directly involve catfish farming work.

(3) FARMER CONCERNS

Farmers expressed the concerns listed below during the interviews. Certification involves compromise. A certification program might not be able to fully meet all the concerns listed here but it should be able to do pretty well with most of them.

-The CPA, ALFA, and WWF need to clarify the benefits to farmers of certification. Specifically the farmers request a discussion of marketing advantages.

-The farmers request that the CPA, ALFA, and WWF make clear any drawbacks to not participating.

-Make clear the motives of WWF in participating in the certification procedure.

-Make clear the environmental and social principles and standards of the WWF.

-Make clear the role of the WWF, and the standards of the WWF, in the process of developing the standards and procedures for certification.

-Make clear the relation between the standards of the WWF and any standards developed by the producers themselves.

-Farmers wish to be certain that participation is voluntary.

-Farmers may enter or leave the program as they wish, after giving proper notification.

-“Country of origin” is clearly displayed on any label.

-Some link to the WWF is clearly displayed on any label.

-Any certification label reaches the retail counter intact for all units of catfish in whatever final product packaging.

-Farmers are able to use certification in their advertising.

-While portraying participating Alabama producers in a good light, certification does not necessarily imply anything negative about other producers in Alabama or about producers anywhere else. The program is not intended to be divisive.

-Farmers in other regions can eventually enter this certification program if they meet the standards set by Alabama producers.

-Processors should not discriminate for or against farmers who are in the group of certified producers; and processors should not discriminate for or against farmers who are not in the group of certified producers.

-Even if they are not immediately a part of certification, the processors, distributors, and retailers should provide assurance that the label goes from the farm to the retail counter. There should be some recourse in case processors, distributors, or retailers break this chain.

-There should be some recourse in case processors, distributors, or retailers improperly label uncertified catfish (or non-catfish) as certified.

-Farmers should not be tied to any one processor so as to be able to participate in the certification program.

-Farmers in the program should continue to have access to several processors, including processors in states other than Alabama. Any processor should be able to easily participate in the program at least to the extent of properly putting a label on the correct boxes of processed catfish. To participate to this extent implies nothing else about the processor.

-Any inspection fees have to be reasonable.

-Inspection fees should be roughly proportional to size of operation: number of ponds, acreage in ponds, number of fish in ponds, or total amount of fish harvested. A payment program similar to the "check off system" for feed might have to be devised.

-Certified catfish might bring a slightly higher price in some urban markets. Some farmers would like to share in any price benefits if possible. Farmers recognized that any such sharing would be difficult to negotiate with distributors and retailers, and to enforce.

-Rules of the game should not be quickly changed "in midstream". There should be procedures in place for proposing a condition change, accepting a change, and carrying out a change. The procedures should incorporate a reasonable advance warning and a reasonable length of time to implement any change. Changes should be able to originate from the producers, WWF, or ALFA.

-As much as possible, any changes should be consistent with the orientation of the producers, WWF, or ALFA as developed in the certification meetings. There should be no surprise changes of philosophy, standards, or implementation by any of the groups involved.

-Changes should not be frequent.

(4) MY SUGGESTIONS

The ideas here are only recommendations.

CHEMICAL USE

-Farmers need a procedure to record general chemical use overall on the farm, and specific chemical use in particular cases (“sick” ponds), without keeping tedious records for all chemical use in all ponds.

-Farmers need not record routine modest chemical use in each normal healthy pond.

Many farms now practice moderate repeated prophylactic use of chemicals to control algae (small doses at frequent intervals to control algae) because that type of practice is more effective than larger does of chemicals intermittently to treat specific acute problems (using a lot all at once to treat a bad problem).

Total chemical use in all ponds taken together on any farm likely is less than what is allowed under prevailing standards.

However, chemical use in any one particular pond might push toward the limits of what is allowed because some ponds develop acute and/or chronic problems that require significant treatment.

-Farmers should keep a record of chemical use in any pond if use in that pond exceeds some threshold limit.

-Farmers need to decide under what conditions they need to keep detailed records on chemical use for particular ponds.

-Farmers need to record total use of each chemical on the farm as a whole over a yearly period. Essentially, farmers need to inventory chemicals stocks when the farms are first certified, and then to record the remaining stock at the end of each year. Together with what was purchased during the year, the difference between the beginning and end of a year is the assumed overall use for that year.

-The record of overall chemical stocks and use, and the particular record on use in specific “sick” ponds, would take the place of detailed recording of chemical use in all ponds.

-Often farmers have to use modest doses of chemicals (principally copper sulfate) to control algae, to keep fish “on flavor”, before the processors will come to the farm to harvest the ponds (the ponds are taken off all chemicals for about three days before any harvest). When the harvesting team from the processing plant arrives as scheduled, this use of chemicals is small and justified. When the harvesting team does not arrive as scheduled, chemical use is prolonged. This prolonged use of chemicals is not the fault of the farmer. Processors should be encouraged to harvest promptly so as to avoid the prolonged use of chemicals on the farm. Farmers should record delays in harvesting and should record any prolonged use of (low doses) of chemicals as a result of delays in harvesting.

-Several farmers mentioned that the use of shad in the last five years to control algae helped to stabilize the ecology of the pond and helped to reduce chemical use. If farmers have records of shad use and of the decline in chemical use, it would be advantageous to present that evidence to other farmers and to the public. This evidence might encourage other farmers to use shad and to keep records of their own experimental use of shad. This use of shad should not be required unless the general body of farmers includes it as part of their provisions for certification.

FCR and HARVESTING

FCR (Feed Conversion Ratio) is influenced by the number of times harvested per year, the number of times seined per harvest, and the time between each seining per each harvest. The longer the wait, the worse (higher) is the FCR. The process is cumulate, so that FCR gets increasingly worse over time with fewer harvests and fewer seines, at least up to a point. To accurately get FCR data, farmers should record when ponds are seined, the number of seines per pond, the time between seines per harvest, the stocking rate, the feed input for the pond and/or farm, and the yield per pond for each harvest.

WATER USE

Now, nearly all water in nearly all catfish ponds in Western Alabama comes from rainfall. Only a very small minority of water comes from wells, and that usually only in dry spells.

-Farmers should record well use.

-No restrictions on well use are currently recommended.

Even levee pond farmers, even if they have access to well water or river water, try to conserve water as much as possible because healthy water is a valuable resource.

-The few farmers that use a significant amount of water from wells (for use in traditional levee ponds) should simply declare that their use does not adversely affect the water table. Until shown otherwise, we should probably take them at their word. They might think of some guidelines whereby adverse affects could be demonstrated so that they can show that they do not adversely affect the water table.

-The few farmers that take water from a source other than wells, such as a local stream or river (for use in traditional levee ponds) should simply declare that their actions are in compliance with regulations and that their use does not adversely affect the water table. Until shown otherwise, we should probably take them at their word. They might think of some guidelines whereby adverse affects could be demonstrated so that they can show that they do not adversely affect the water table.

-Farmers who work primarily with levee ponds, or who have levee ponds, or who use wells for a significant source of water, or who use rivers for a significant source of water, should not be excluded from certification for those reasons alone. Within the context of Western Alabama catfish farming, these ponds do not pose a problem partly because everybody else uses so little water but largely because these ponds are run effectively and do not themselves pose a threat to water use. It might be necessary for levee pond farmers, and farmers that use a significant amount of well water or river water, to develop some particular guidelines for their situation. Actual advice on these guidelines would require more work particularly with those farmers. They can likely develop a reasonable set of standards on their own if they keep the goals of certification in mind.

BIRDS

-Farmers should be allowed to shoot at birds, especially cormorants (now, few farmers wish to kill birds other than cormorants although pelicans might become a problem in the future). Farmers should not have to stop shooting at birds, although farmers should not kill more than is legally allowed of any species.

-Farmers should record about how many shots they take at birds and the number of birds they actually kill. This record will show that shooting is more a matter of scaring birds than of actually killing them. This rationale for keeping the record does not imply that farmers should not be able to kill some birds in accord with legal allowances.

-Farmers should not use shotguns unless necessary (see point below).

-Farmers on cormorant flyways, or in other places where cormorants gather, have to use shotguns. The use of shotguns in those cases should be permitted. The farmer should be the judge of whether or not the farm is on a flyway or in a place where cormorants gather.

DEAD FISH

A typical 20-acre catfish pond has at least 100,000 live fish (5000 fish per surface acre). Rarely do more than three fish die per day per healthy pond, often less than one per day on average. Except for unusually large fish kills, dead fish in a pond are not a threat to health or sanitation or to the quality of the remaining live fish in ponds.

-Farmers should not be required to remove the few dead fish per week that typically die in a normal healthy pond. It is impractical to search ponds for a few dead fish and to remove dead fish regularly.

Sometimes ponds develop problems so that several hundred or several thousand fish die at once. This event does not necessarily signal that the pond as a whole has “gone bad”. To forestall problems with bacteria, in such cases sometimes farmers do remove as many such dead fish as they can.

-Farmers need to develop a threshold number of dead fish for when dead fish should be removed from a pond: 10 dead at once, 50 at once, 500 at once, 1000 at once, 10,000 at once, etc.

-Farmers need to develop guidelines for how to remove dead fish, and what can be done with removed dead fish.

-Records should be kept of fish deaths exceeding the threshold, and records should be kept of disposal methods actually used.

-Large fish kills do not occur as often during the cold season. Dead fish take longer to decay in the cold season, and are easier to remove. Farmers might need a different set of guidelines for the cold season and the hot season. However, I recommend that modest numbers of dead fish be allowed to remain in ponds even during the cold season.

EMPLOYEE RELATIONS AND OTHER SOCIAL RELATIONS

The context for evaluating the relations of catfish farms with employees or with the surrounding society should be the condition of farms, society, and farm labor in general in the United States. It should not be the context of a highly structured stereotyped industrial factory with a labor union in the Midwest during the glory days of American labor unions. By the suggested standard, the condition of employees is fairly good, relations between owners and employees are fairly good, and relations to the larger society are fairly good.

