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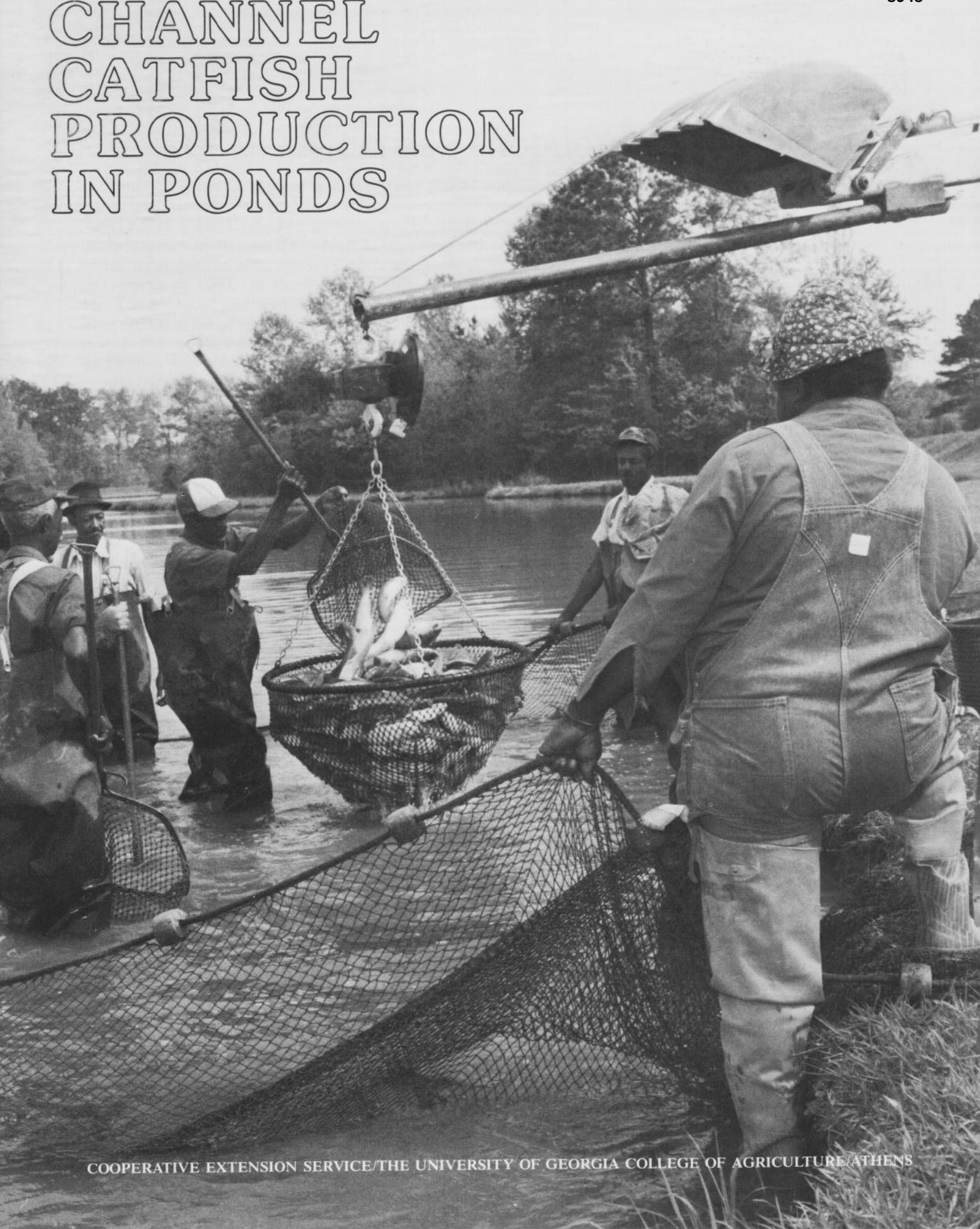

COOPERATIVE EXTENSION SERVICE/THE UNIVERSITY OF GEORGIA COLLEGE OF AGRICULTURE/ATHENS

CHANNEL CATFISH PRODUCTION IN PONDS

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CATFISH FARMING has grown rapidly since its beginning in the 1960's. Over 2,000 acres of water were used in commercial catfish production in Georgia in 1980. In the United States, catfish farming is the largest aquacultural industry, with over 56,000 acres of water used to produce an estimated 100 million pounds of farm-raised catfish in 1979.

Much of the total U.S. commercial production is sold to catfish processors. Some producers sell live or dressed catfish through local outlets. Many growers stock their ponds for commercial recreational fishing, and others sell their catfish to live-fish haulers who deliver primarily to recreational fishing lakes.