The very large majority of farms are family farms, with no employees or with only some part-time employees. Thus many issues of owner-employee relations do not come up, such as providing health care or retirement care. To the extent that these issues do come up, the following points might be relevant.

-Hires are being replaced by automation. This is not an indication of poor relations with employees but of modern farm management, and should not be discouraged.

-There is a long tradition of farm owners "taking care" of their employees, including offering adequate medical care when required. This tradition should be understood as part of an overall pattern of honor, respect, work, and work relations.

-Only farms above a certain threshold could afford formal health care for their employees.

-Only farms above an even larger threshold could afford formal retirement plans for their employees.

-Even if such thresholds could be determined, I do not advise that farms of any size be required now to give formal health care or formal retirement to their employees. Such care might be recommended but should not be required. This condition might be re-evaluated in about fifteen years, depending on world market conditions.

-Farms that do offer formal health care or formal retirement should continue to do so. They are commended for doing so. Farmers should not take the fact that certification does not impose formal requirements for health care or for retirement as an excuse to cease providing. Existing patterns should be maintained.

-Many farms provide housing and/or transportation for their long-term employees, as part of a traditional personal relation with such employees. Many old resident families, some poor, benefit from this practice. This practice should not be formalized either, for many reasons. The reasons are not listed here.

-Owners spend considerable time informally instructing employees in safety, in particular because owners often take personal responsibility for health costs. Many owners do show videos provided by the "Fish Center" in Greensboro, and some owners have taken employees to safety courses there. All these practices seem adequate for now and should be encouraged, especially given the good apparent safety records of farms.

-Records should be kept of health incidents or of accidents. The farmers should devise their own standards for which incidents or accidents should be recorded.

-Farmers might give thought to future formalization of employee relations, but not try to institute that now.

WETLANDS

The vast majority of catfish ponds were created from converted old cow pastures and meadows, and not from wetlands or by cutting stands of trees.

-Even so, I request that future catfish ponds not be made from wet places or from stands of trees without careful consideration. There is already enough catfish production to supply the current market. Farmers might consult wildlife biologists and foresters before buying land for conversion to fishponds, before converting wet areas on land they already own, or before cutting stands of trees on land they already own. This requesting should not be made a mandatory point in the certification program.

EROSION

Most pond banks are covered with vegetation. In some places on pond banks, erosion is evident so that the underlying dirt shows and so that the loss of bank mass is clear. This is less of a problem than it might seem (see appendix) but still needs to be addressed:

-I suggest using limestone rock or "rip rap" for repairs. Replanting vegetation, or using other covering material, should also be acceptable.

-Farmers need to determine a threshold size of an eroded area, above which repair needs to be done. Farmers need to determine how big an eroded area can get before it has to be repaired. I suggest an eroded area should be repaired when a farmer can place a 10-foot stick completely inside the eroded area in some way, no matter the other dimensions of the eroded area. Thus, even if the eroded area is 10 feet by 1 foot, it should be repaired.

-Put rip rap or other similar hard substance on the ground in the area where water comes out of a drainpipe.

Some drainpipes extend into the middle of small waterways. This is a good practice because it directs the flow of water where the flow is likely to cause the least erosion. Even so, this practice can cause erosion when the water level in the waterway is low. Therefore:

-For shallow waterways, put rip rap or other similar hard substance at the bottom of waterways where a drainpipe extends into the waterway.

(5) QUESTIONNAIRE RESULTS

No particular farmer or farm is identified in these results. All results are aggregated. Where a farm might be identifiable by reference to its size or a distinguishing feature, I omit reference to the farm.

The original project intended 25 interviews. Not every respondent gave a simple answer to every question, so the number of respondents (“n”) is not the same for all questions. There were about 22 responses for most questions. “Average” means “arithmetic mean”. “SD” means “standard deviation”.

The persons interviewed were picked from a list of about 45 people, supplied by Greg Whitis of the “Fish Center” in Greensboro. Who was actually interviewed depended on who was available and willing. Unfortunately, the interviews took place in August, the busiest time of year, and this situation constrained who was available to participate.

As I had requested, Greg Whitis divided the farms into categories of large, medium, and small. I tried to interview an equal number from each size group but was limited by availability.

Although Western Alabama is one geographical region, it has at least four sub-regions in which farming conditions differ significantly. These are listed in an appendix. I interviewed at least two farmers from each sub-region. I also interviewed farmers from near the Mississippi border.

The questions as written did not always make sense in the field (that is a common occurrence with questionnaires and not a cause for concern). I modified the questions to suit the situation and the responses of the farmers. Both the original and modified questions are given. I try to distinguish farmer comments from my comments. Where a comment is not qualified, it likely originated with the farmers. I usually agree unless noted.

SOME BACKGROUND INFORMATION NOT ON QUESTIONNAIRE

The interviews were skewed toward large farms because the owners of those farms could more easily squeeze me into their schedules during August. I do not think this skewing invalidates the results. This skewing probably helped give a more accurate picture of some aspects of farming such as disease incidence and chemical use.

Number of farms with 1-9 ponds = 6.

Number of farms with 10-20 ponds = 7.

Number of farms with 21 or more ponds = 9.

One farm had 21 ponds but I would classify it as a medium sized farm.

Total = 23.

Average number of ponds = 24.3; SD = 21.4; n = 22

Average acres in ponds = 292.3; SD = 262.6; n = 20

Average acres available for watershed = 1116.2; SD = 959.3; n = 20

Ratio of average acres for watershed to average acres in ponds = 3.81; n = 20

STOCKING AND FEEDING

(1) Do you top harvest or clean harvest?

All 22 respondents only top harvest. Ponds are never drained specifically for harvest.

(2) What is the stocking rate used?

Average = 6252 fingerlings per acre per stocking episode (usually once per year or after a harvest); SD = 1780; n = 22

(3) How many crops per year are obtained?

Average = 1.47; SD = 0.65; n =22

Also relevant were the number of times a pond was seined per each time harvested:

Average = 1.78; SD = 0.58; n=21

(4) How much feed is used per day?

These figures pertain only to the peak summer season from about March through September, when fish are fed every day (except just before harvest or when the pond has problems). During winter, fish are fed much less and sometimes are fed only every-other-day. It makes no sense to mix up the two seasonal situations. I took data on summer because under-feeding in winter is not likely to be an issue. Because feed is a major cost, farmers took care not to overfeed. They each monitored feeding activity in their own way to try to minimize feed use.

Average = 114.7 pounds; SD = 41.7; n = 21

(5) What is the average FCR?

Average = 2.21; SD = 0.23; n = 21

This mean is probably not representative, and might indicate some wishful thinking. This result is only an average of stated figures from each farmer. This result is not weighted by number of ponds or by acres in ponds. Better indicators would be a weighted median with a histogram. Those are not given here. I suspect they would show an industry-wide median of around 2.4, with a large clustering around that median, with an asymmetric tapering to the left (downward) to about 1.9, and with very few figures over 2.6. See appendix on why it is hard to get an accurate figure for FCR for a catfish farm.

PREDATOR CONTROL

(1) What are the major sources of predation?

Sources listed are: cormorants, herons, two types of cranes, and pelicans.

Ground predators such as raccoons are not important. Vultures are not predators.

The only significant source of predation, and on which farmers focused strongly, was cormorants. Except for pelicans, the other birds are waders at the pond edge, do not come in large numbers, do not take too many fish, and do not interfere with feeding. Cormorants dive into the center of the pond, come in large numbers, take many fish apiece, and significantly interfere with feeding even when they do not take fish. Cormorants are a real threat to pond welfare.

The extent to which a farm was hurt by cormorants depended on many factors but an important distinction is farms on flyways (most hurt) and those not on flyways.

(2) What is the most effective means of predator control used?

Shooting, including killing occasionally.

Some farmers do not like to shoot birds, even cormorants. Some farmers did not like to admit that they shot birds. Both these types of farmers stressed the importance of frightening the birds by other active methods but they acknowledged the importance of shooting.

(3) Have other predator controls been attempted? Explain.

All farmers have tried many types but other types of control are not very effective. They include: noise canons, random shooting for noise, scarecrows, placing old cars around the farm, moving old cars around the farm, and sending people out to frighten the birds. Moving old cars around the farm seems to be the only non-labor intensive method that works a bit, and it does not work much. Sending people out is too expensive.

These other methods do not work because cormorants come in large numbers and because the birds learn quickly. Cormorants can tell the difference between a car that has sat for a while from one that moves, and can tell cars from which people have emerged to shoot at them from cars that have never posed a threat.

(4) Are there suggestions for developing a more effective predator control?

Shooting has to be allowed.

Lately the US Fish and Game service has received permission to interfere with breeding at the rookeries.

Farmers have heard of using wires, fences, or plastic around ponds to inhibit birds in their usual flight and landing, but farmers are skeptical of the practical benefits, especially in relation to costs of construction and care.

CHEMICAL APPLICATIONS

My comments: It seems that the unstated intent of the listed questions is to find out if farmers understand the use of particular chemicals, use chemicals in accord with understanding and guidelines, and ever overuse chemicals or misuse chemicals. To answer the listed questions would have required very detailed conversation with the farmers, including tedious looking through records. Early attempts to do this quickly convinced me it would end interviews, did not yield useful data, and would not answer the unstated general questions that apparently motivated the stated specific questions.

It was difficult to get hard data on frequency of applications and dose rates.

It was more effective to ask farmers about general use of particular chemicals. See below.

It was more useful to find out where farmers got their guidelines for chemical use. The large majority got guidelines for chemical use from the Fish Center.

The farmers clearly understood limits and guidelines, and followed them. Nearly all had heard of a bad experience with not following the guidelines. They understood that a chemical could be used within limits stated on the label but still used improperly and with bad results if not used in accord with the current chemistry and biology of a particular pond. To use chemicals that specifically, they relied on the Fish Center. The Fish Center is very unlikely to provide guidelines that lead to overall misuse of any chemicals. Some large farms had their own laboratories that could give similar information on specific pond conditions and suggest guidelines.

Farmers all understood that some chemicals were no longer used, such as malachite green. It is very unlikely that they used banned or dangerous chemicals.

Farmers also understood that some chemicals had limited specific uses but were dangerous, such as rotenone (a fish killer). It is very unlikely that they used these chemicals in catfish ponds.

Chemicals are expensive. Farmers do not wish to use chemicals unless the chemicals are cost effective and are not likely to hurt the pond. That kind of use is likely to be within standards and not likely to hurt the environment.

Also, chemicals do not leave the pond in effluent. See later questions in the series on effluent.

Pesticides and Herbicides (Algae Control)

(1) Are pesticides (herbicides included) used?

Yes.

The term “pesticides” might be technically the correct term for chemicals used to control both animals and plants, and a “herbicide” might technically be a kind of “pesticide”, but it is confusing when the terms are used this way. People think of pesticides for controlling animals and of herbicides for controlling plants. They do not think of herbicides as a kind of pesticide. I had to state the question as written first, and then restate the question in normal terms, to get a proper response. It would have been better to split this question in two, following normal usage.

(2) What is the goal(s) of pesticide use?

Pesticides are sometimes used to control insects and spiders around electrical boxes. No chemicals were used to control rats, snakes, coyotes, or birds. Rarely were chemicals used to control ants.

Chemicals are used to control algae and to control weeds around the pond. These were called “herbicides” for this study.

(3) What types of pesticides are used?

Insect and spider traps are used. One farmer discovered that sheets of fabric softener kept pests out of electrical boxes for a while.

Round-Up, 2-4-D, and chemically similar products were used to control weeds around ponds sometimes. It was not possible to get dose and application information. Cutting weeds was cheaper and more common than chemical use.

For algae control, these chemicals have been used:

Copper sulfate
Diuron
Potassium permanganate
Formalin

Copper sulfate and Diuron are the most widely used chemicals for algae control. Potassium permanganate is used only in particular kinds of emergencies. Only one farmer uses formalin regularly, and that is for disease control as much as for algae control.

(4) How much and what kind(s) of pesticide is used? Frequency of applications and does rates?

This was a vexing question. It required considerable patience by the farmers. It is not possible to give any kind of aggregated answer. Use varies considerably by pond, and somewhat by farmer. It would be necessary to give detailed descriptions for each farm and each chemical, sometimes for particular ponds. I could not do that. I have these suggested questions for future surveys to replace the questions listed:

(a) Ask for each particular chemical of interest.

(b) Ask where the farmer gets use information for each chemical.

(c) Ask what percentage of ponds got the chemical last year.

(d) Ask what percentage of ponds routinely gets the chemical.

(e) Ask what percentage of ponds caused a problem that pushed dosage limits.

(f) Some chemicals have multiple uses (copper sulfate). Ask for each particular usage for each particular chemical.

(g) Ask if the total bill for chemicals has gone up or done, and why. The total bill is an indicator of overall chemical use.

(h) Ask if the bill for particular chemicals has gone up or down, and why.

(i) An optional question is the chemical bill per pond for ponds that have required more than a minimal amount of chemicals.

I will try to answer some of these questions as best I can.

No farmers used pesticides to kill any animals other than insects, and even that use was minor. Thus dosage is irrelevant.

Potassium permanganate (PP) is quite expensive. PP is used only to treat very bad cases of algae, in particular blue-green algae that causes off flavor or can kill fish. It is dangerous in that PP can kill all algae, and therefore can cause a rapid depletion of oxygen in the pond and potential large-scale fish death. Even a modest dose can cost over $1000. Thus farmers use PP only in emergencies, and use only as little as necessary. They always use PP in accord with directions from the Fish Center and/or in accord with their own experience. Farmers had trouble remembering the last time they used PP. A large farm estimated that it is used PP on about 5% of ponds per year. Farmers with 30 or fewer ponds usually had used PP 2 times, or fewer times, in the last 5 years.

Copper sulfate (CS) is used to control both algae and fish diseases. The remarks for this section apply only to it uses for controlling algae; later comments will be directed toward use for disease.

Of 22 farmers asked, 18 had used copper sulfate this growing year. Of the 4 farmers who did not use copper sulfate, 2 also used almost no Diuron, while the other 2 farmers did use Diuron as his/her major algae control chemical. Of the 2 who used almost none of either chemical, they did not use the chemicals because the chemicals were not needed; the farmers would use the chemicals if needed. One farmer had not used copper sulfate in over 3 years.

Of the 18 who did use copper sulfate, most applied a basic dose in either the spring or fall, and then applied minor doses as needed according to their reading of pond algae or according to a reading by the Fish Center. The usual dosage is 0.01 of the total alkalinity. As far as I can tell, other than the major annual doses, farmers had to use it in significant amounts in less than 50% of their ponds; large farmers gave about this estimate (I did not make them look up their records). Of smaller farmers: one farmer who had 9 ponds used it at all in only 2; one farmer who had 11 ponds used it in only 1. Finances tell a similar story: one farmer who had 16 ponds spent only $2000 on copper sulfate in the last year, down from many times that; one farmer who had 6 ponds and used to spend over $10,000 on over a ton of copper sulfate spent a few hundred dollars on 4 bags. Other farmers reported similar reductions. I estimate total chemical bills per average pond to be less than $1000 as long as the pond has no serious problems and the pond is not held up a long time before harvest.

Diuron is preferred by some farmers because it stays in the water a bit longer and they think it is cheaper (I did not try to verify or disprove this idea).

Of 22 farmers, 13 used Diuron significantly in the past year. All of them also used copper sulfate, but primarily as for spot problems for which they felt it was best suited, or to keep fish on flavor for the last few days before harvest. Diuron was the dominant form of algae control in 6 out of the 13 who had used it. Even in those farms, it was used in the range of 30% to 60% of ponds. If it was used in all ponds, it was used usually only once per year in the spring or fall; 4 farmers did that. The dosage level was as recommended by the Fish Center or as determined by the farmer, with care not to deplete the standing algae crop.

(5) How effective are the above treatments in accomplishing your goal?

All farmers felt that the combined regimen of shad and moderate use of a variety of chemicals was quite effective. They were satisfied that they could control algae growth and keep ponds healthier than in the past.

(6) Are there suggestions to better reach the goal of pesticide application?

Here “pesticide” is take to mean “algae control chemical”. None specifically. Farmers would appreciate more research and advice, particularly into the algae that causes off-flavor (blue-green). They wish methods to selectively deplete blue-green algae without harming other algae.

Piscicides

(*7) Are piscicides used?*

Some farmers recognized this word, and all understood it when I explained the derivation (literally “fish” + “killer”). All had heard of chemicals that do this, such as rotenone. None of them had used any in a catfish pond in at least 5 years, probably at least 12 years. When ponds were first dug 15+ years ago and first filled, some farmers used a piscicide before the first stocking, but the practice has long ago died out. Farmers know that the chemicals are sometimes used in ponds for sport fish or ornamental fish, or even sometimes in hatcheries, but the water from those ponds does not get into catfish ponds. Before the usefulness of shad was recognized, farmers had tried low doses of rotenone to try to kill shad without killing catfish, but this practice was never very successful, and had not been done by any of the interviewees as long as they could usefully recall.

(8) – (12) Not relevant

Fertilizers

(13) Are fertilizers used?

The answer to this is much as with piscicides. Some fertilizers were used when ponds were first dug. One farmer recalls trying fertilizer on a new pond 8 years ago, but the experiment did not work out well, and he never tried it again. Many farmers commented that any feed would act as a sufficient fertilizer without adding anything else.

(14) – (18) Not relevant

Salt

(19) Are salt(s) added to ponds?

The farmers and I took "salt(s)" to mean sodium chloride only, for reasons explained below.

The answer is "yes" in nearly all cases where salt does not occur in water naturally.

3 of 22 farmers had enough salt in naturally occurring well water so that they did not have to add salt, so 19 of 22 farmers did have to add salt. Even of the 19, 2 more had some salt in their water but not enough so that they did not also have to add salt.

I emphasize that adding well water did NOT mean completely replenishing the pond each year, but only adding what was needed to compensate for evaporation and for decreasing salinity due to rain water entering the pond. Even ponds that use a significant amount of well water also often get a significant amount of rainwater.

(20) What is the goal(s) of salt application?

Every farmer was able to clearly state that the goal of salt application was to raise chlorides for various reasons, including to help fish breath and to control unwanted microorganisms.

Since the goal is to raise chlorides, it makes no sense to add salts that do not have chlorides, or to add sources of chlorides more expensive than sodium chloride. Thus "salt(s)" = sodium chloride.

(21) What type(s) of salt is used?

In all cases, bulk salt, almost always bought from the local Co-Op.

(22) How much and what kind of salt is used? Frequency of applications and does rates?

This is another question where the answer varies too much for an easy summary. The amount added varies by farm, by pond, and by the weather for that year.

Better questions to ask might be:

(a) What is the chloride concentration goal?

(b) To what level have chlorides fallen before primary salt application, usually in the spring?

© How much salt per acre per foot (acre foot) do you usually have to add to achieve the desired chloride concentrations?

Unfortunately, I did not get full data to these questions.