Catfish are grown in ponds, cages, and raceways. However, pond culture is by far the most popular method of production. Channel catfish require a warm water environment for good growth. Optimum temperature for growth is 85 degrees F. North Georgia has about 200 days per year when water temperature is above 60 degrees, while extreme South Georgia may have 250 days. Other factors being equal, the longer the growing season, the greater the annual production and return on investment will be.

The future for catfish farming in Georgia appears bright. Difficulties encountered by catfish producers include uncertain markets, "off-flavor," water quality control, harvesting difficulties, and parasite and disease control. Still, the risks are not much different from those encountered in other farm crops, and the industry continues to expand. However, management requirements are higher for catfish production than for most other crop or livestock enterprises. This publication briefly outlines the basic requirements for successful catfish farming in Georgia.

ECONOMIC CONSIDERATIONS

Catfish farming involves more than stocking fish in water, feeding them and reaping the profits. In fact, it is a very expensive type of agriculture. After evaluating pond sites, water supply, soils, and marketing possibilities, one must examine the potential profitability of the proposed operation.

The following is a list of costs common to most catfish farming operations.

CAPITAL COSTS	OPERATING COSTS
Land	Feed
Pond construction	Fingerlings
Drain (pipe, valve and fittings)	Electricity
	Fuel
Water supply	Maintenance and repairs
Buildings (storage and service)	Transportation
	Harvest labor
Pond aerators	Daily labor
Boats and motors	Chemicals and drugs
Trucks	Insurance
Fish hauling tanks and agitators	Telephone
	hliscellaneous costs
Feeding equipment	Interest on operating capital
Tractors	
Mowers	
Oxygen testing equipment	
Seine nets	
Dip nets	
Waders and boots	
Baskets and buckets	
Miscellaneous equipment	
Taxes and insurance	

To calculate profitability, first calculate the expected gross returns by estimating the value per pound of marketable fish and multiply by the expected average yield per acre. Then multiply by the total number of acres to be harvested. Second, after deciding on a particular method of depreciation, calculate the depreciable costs, except for land. Third, calculate annual operating costs. Then subtract both depreciation and annual costs from gross returns to find out how profitable your operation might be. An ***example is*** given ***below.***

Gross Returns=		$12,000 ($.60/lb. x 2,000 lbs./acre x 10 acres)
Less Depreciation on Capital Items	$1,000	
Less Operating costs	$9,000	
Total Costs		$10,000
Net Returns		$ 2,000 or $200 per acre

The largest operating costs you will have are feed and fingerlings. These two costs alone will account for approximately 60 to 70 percent of annual operating costs.

FIGURE 1. HILL POND COMMONLY USED FOR CHANNEL CATFISH PRODUCTION.

POND CONSTRUCTION

Excavated ponds dug into flat ground and filled with well water are ideal for catfish production, and farmers should look for such conditions. However, areas with a combination of flat bottom land, good clay soils and sufficient ground water are uncommon in Georgia. Most catfish in Georgia are grown in hill ponds. Dams are constructed between two hillsides, allowing runoff water to collect (Figure 1). Hill ponds are not ideally suited for catfish production, but they can be used successfully.

All stumps must be removed and the bottom smoothed in order to remove fish by seining. A harvest or catch basin, located near the drain in the deepest end of the pond, helps in removing fish. A drain pipe of sufficient diameter to allow rapid drainage of pond water is absolutely necessary. Most importantly, a pond should be constructed so that it can be drained completely.

To obtain expert assistance in building a pond suitable to your needs contact the Soil Conservation Service (SCS) district office in your county.

STOCKING

Several species of catfish can be grown commercially. They are the channel, blue and white catfishes. The channel catfish is the one most commonly used because it has the best combination of characteristics for commercial production,

The number of fish to stock in a pond depends on several factors:

Size of pond
Experience of producer
Length of growing season
Market size desired
Water supply

The most important of these factors is the size of the pond. Fish should be stocked primarily according to the surface area of the pond. Overestimating the area could result in putting in more fish per acre than can safely be grown. Depth plays no part in determining stocking rate.

Experienced producers stock about 3,000 fish per acre. Inexperienced producers should stock no more than 2,000 fish per acre. Lower stocking densities reduce risk of losses to oxygen shortages, parasites and diseases. In time, producers gain the management experience that allows them to increase stocking rates.

Fingerlings can be stocked at any time during the year. The best time to transport fingerlings is when the water is cool, so that stress on the fish is reduced during transport and stocking. Fingerlings are trained to accept feed faster when temperatures are beginning to moderate, such as during February and March.

Before stocking, eliminate all wild fish such as bream, minnows and bullheads that otherwise would eat much of the food intended for the catfish. Wild fish can also bring in parasites and diseases.