The winter rains usually deplete chlorides in the ponds, and there is not much point in adding salt during the winter rains, so most farmers add salt just before the spring growing seasons. Often they need to add salt only once per pond per year. All farmers had chloride test kits, and would add salt to specific ponds if test results indicated they should. A typical chloride goal is 50-60 ppm, but 2 farmers aimed for at least 100 ppm because they said it minimized many problems, especially disease (even though salt at these concentrations does increase rusting of aerators). 8 of 22 farmers said they usually had to add salt only once per year. The others said they usually had to add some supplementary salt after large rains in some ponds.

Assume that a pond is 8 feet deep on average (a slight overestimate to be cautious). A typical application is 100-200 pounds per acre per foot depth (per "acre foot") in the initial spring large application, or thus about 800-1600 pounds per surface foot. An average might be around 1000 pounds per surface foot. This amount varies by need and by desire of farmer.

(23) How effective are the above treatments in accomplishing your goal?

Quite. Farmers are satisfied.

(24) Are there suggestions to better reach the goal of salt application?

None specific. A humorous goal is to develop corrosion resistant cheap aerators.

Lime

(25) Are liming materials added to ponds?

Yes.

Here regional differences within Western Alabama become relevant. Particularly in Hale and Dallas counties, some of the soil is underlain with limestone rock in various conditions. In some cases, the limestone is exposed in ponds; in other cases, limestone is probably mixed in with the soil of the pond; in other cases, solutes from limestone probably leach into the pond water. In these cases, it is usually not necessary to lime ponds. Farmers consider these situations advantageous.

In areas where the water is naturally salty, farmers generally used lime only as needed (see below) or not at all because the salty water inhibited growths of unwanted blue-green algae and inhibited disease, purposes for which lime is used.

10 of 22 farmers did not need to add lime, at least not regularly. Of the remaining 12, 3 added it only as needed to particular ponds; the other 9 added it regularly in various schedules.

(26) What is the goal(s) of lime application?

No farmers gave the exact chemistry of carbonates in pond water, nor was it to be expected that they would. All understood the effect of carbonates in buffering pH and in helping other beneficial reactions. Most believed that it stabilized algae growth; some speculated that by stabilizing algae growth it might inhibit unwanted blue-green algae blooms.

Farmers used spot applications of lime to control particular localized algae blooms or weeds in the pond, rather than use copper sulfate or Diuron. The spot applications of lime had little effects outside the area of immediate application, and what effects extended beyond the immediate application were likely to be useful.

(27) What type(s) of liming material is used?

Agricultural burnt lime, primarily from the local Co-Op. For spot applications, farmers kept bags of lime.

(28) How much and what kind of liming material is used? Frequency of applications and dose rates?

Lime is usually applied generally in the spring if needed, and then applied to specific ponds as needed afterwards. The major dose varied from 18 pounds per surface acre to 100 pounds per surface acre. If a farmer thinks that he has carbonate problems he will test his/her water with a kit or send a sample to the Fish Center. He/she will then lime according to standards or according to recommendations from the Fish Center.

Another method of “applying” lime is to use limestone rock to repair pond walls, and sometimes pond bottoms. The limestone rock leaches into the pond and might increase carbonates in the pond water. Farmers reported that ponds that had been repaired this way were more stable over the course of several years.

(29) How effective are the above treatments in accomplishing your goal?

Farmers are satisfied.

(30) Are there suggestions to better reach the goal of lime application?

None.

Other Chemicals

(31) Are there any other chemicals used? What kind? If no, proceed to question #44

There was no question #44.

There were no other chemicals used in any amounts significant enough to record.

GENETICS

(*1) Are genetically modified fish used in the culture process?*

No genetically modified fish are used in the current sense of the term.

Two kinds of hybrid catfish are sometimes available for farmers to experiment: “103” hybrids and “blue-channel” hybrids. No farmers interviewed were using those now. Five farmers had tried one or the other of the two hybrids. Of those who had experimented, they would like to see pilot projects run by universities or other agencies, especially pilot projects where the processing plants were reset to process the hybrids.

(2) What are the benefits of using these fish?

Since the trials involved only a few crops, the benefits are not fully clear.

For “103” hybrids, the main benefits might be disease resistance.

For “blue-channel” hybrids, the main benefits seem to be better feeding behavior, better oxygen tolerance, and a better FCR. The main drawback was that the different shape required a specific setting of machines at the processing plant.

SITING

Here it is worth repeating some data from the beginning:

Average number of ponds = 24.3; SD = 21.4; n = 22

Average acres in ponds = 292.3; SD = 262.6; n = 20

Average acres available for watershed = 1116.2; SD = 959.3; n = 20

Ratio of average acres for watershed to average acres in ponds = 3.81; n = 20

(1) What types of ponds are used? i.e. watershed, levee, or both?

This question involves a problem of definition. Watershed ponds come in two types: a primary type and a linked (or "stair stepped") type.

For all practical purposes, either type of watershed pond receives nearly all of its water from rain. A primary pond receives its water directly from a sloped watershed that drains into the pond while a linked type receives its water from a primary watershed pond or from another linked pond. Neither type of watershed pond receives a significant portion of its water from wells or streams.

The primary watershed pond has three obvious built-up sides (embankments or levees). The fourth side is the lower end of a hillside slope, down which water comes into the pond.

The linked watershed type has four built-up sides (embankments or levees).

Watershed ponds are typically tied into systems of primary and linked ponds through pipes and some pumps. Farmers call this "stair stepping", an accurate description of how water flows from higher to lower ponds. Because linked ponds can be down the chain of getting water, they are sometimes in flatland.

A stereotyped levee pond has four built-up sides, or "levees", and is usually located in flatland, just like a linked watershed pond. However, a true levee pond receives a significant amount of water from a well or from a nearby water source such as a stream; it usually receives the majority of its water that way or all of its water that way.

When asked how many levee ponds a farm had without qualifying the question, the farmer sometimes counted linked watershed ponds as if they were true levee ponds. However, when asked according to the source of the water for the pond, a farmer always separated a linked watershed pond from a true levee pond.

The responses here count linked watershed ponds as watershed ponds unless specified otherwise. Ponds counted as "levee" are true levee ponds. Water source and water use are covered in the next section of questions.

Both watershed and levee ponds are present but not often on the same farms. The very large majority of ponds throughout the heart of catfish farming country are watershed ponds. Levee ponds are found in areas without the right slope for watershed ponds.

Levee ponds are also found where naturally salty water occurs underground. However, in this case, ground water is not used because rainwater is unavailable but because saline water is preferred. Thus many of the levee ponds in Western Alabama are different from levee ponds found in Mississippi or Louisiana where levee ponds are built because rainwater cannot be easily collected or are built to take advantage of local groundwater. Levee ponds that use natural salt water in Western Alabama rarely cause any problems to other users of groundwater.

(2) If both, what is the proportion?

Of the 22 respondents, 1 farm of 32 ponds had entirely levee ponds, fed from saline well water. One farm of 35 ponds had 5 that were levee ponds. One farm that had 16 ponds had 3 that were levee ponds. One farm that had 25 ponds had 9 that were levee ponds. At least three other farms used saline well water to contribute to the water in their ponds but not as the majority source of water in any pond. Thus 4 of 22 farms had ponds that they considered levee ponds by the water use definition, but on only one of those farms were the majority of ponds levee ponds.

Out of 559 ponds, 510 (91%) were watershed while 49 (9%) were levee.

After a while, I began to ask farmers how many of their watershed ponds were “4 sided”. I asked only 7 farmers. The 7 farms had a total of 120 ponds, of which 71 were 4-sided ponds. A simple “watershed or levee” question would have mislabeled those ponds as levee and misrepresented the character of water management.

WATER USE

(1) What is the main source of water on the farm?

See “SITING” above. Except for one farm with all levee ponds with naturally salty water, the main source of water for all other farms was rainwater, even of farms that had access to salt water wells. The very large majority of ponds are fed by rain, directly or indirectly.

Note that, on average, there is 4 times as much land for watershed as in ponds. This usually provides an ample source of rainwater, which is why well water is not significantly used.

(2) Is groundwater used? If so, how much and when?

There are two sources of groundwater: wells and local streams. Of 22 farms, only 1 used water from a local stream. This farmer was careful to locate his intake pipe above the legal level for water maintenance of the stream, so he never drew water except when there was an available surplus.

All farms had wells. In some cases, the wells had not been used for a long time, so the farmer was not sure if the wells were still working. Exclude farms with primarily salty water from wells (for that, see above): Of 14 farms where I got an accurate count of non-saline wells, there were 35 wells, or 2.5 wells per farm. That is 248 ponds altogether, or 1 well for every 7.1 ponds. I do not know how many of those wells were working but not all of them.

It used to be common practice for farmers to “top off” a pond for about 6 inches (out of about 6 feet) at least once a year. This is done now on only 2 farms of 18 interviewed (excluding 3 farms with primarily salty water from wells and 1 where the answer is unclear). Farmers use well water when the weather has been very hot and dry, as in the drought years of 2000-2001. Of the 18 that had wells, only 3 had been used in the last year up to August 2005. At least 4 had not been used since the drought years (over 3 years). Of the remainder, the farmers were not sure when they were last used, but had not been used much.

Of the 3 farms that use much saline well water, only 1 used mostly well water, and even that farm used as much watershed runoff as possible. 1 other farm used salt water where available, but it had enough ponds, and used such a combination of water sources, that it is not possible to estimate the percent of salt water from wells used in relation to total water use – it was very likely under 50%. That is generally the case on other farms that use salty well water, although it might be about 50% on the other farms.

(3) How frequently are ponds fully drained?

The simple answer is, “Never, except when absolutely necessary for repairs”. The loss of fish and water is too costly. One large farm of over 50 ponds had only drained 2 ponds in the last five years. One medium sized farm with 10 ponds had drained 3 ponds in 18 years, 2 to clean, and 1 to renovate. Other farmers had not drained a pond in 15, 15, 18, 19, and over 20 years. None interviewed had done so in the last five years. Farmers who had been in business for less than 10 years had never drained a pond.

Farmers used to “drain down” a pond every once in a while to make sure of an especially thorough harvest. The extent of drain down varied with the original depth of the pond. Now, however, with pond water more stable, ponds are only drained down in this way less than every five years or less often; one farmer estimated every 8-10 years but that might be a bit on the long side (it used to be about every 3 years). I did not get useful figures on how often the average pond is drained down, but it was at least at five-year intervals. Most farmers could not remember doing it since the drought years of 2000-2001 when ponds did not need to be drained down.

When ponds were first built over 20 years ago, some were built over 10 feet deep, the deepest practical depth for current harvesting techniques (the seine is 11 feet deep). Those ponds have to be drained down for harvest. Most of those ponds were rebuilt since so as to be more easily manageable. By the “luck of the draw” I did not interview any farmers who still had ponds like this, or I did not know to ask them. I did ask afterwards about how many such ponds are still left, and was told that 5% at most of total ponds are still unusually deep, probably much less.

EFFLUENTS

Catfish farms do not open their gates to harvest as do shrimp farms. The only time that water flows from the bottom of the pond to the outside of the pond is when the pond is renovated, or in some other unusual circumstance (see WATER USE above). Even then, the pond is not usually drained “dry” but only down to about 1 foot of water, so some of the heaviest effluent still stays in the pond. Catfish farms do not produce effluents in the sense associated with other kinds of aquaculture.

(1) What time of year does the farm produce most effluents?

During the rainy season, from November through March.

In fact, this is almost the only time of the year when the farm regularly produces effluents. Only rarely, after a very heavy summer rain or a hurricane, does water overflow the ponds outside of the winter rainy season.

Even these effluents must be understood. These effluents consist largely of fairly clean rainwater that flows into the pond, stays on the top of the pond, and then flows out of the pond through an excess-water drain pipe. This effluent is not water from the middle or bottom of the pond. Please see the work of Dr. Claude Boyd and his students on the composition of effluent from catfish ponds and its environmental effects.

(2) What is the fate of farm effluent? i.e. streams, pasture land, etc.

A question of terminology has to be cleared up. In local speech, a “ditch” can mean an old small natural waterway that has since been altered by people (usually deepened or straightened) to make it more usable. Most farms are on sloped ground, and the water naturally drains to low places on the slopes. These low places become active waterways in the winter, and even in summer carry water after heavy rains. Many of these small waterways were once natural waterways but are now ditches. This indicates that the farmers did not dig an extensive system of artificial ditches to channel their effluent, and did not significantly alter the natural environment, but made use of a natural pattern that was already in place.

It is also necessary to know something about land use and land use history. Originally this land was wet prairie, with mild rolling hills, and many small waterways, ponds, and low wet areas. It was drained for row crops from 1820 through about 1920. After the decline of row crops starting in the 1940s, much of this land went “semi-wild”, including the growth of stands of trees. As a result, most farms, not just catfish farms, now have small tree belts ringing them, and some have modest stands of trees within them. These tree belts tend to be at the bottom of slopes, where water naturally drains, and the land is not much suited for crops or ponds. After row cropping, many farms reverted to raising cattle. Much of the land became lightly wooded pastureland. The return of some row crops in the 1970s changed this pattern somewhat, but not too much. (The upsurge of tree growing in some parts of Alabama changed it considerably, but that is not too important in most of the area of catfish farms.)

Of course, catfish farmers have dug ground and cut trees, but their activity has to be placed in the context of the natural landscape and the history of human activity there.

With that background, it is now possible to summarize. Most effluent flows out of overflow pipes from the ponds into ditches in low places. Sometimes the water flows through about a quarter mile of pastureland to get into the ditches. Sometimes it flows in the ditches about a quarter of a mile to half a mile. The pastures and ditches usually lead to the tree rings around the property. The tree rings often have natural small streams in them. Sometime the tree rings have considerable marshy ground naturally within them. I am not sure if this marshy ground qualifies as “wetlands”. The water then flows less than 5 miles to a named and/or well-known small stream, then usually less than 10 miles to a river or named large stream. I have descriptions of the flow from about a dozen farms but do not include it here.

I do not know the volume of the effluent. That depends on the amount of rain.

(3) Is the farm equipped to measure effluent water quality? If so what variables?

No. Farmers did not think it necessary to measure excess rainwater. Ponds are drained so seldom that farmers did not consider it practical to keep supplies on hand to measure the effluent on those occasions.

(4) Are there any control measures taken to reduce effluent? If yes, explain.

Farmers prefer that the water flow some distance before it enter a stream or someplace where it might have an impact, but that is more out of long-standing notions of courtesy than because of any concern over bad effluents. They prefer that it flow through pasture and into stands of trees, into natural wet ground, or into natural small waterways.

Otherwise, “No”, farmers did not deem it necessary to reduce rainwater overflow.

DEAD FISH

(1) How frequently are dead fish observed in ponds?

Dead fish are observed in these common conditions:

(A) In winter, due to natural unexplained causes.

(B) In summer, due to natural unexplained causes.

© In times of stress, usually abetted by disease, in disease seasons.

(D) During times of large fish kills, due to disease or algae problems, almost always in summer.

(A) and (B) lead to perhaps 2 dead fish per day per pond.

© leads to many hundreds of dead fish, in about half the ponds, once per pond, during a few months per year.

(D) leads to many thousands of dead fish, in a minority of ponds (less than 10%), usually once per year in summer.

(2) Are there times of the year when dead fish are more prevalent?

See (1) above.

(3) What is the major cause of dead fish in ponds?

Fish get sick during times of stress. Stress occurs when water changes temperature in spring (March and April) and fall (October and November). Stress occurs if water gets too hot in summer.

The only real cause of concern is the large fish kills in summer. These are usually caused by problems with algae, especially problems that lead to oxygen depletion.

(4) Are there any control measures implemented to reduce the amount of dead fish in ponds?

Farmers always try to make sure the fish stay alive, primarily through good pond management. Other than that, this question was not clear.

(5) Are dead fish removed from ponds?

Many farmers used to remove dead fish when they first started farming 20 years ago. Now, of 22 interviewees, only 1 still removes dead fish regularly.

(6) Would dead fish removal be a practical way to reduce the amount of dead fish in ponds?

No. It is not practical to remove the few normal dead fish from a pond. Most people do not even see these fish unless they look for them.

It is a good idea to remove the many dead fish from a disease or a summer water problem, but this has to be done within about 48 hours of the original problem or the bodies become too soft to remove from the water.

Not only for aesthetic reasons, but to reduce the amount of unwanted bacteria, it would be a good idea to remove large fish kills as soon as possible. Please see my suggestions.

(7) Are there any suggestions that would aid in the reduction of dead fish in ponds?

See above. Farmers do not want dead fish in ponds. It was not clear if this question was about methods of disposal of dead fish after they are dead. In that case, there were not suggestions.

Here it is appropriate to say something about dead fish and the disposal of dead fish. Vultures eat many of the routine small numbers of dead fish. This disposal method is sometimes annoying but it is also natural and effective. Of the small routine numbers of dead fish, the best disposal method is to leave them in the pond. They rot more quickly in the pond, and their nutrients are more quickly recycled there. It would not be more effective or natural to drag them onto land. It would certainly not be more effective to bury them, burn them, or lime them. In a normal pond of about 20 acres, there are at least 100,000 fish. A few deaths a day is small in comparison to the percentage of deaths in other animal husbandry operations such as poultry farms (even free range), hog farms, and cattle feedlots.

FISH DISEASE

I do not list the various illnesses or their specific treatments. I do mention that most farmers felt illness had decreased in the last five years due to better water stability due to better algae control and reduced use of food.

The most common first treatment for a disease was to reduce feed.

(1) How frequently are fish illnesses observed?

See above under DEAD FISH.

I think the questions here should be:

“What ratio of ponds per year develop a significant illness requiring treatment?”

“What ratio of ponds per year develop a serious illness leading to significant death?”

“What percent of the crop is lost each year due to illness?”

I could not get much data on these questions. Here is what I got:

Ponds with natural salt water differ from ponds without. Ponds with natural salt water usually have less disease (3 farms with natural salt water reported no significantly diseased ponds in several years). The following data applies to ponds without naturally salty water.

Probably 10% - 20% of ponds get a significant disease each year requiring extra treatment. One farmer said that this results in perhaps a 2% loss of total fish, which might be about a 10% loss of fish in the ponds that get significant disease.

Even sick ponds do not usually experience a large fish “kill” but it was not clear how many of the diseased ponds do experience a major kill. Major kills result more often from algae and oxygen problems than from disease.

I got estimates from farmers on the incidence of serious fish disease from 13 farms with non-saline water, such as “out of my 10 ponds, 1 or 2 get a disease every year”. I took the highest figure, so that in the previous example, I would have listed 2 out of 10. The 13 farms had 266 ponds, 46 of which got significant disease, or 17%.

(2) Is there a particular time of year when illnesses are prevalent?

See above. Times of stress, usually due to temperature change: spring and fall.

(3) Are there any control measures taken? I.e. chemical treatments, etc?

The first measure taken is to reduce feed.

If the farmer cannot diagnose the illness, he/she takes a sample to the Fish Center in Greensboro. If they cannot diagnose the disease, they consult other experts.

The most common chemicals used are probably copper sulfate and Diuron. I did not try to get dosage schedules because they would be specific to cases.

(4) Are there any suggestions to reduce the occurrence of fish illnesses?

Research to develop vaccines.

Research on fish genetics and on diseases.

SOCIAL ISSUES

Here some background is relevant. The very large majority of farms are family farms. As in most agrarian parts of the world, the accepted, productive social division of labor in Western Alabama is that men work away from the house while women usually work around the house, but women will work in the fields when necessary or if they prefer. Usually one man does most of the work on the farm. One man can take care of up to about 20 ponds by himself. Even on large farms, the owners often work on the farms along with other members of their families and along with any hired help.

Full-time employees on family farms of 20 ponds or less are usually family members, except for some long-term relations (see below). 13 of the 23 farms had 20 ponds or less, so most of the employees on those farms were family members.

Work on a catfish farm requires that the worker be available at all hours of the day to check the condition of ponds and to respond to pond conditions. Not all people want this kind of work.

There is no tradition of health insurance or formal retirement plans. There is a long tradition of farm owners “taking care” of their employees, which usually includes the cost of medical care when needed.

On farms that hired labor, until about 10 years ago, there was a tradition of a hired man working very long term for a particular farm, perhaps his whole life. Not only did the man receive money, he usually also received a place to stay and access to a vehicle. Some of these men raised their own families in their dwellings; some did not have families.

Starting about 20 years ago, the people in these long-term relations began to die out. The farmers tried to replace them with similar arrangements but usually could not because the new generation did not wish the kind of “round the clock” availability required on catfish farms and preferred to migrate to urban areas or preferred other kinds of work.

(1) How many people does the farm employ?

These figures exclude one unusual large farm that employed many full-time and part-time workers for various catfish related tasks. In all cases, n = 22.

Mean full-time workers = 2.82; SD = 1.87.

Mean full-time family workers = 1.86; SD = 1.17.

Mean full-time non-family workers = 0.95; SD = 1.17.

9 farms had 0 non-family workers. All these farms had 20 ponds or less.

Notice the large SD in comparison to mean for non-family workers, indicating that they were concentrated in a few larger farms.

Farms also employed part-time help. They usually hired men students for summer work, and hired women for clerical work. The women were usually family members. I did not separate the few cases of part-time women workers who were not family members.

Mean part-time workers = 1.38; 1.43;

Mean men part-time workers = 1.0; SD = 1.05.

Mean women part-time workers = 0.38; 0.80.

(2) What is the sex ratio?

This data includes family members, including owner-operators. See above for part-time workers.

Total full-time men employees = 55; total full-time women employees = 7.

The total for women included 1 woman owner-operator, and 6 women who did clerical and other work on their family farms.

I assume this question is meant to assess the fairness of hiring toward the genders. Given the family nature of the farms, the fact that most employees are family members with a variety of chores (including women family members who have to do chores other than those directly related to catfish farming), the presence of some women workers, and local culture-and-society, this question is not a good assessment. I have done what I could. The reader should keep in mind that some farms do employ women as "farm hands" and that those women generally have a good reputation for careful and reliable work. My sample did not happen to include any, but I have met them. Women do not generally want outdoor farm work that can require their presence at any time of the day.

(3) What is the turnover time for employees?

I assume this question is intended to assess the quality of relations between employers and employees, and the nature of work on the farm. Again, given that most employees are family members, the question is useful but may not address the underlying intent.

Long-term relationships usually lasted for over 15 years. Some of these still persist, and some new ones have been forged, but not as in the past.

Summer help turns over quickly.

Clerical help tends to last for several years.

Farm hands with whom there was no previous relation between the family of the employers and the family of the employees usually worked only 5 years or less. The duration has probably declined over the last 10 years, so that it might now be 2 years or less.

Most farmers cited about 5 years as the average length of time in employment for employees with no previous long-term connections.

On some large farms with health benefits, the duration might be slightly longer.

(*4) Is worker safety training provided? If yes, explain.*

Nearly all employees have been around farms most of their lives, and need little formal training. The farmers are willing to assume costs of health care for accidents on the farm, and so do not wish any accidents.

Little formal training was given. About half the farmers had shown training videos from the Fish Center to at least some of their employees. At least 4 farmers had taken their employees to safety related classes at the Fish Center.

Very much informal training is given through example and verbal instruction.

In the last year, only 3 farms had accidents that required medical care, and none of those was serious enough to require hospitalization.

In over 25 years of catfish farming, I found only 2 cases of fatal injury on catfish farms in my sample, and those were not related directly to catfish farming. The details are irrelevant. This might be the total sum of all the fatal injuries on all catfish farms, since farmers knew of all cases of serious injury on almost everybody's farm, and would tell of incidents if prodded.

(5) What aspect(s) of production is the most dangerous for employees?

I broke this question down into chemicals, mechanical, and electrical. The responses were weighted toward mechanical and electrical in about equal proportions.

One farmer spontaneously denied those alternatives and emphatically insisted on "lack of sleep". Another said simply "stress". When those alternatives were included, the other farmers agreed enthusiastically. These causes apply mostly to owner-operators; they suffer at least as much as do employees. The owner-operators do not seem to put employees at risk any more than the prevailing standards for farm employees anywhere, as the good safety record shows.

(6) Does the employer provide benefits for employees? If yes, explain.

Of 14 farms that had non-family workers, 6 provided formal health benefits. The extent of the health benefits was not clear. Probably only 4 provided systematized health benefits such as Blue Cross Blue Shield. These were all large farms run.

Of 14 farms that had non-family workers, 2 provided formal, regular retirement benefits. These farms also provided formal health benefits. These were large farms. 2 other farms had irregular plans where they paid into retirement accounts when profits were sufficient. This happened about every other year or every third year.

(7) Are there any other employer/employee issues that are of considerable importance?

Farmers generally had little trouble with stealing or disputes.

The farmers very much want reliable, long-term employees. They are willing to pay wages above the typical area standard for such employees. They are happy to train such employees if they feel the employees will stay. Please see final comments in appendices below.

Because of the nature of the work on the farms, and the difficulty in finding reliable employees, farmers are turning toward automated monitoring systems for their ponds. This turn toward automation might seem as if it would lessen employment opportunities on catfish farms, but I think it might have the opposite effect. It will take away some of the urgency of being alert 24 hours per day. It will make work on catfish farms generally more tolerable and therefore more attractive. In the long run, there might be somewhat fewer total employee hours than now, but the employees that stay to work those hours probably will stay longer on the job and be more content with it.

(6) APPENDICES OF BACKGROUND INFORMATION

The material in these appendices repeats some information already provided in the main body of the report. The goal is to provide information in groupings that are most convenient for a variety of readers. If a reader gets the electronic version of this report, it probably will have pictures inserted or attached.

GEOGRAPHICAL BACKGROUND

The geography influenced the social history, the nature of catfish farming, and the kinds of catfish farms. Most of the catfish ponds in Western Alabama are in Dallas, Greene, Hale, Perry, Pickens, Greene, Sumter, and Marengo Counties. The bulk of ponds are in Hale, Dallas, and Sumter counties.

Most of the region has these three layers of geographic strata:

(1) Very large underground aquifer.

(2) Varieties of limestone on top of the aquifer.

(3) Prairie soil on top of the limestone.

The limestone sticks out through the prairie soil in some places. In other places, bits of limestone are mixed with the prairie soil. It is usually evident along the banks of named streams. Even so, the prairie soil can be many tens of feet thick. It is thickest usually along the belt around Highway 80, and along the roads north of Highway 80 into Greensboro, state roads 25 and 69.

The region is not fully flat but is mildly rolling hills. The hills increase to the north, west, and south. To the east, the soil is not old prairie soil and is not always suitable for catfish ponds.

This old prairie formed on top of the alluvial plain that descends down from the old Appalachian Mountains to the Gulf of Mexico.

The region is fairly wet. It used to have many small waterways and ponds.

The original land covering was composed of hardwood trees on the drier soil, some stands of pine, some wetlands, and a variety of tree species that grew near water.

LAND USE HISTORY

Modern land use began about 1820 when people of European descent removed the Native Americans, and then cleared and drained the land for cotton. They imported slaves of African descent to work the cotton farms. Some cattle were usually raised along with the row crops, especially in the more hilly areas around the perimeter of the prairie.

In clearing and draining the land, the settlers changed the original appearance and ecology. It is not clear how stable the new landscape of cotton farms was, but likely it had considerably more erosion that the original landscape.

Row crops dwindled considerably after 1920, and were essentially gone by 1950. For the most part, farmers switched over to cattle, but some farmers grew trees, especially in the northern and southern hilly areas that ring catfish country. In the catfish area, some native wood recovered.

In the 1970s, row crops made a temporary resurgence, especially with soybeans. But this area could not compete with the Midwest of the United States and with other areas of the world, and so soybeans declined.

The land price boom of the 1970s left many Alabama in long-term debt.

CATFISH FARMING

Catfish farming began in the late 1970s but did not really “take off” until the early 1980s. It reached about its current peak of land use in the late 1990s. Since then, drought, low prices, fluctuating prices, and overseas competition from similar species (Vietnamese “basa”) have much slowed the amount of land being converted to catfish ponds. Some ponds on the periphery of the catfish area, where conditions were not most suitable for farming, have gone out of production.

During the peak times of the 1990s, small farms with less than 10 ponds were able to do fairly well. Since the harder times of the 2000s, small farms even in the core area have failed. They are probably unable to withstand the price fluctuations, the increased cost of fuel and feed, and the debt load. It is not clear now how much land remains in what size farms. Small and medium sized family farms still dominate in numbers of farms but large-sized farms probably hold the majority of land.

CATFISH PONDS AND HARVEST

Originally ponds were made from low points in the topography or from pre-existing ponds by modest shaping of the land. These ponds tended to be fairly deep, often well over 10 feet deep. These old ponds are now probably less than 5% of all ponds.

In the 1980s, most ponds were deliberately built near slopes to take advantage of water coming from the slope. These ponds tended to be about 10 acres in size, 4-6 feet deep in the shallow end, and 6-8 feet deep in the deep end. In the last decade, the average pond size might have increased to 20 acres for new ponds, 6-8 feet deep in the shallow end, and 7-10 feet deep in the deep end. The larger, deeper modern ponds seem to maintain water conditions better and to resist unwanted algae better.

Unlike as with shrimp, catfish ponds are not drained completely for harvest. They are seined. The seine can be as high as 11 feet, so it is possible to seine a pond 10 feet deep.

Ponds are usually harvested once or twice a year, depending on the stocking rate and how the farmer wishes to manage his/her ponds.

To keep the optimum size of fish (see below), farmers often desire that a pond be seined more than once per harvest. This does not always happen, for a variety of reasons.

In the past, it was common to “drain down” deep ponds a few feet before seining to make seining easier. This has become less common, although I did not get data on the current practice.

Ponds are almost never completely drained out. Now, they are drained out almost only to be redone, or for major repairs. This probably happens less than once a decade, perhaps only about once every 15-20 years. One reason has to do with managing pond ecology.

Catfish ponds are typically stocked at about 6500 catfish per surface acre. If the fish are not sterile, they can breed in the pond, although that is not a major source of new fish. Some fish die naturally. Even so, because not all fish are removed during a harvest, it is possible to have about 10,000 fish per surface acre. The average weight of a fish might be around 2 pounds.

This density of fish at that weight requires supplemental oxygenation. Ponds are aerated with mechanical aerators. The aeration schedule depends on the particular pond management strategy of each farmer.

Except for a very few large farmers, catfish farmers do not harvest their own ponds. Instead, they ask the processing plant to send in a crew to harvest a pond when the farmer believes that the pond is ready. The processing plants maintain harvesting crews and, for most farmers, there are not reliable means to harvest other than through the processing plants.

MANAGING ALGAE

It is important to manage algae for two major reasons, given below. This issue bears on relations between the pond and the surrounding environment.

(1) Algae are a source of oxygen. It is good to have a certain amount of algae. However, algae tend to “bloom” and then “crash”, in unstable cycles. An algae bloom-and-crash causes a depletion of oxygen, not only because the remaining algae no longer produce enough oxygen but also because the decomposition of the dead algae takes oxygen from the pond. The resulting oxygen depletion can cause major fish death and loss. The farmers work to stabilize the total algae population so as to avoid the problems.

(2) Blue-green algae cause the fish to have an “off” flavor. The processing plant will not send a harvesting crew unless the amount of blue-green algae is low, and the fish are “on” flavor. To reduce blue-green algae can take a long time, and is a major causes for chemical use, and can be expensive. It is likely that a healthy, stable population of other algae keeps the blue-green population down, and thus makes it more likely that a farmer can get his/her pond harvested quickly without having to wait and without having to use many chemicals.

Thus for both reasons farmers wish to keep a healthy and stable population of non-blue-green algae.

Through chemicals, farmers used to try to kill algae when the population had become dense, just before it would bloom-and-crash, thereby avoiding a bloom-and-crash. However, this strategy required a fair amount of chemicals, was dangerous in that a farmer could wait too long and the algae would crash, or was dangerous in that too high a dose could cause a crash.

Shad fish are herbivores; they eat algae. Before the year 2000, shad were considered a pest. About the year 2000, farmers realized that a reasonable population of shad helped control all algae and helped reduce blue-green algae. Gizzard shad occurs naturally. Threadfin shad have to be stocked. Since 2000, many farmers have allowed the gizzard populations to grow or have stocked threadfin shad as a way to stabilize algae populations.

At the same time, farmers began to use fewer chemicals, in more frequent doses. The goal was not to let the algae population get too high but rather to stabilize it.

The combination of shad and moderate chemical use seems to have worked fairly well.

PRESERVE POND ECOLOGY

Stable pond water is a valuable resource. Farmers do not wish to lose stable, healthy pond water. They want to conserve their pond water. They have no incentive to drain their ponds for harvest, and little reason to drain them down for harvest.

Moreover, any pond water that did escape the pond would likely be healthy pond water from the top of the pond (see “EFFLUENTS” below).

FCR (FEED CONVERSION RATIO)

The only way to get an accurate estimate of FCR is to stock an empty pond, measure all the feed for the growing cycle, and then completely harvest the pond (usually through draining). Catfish farmers do not do that. They harvest by seine. They get only part of the fish in the pond, so that some of the fish from previous stockings are mixed with fish from the last stocking. The fish that are “left over” tend to grow large. Large fish are less efficient in their use of feed for growth and yet they are able to out-compete smaller fish for the bulk of the feed (the ideal size might be around 1.5 - 2 pounds). For all these reasons, it is difficult to get an accurate FCR for a catfish pond, and the FCR for a catfish pond does not directly compare to the FCR for a shrimp pond or other pond where harvest is total.

FCR is lower (better) when catfish ponds are harvested more often, and when ponds are seined several times at each harvest, because more large fish are removed that way. However, not all farmers have access to this kind of harvest service. Large farmers have more access than small farmers. Any difference in FCR between sizes of farms might relate as much to harvest access as to management ability or management practice.

It would be possible to get a more accurate assessment of general FCR by recording food use and harvest weight over several years to smooth out the fluctuations per harvest and per seining. Even this method would not give an accurate estimate for comparison across farms unless all the ponds in all farms were harvested in the same frequency and thoroughness.

For data on FCR, please see questionnaire results.

Please see reports from Greg Whitis of the Fish Center for data on the optimum stocking ratios and management practices to produce the lowest FCRs and for best profit.

SUB-REGIONS

Sub-regions within the catfish growing area vary according to the following factors. The importance of this information is that t I tried to interview farmers from each major sub-region except where farming had declined markedly.

(1) Whether or not the soil is true prairie soil or not.

(2) The extent of red clay or other clay in the soil.

(3) The extent of limestone nearby, or the extent that calcium-carbonate leaches into the pond water. Generally, the more is leaching, the better.

(4) The amount of sand.

(5) The slope of the land. Mild hills are best. Totally flat reduces the amount of water available from watershed. Many small hills with sandy soil makes it hard to locate ponds and hard to direct the water flow. The sandy soil is unsuitable.

(6) The presence of salt in natural wells.

(7) Whether the land was held in large tracts or whether the land was held in small tracts (still by farmers who were mostly of White European ancestry).

According to these criteria, there are these major sub-regions:

(1) The core of the catfish area in Hale, Dallas and Sumter counties. This has low hills, prairie soil, and limestone in many places. It has no salt in the wells.

(2) The area around the Mississippi border that does not have salt water in the wells. Otherwise it is similar to the core area of (1).

(3) The area around Eutaw and Epes in Green and Sumter counties, near the Mississippi border. This area is hillier than the core area (1), and does not always have true prairie soil, but does have salt water in many of the wells.

(4) The area in Perry County near Marion. This is similar to the core area (1) but seems to have less limestone and is slightly hillier.

(5) The area around Demopolis. This is flat. It has smaller farms.

(6) An area south of Demopolis. This is hillier, has smaller farms, and not much limestone. This area is hilly enough to have tree farms around the catfish farms.

(7) There used to be a distinct area north of Greensboro, as far as Tuscaloosa. This area could extend all the way to the Mississippi border, as into Pickens County. This area declined due to the sandy soil and the hills. I did not go to this area.

It is possible to merge areas (1), (2), (4), and (5) into one larger general area.

CHEMICAL USE

This topic was covered in the questionnaire. Pease see there. In brief:

Farmers use few chemicals, primarily for algae control. These include:

Copper sulfate
Diuron
Potassim Permanganate (seldom)
Formalin (rare)

Farmers wish to use chemicals primarily to control algae, not to kill it, except for PP. It is very unlikely that total chemical use over the farm pushes any boundaries. It is possible chemical use in any one pond might be significant, although even then I doubt it is excessive. See my recommendations.

Because ponds are not drained, and because these chemicals deteriorate reasonably quickly, or because they are bound to the pond bottom (copper sulfate), it is very unlikely that they pose much of an environmental threat. They do not get into the environment.

PP kills most of the algae in a pond, and so is not desirable except in case of a potential massive bloom that has to be controlled or, more often, in case blue-green algae are growing out of control. It is very expensive; a single use can cost several thousand dollars. A farmer has to be ready to aerate extensively and to regenerate the natural algae after using PP.

Please see the work of Dr. Claude Boyd of Auburn University and his students on this topic.

"STAIR-STEPPING"

This phrase refers to the relation of the ponds to each other in terms of water flow, and that implies the relation of the ponds to the surrounding watershed. This section comments on both aspects. Assume all ponds are "watershed" ponds (see below).

Ponds are typically built on the lower half of hillsides and in the low areas between hillsides. Water runs down the hillsides into the ponds during the rainy season. The first ponds on the "up" side of the hill collect most of the water. Water from those ponds goes into subsequent ponds lower down the hillside. The water does not overflow the sides of the ponds but goes through a series of pipes and valves. The mouths of the pipes are located toward the top of the pond not toward the bottom. It is as if the ponds were on a stairway, with lower ponds on lower steps of the stairway. Water moves from pond to pond just as the old children's toy a "slinky" used to move down stairways. The phrase "stair-stepping" comes from this relation.

Ponds lower down the stairway can receive water directly if the rain is heavy enough or long enough.

When water leaves the last ponds in the stair-steps, it does not usually overflow the walls but goes out through an overflow pipe.

In the early days of farm construction, the highest pond on the stairway was often dug large and deep to serve as a reservoir for the ponds below, much as "water towers" in urban areas serve as reservoirs for a neighborhood water system. As the farms learned more about the regularity of water flow, and as they learned to conserve valuable healthy pond water, these original large reservoir ponds were often cut up into normal sized growing ponds. That cutting up of former reservoir ponds is probably one of the largest sources of any pond draining for reconstruction of the last 20 years.

The ratio of watershed area to pond areas is about 4 to 1, although this ratio varies considerably by farm. In most cases, the watershed is pastureland with cattle at moderate density. This kind of watershed is not likely to carry many chemicals or other sources of concern into the ponds. Since the decline of row crops, only in some few cases does the watershed have much row cropland. In those cases, farmers might wish to consider the possibility that chemicals are coming into the ponds, and what to do about it.

LEVEE PONDS AND WATERSHED PONDS

This section discusses a problem in definition that has implications for how people understand the place of catfish ponds in the overall ecology.

An idealized watershed pond has three built-up sides. The fourth side, which is not built-up, is on the slope of a hill, and is designed to allow water to flow into the pond from the hillside. Some watershed ponds with three sides receive ponds only from the hillside, and some receive water both from the hillside and from other watershed ponds.

A stair-stepped watershed pond has four built up sides. It receives water primarily from other watershed ponds further up the hillside.

A true levee ponds receives most of its water from wells or from nearby natural ponds and natural watercourses. A true levee pond also has four built up sides.

Watershed ponds and levee ponds have a distinctly different relation to the environment and to the local water regime. Watershed ponds take very little water from the water table and now are rarely a source of concern to farmers other than catfish farmers or to other people who might need water. When many levee ponds are in an area, they can cause problems. Nowhere in Western Alabama are there enough levee ponds concentrated in one area to cause a regular problem, as far as I know.

It is possible to confuse a four-sided watershed pond with a true levee pond that also has four sides.

When asked how many ponds were watershed and how many were levee, farmers sometimes counted all four-sided ponds as levee ponds. However, when asked how many ponds they had that derived most of their water from rain as opposed to wells, farmers always counted stair-stepped watershed ponds as watershed ponds. For numerical results, see questionnaire.

WELLS AND THE LARGE AQUIFER

All farms have wells. When ponds were first built in the 1980s, farmers sometimes used enough water from then existing shallow wells to cause concern for their neighbors. Since then, farmers in Western Alabama rarely do so. Farmers use wells to “top off” ponds in case of a very dry time, such as in the drought years of 2000-2001. Even then, I do not think they drew enough water to cause any complaints. The farmers and their neighbors might be polled on this issue. They rarely use wells for other purposes for catfish farming. I did not enquire about wells for other uses (except for human consumption).

Western Alabama sits above a large natural aquifer, with many portions to the aquifer. Modern wells are usually about 1000 feet or deeper, deep enough to tap into the aquifer and deep enough not to divert the water that is usually used by neighbors. It is very unlikely that catfish farmers can deplete this aquifer through any normal use, even in drought years.

EFFLUENT

Because catfish ponds are not drained for harvest, they do not produce effluent in the same way that a shrimp pond produces effluent.

The only effluent normally produced by a catfish pond occurs when heavy rain fills up the pond to the level of an overflow drainpipe. Even much of this effluent simply goes down the stairway from one stair-stepped pond to another.

Sometimes it rains enough to overflow all the ponds in the stair-step system. Usually this happens only in winter when the rain is steady and heavy. However, in winter, feeding is light and chemical use is very light, so that any water that comes out of a pond is not likely to carry much effluent. Overflow happens in summer when rain has been very heavy and steady, as in a hurricane. Regardless of the season, the water that comes out of a pond is rainwater that flows into the top, stays primarily on the top, and then comes off the top. It does not sink to any drain system on the bottom because ordinarily any bottom drain is not used. This kind of water would not have much effluent even if the pond water were not clean.

Rain effluent of this overflow type typically flows about 50 yards through pastureland into a system of ditches (modified low points or old natural waterways); then it flows another 100 yards through more pastureland to the trees that ring the farm and that serve as a boundary between this farm and its neighbor farm; then it typically flows a mile or so in an unnamed local water to a small named water; then it might flow five miles or so to a local named waterway.

Many current wet spots are not true wetlands but are soggy places that were created because the conversion to cow pastures changed drainage many decades ago. These soggy places are not large enough to sustain the usual ecology of wetlands. Many current stands of trees are not really typical of the old ecology but are the transitory result of multiple cutting, of poor drainage, or of letting cow pastures get out of hand. Some stands of hardwoods are a reversion to the old ecology, and farmers generally leave these alone.

Every 15-20 years, when a pond is drained for reworking, water that carries an effluent load can enter the local ecosystem. Even then, the pond is not usually drained to the bottom but only to about the last foot. It is not likely that this effluent puts many chemicals into the ecology but it might put some organic material and suspended solids into the local small, unnamed waterways for a brief time.

Please see the work of Dr. Claude Boyd and his students that verifies the low impact of such effluent on the local environment.

Catfish ponds are probably closer to the original ecology than either row crops farming or raising cattle on pastureland. They help reestablish the original pattern of mixed ponds and prairie that was evident before this area was drained and cleared for cotton farming in the early 19^{th} century. Catfish ponds certainly improve water drainage and diminish erosion compared to most row crop farming. They probably improve water drainage and diminish erosion over cattle rearing as well, although this question would take directed research to answer clearly. I think catfish ponds can be seen as a form of water conservation and not as much of an erosion threat.

WIND-INDUCED EROSION

Pond walls are sometimes scoured devoid of vegetation, showing the soil underneath. This can be a cause for concern. This condition has to be placed in context. This erosion is usually caused by water lapping against the pond wall. The lapping is caused by wind blowing across the pond. The erosion is usually on only one or two sides of the pond, depending on the direction of the prevailing wind. The dirt that comes out of the pond wall does not blow away or leave the pond, as in typical “dust bowl” erosion patterns or row crop erosion patterns. Rather, it falls back into the pond. It is recycled when the pond is redone. Sometimes it is recycled when the farmer scoops up mud from the pond bottom to repair the scar in the wall.

Even if the concern is less than in other cases of erosion, this erosion should not go untreated. See my recommendations.

BIRDS

The major bird of concern is the cormorant. The U.S. Fish and Wildlife Service (FWS) monitors the status of cormorants but their exact legal status was not clear to me at the time of this report. Farmers can obtain a permit to shoot them.

Cormorants are a problem because they come in large numbers (sometimes by the thousands), dive into the water to get fish (especially the small and valuable fish), annoy the fish at all times but especially at feeding time so that the fish are always stressed and feed poorly, and because the cormorants are adept at learning not to pay attention to the typical non-lethal measures taken against them.

It is unlikely that catfish farmers shooting at cormorants have had much of a negative impact on the cormorant population. According to FWS statistics, the cormorant population in the Southeast had been increasing at about 7% per year for over 20 years until the late 1990s, about the same time as catfish aquaculture has been practiced and had expanded. The FWS specifically sites feeding at aquaculture ponds in the South as one major cause of population increase.

The URL for the report is www.fws.gov/migratorybirds/issues/cormorant/status.pdf

It might be useful to go through the FWS page system. Try going to this page first. It has several useful reports and documents on the cormorant.

www.fws.gov/migratorybirds/issues/TBLCONT.html

From that page, click on “cormorants” to get to:

www.fws.gov/migratory/birds/issues/cormorant/cormorant.html

The response to the cormorant depends whether the farm is on a flyway or not. Cormorants come in the largest numbers and most regularly on the flyways. If not, the farmer should be allowed to shoot at cormorants with a rifle. If yes, the farmer should be allowed to use shotguns as well. Please see my recommendations.

DEAD FISH

Please see my recommendations and the questionnaire results.

SOCIAL RELATIONS AND GENDER RELATIONS

Please see my recommendations and the questionnaire results.

COMMUNITY RELATIONS AND RACIAL RELATIONS

This section is written to forestall any concern that racial relations were overlooked.

I received no indication that catfish farming has led to adverse relations with society in general. American society, Southern American society, and West Alabama society, always have had problems with relations between ethnic groups (African and European) and between rich and poor. It is unlikely that catfish farming has made these relations any worse than what they were before. It is not clear if it helped, or if it could help.

The core area of catfish farming is called "the Black Belt" not only for the color of the prairie soil but also because of the very high population of African Americans (Blacks). This area has an unhappy reputation for being very poor and for having high rates of unemployment, particularly for Blacks. Many initiatives by the State of Alabama might have helped ameliorate the poverty somewhat, but not much.

Catfish farming has certainly contributed to an overall increase in wealth in the area, as noticeable in infrastructure and with small business firms.

The wealth has helped most groups within Western Alabama society, including Blacks, even if it has helped some groups less than others. The wealth has probably not been distributed evenly over all ethnic groups and age groups. Such an ideal equal distribution is not true in America at large and should not be expected here. It is unlikely that wealth distribution in this area as a result of catfish farming was any worse than what would have been expected, and very well might be better.

The farm owners are almost exclusively of European descent (White) because of long-term landownership patterns and because of who bought land in this area in the land boom of the 1970s. Catfish farming has not made this pattern any different than in the past, nor should that be expected.

Many of the employees in traditional long-term relations with catfish farms were Black, although certainly not all of them. The relation of farm owner to long-term employee was not necessarily based on old patronage ideas and probably should not be understood primarily in that way now. At least some of the current farm managers and long-term employees are Black. I made no effort to quantify because my small sample would not have been relevant.

There are some indications of positive attempts to hire Black workers during a period a few years ago. But working conditions and general economic conditions in the region are such that recent hires have not stayed very long regardless of ethnic group, and so the ethnic mix in hires has not noticeably favored Blacks or hurt Blacks. It was not to be expected that catfish farms would dramatically change employment patterns in the area. It might be that automation actually helps with this problem. Please see my recommendations and the questionnaire results.

For a brief period, some farmers hired some Hispanic workers. The Hispanic workers were given some housing, and treated at the same standards as White workers or Black workers. However, there is little Hispanic culture in this region. Apparently the Hispanic workers became bored and sought other employment in urban areas such as Tuscaloosa. I could find no indication of conflict or of dissatisfaction in this episode. Because there were no Hispanic workers evident now on the farms in my sample, I did not investigate this episode in any detail. Hispanic workers might seek work on catfish farms in the future as more Hispanic people move into the area and so provide needed cultural context, and as working conditions change with automation.