If possible, eliminate wild fish from the water supply. Saran screen with 40 meshes per centimeter can be used to filter out unwanted fish and fish eggs. Saran can be used as a sock to fit over the water supply pipe or it can be framed into a box when large flows of water must be filtered (Figure 2).

Bass fingerlings can also be stocked with catfish at the rate of 50 per acre. Bass will eat small wild fish, preventing a rapid increase in their numbers. If catfish are to be stocked in a pond containing bass, then catfish fingerlings over 8

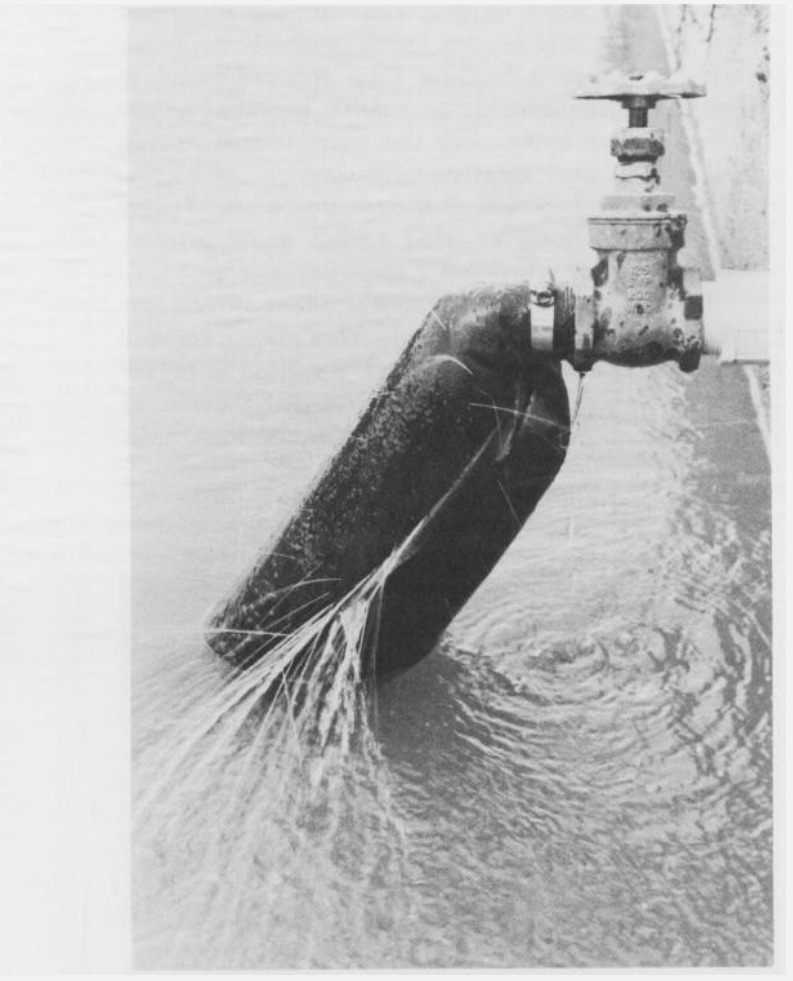

FIGURE 2. SARAN SOCK FILTER FITTED ONTO WATER SUPPLY PIPE.

inches long should be stocked so that bass do not eat them.

If wild fish are already in your pond, drain it completely and leave it dry for several weeks. Rotenone (5 percent wettable powder) applied to remaining pockets of water at 1 part per million will rid you of the rest of the fish. In warm weather rotenone disappears from the water in 7 to 10 days.

Before stocking fish in a pond, the water temperature in the transport tank holding the fingerlings should be adjusted to match the pond water temperature. This can be done by putting small quantities of water into the tank from the pond so that the tank water eventually equals the temperature of the pond. It is a rule of thumb that catfish can withstand a 10°F. change if the water is tempered over a period of minutes. For greater temperature differences care must be taken to slowly equalize water temperatures before moving the fingerlings from the transport tank to the pond. In this case, adjusting water temperature 1" F. every ten minutes is a good rule to follow.

Lack of sufficient tempering can directly cause death of fish by temperature shock. If fish are not killed by the shock, they can be weakened, lowering their resistance to parasites and diseases.

Starting with good quality, healthy fingerlings is very important to profitably growing a crop of fish. Obtain fingerlings from a producer who has a reputation for producing good fish, who knows how to treat fish for parasites and diseases and who has equipment and know-how for handling them without excessive stress.

FEEDING

Catfish grown at high densities require a nutritionally complete feed to produce good fish growth and maintain health. Commercially prepared catfish feeds, available at most feed stores, should contain from 28 to 36 percent protein plus necessary vitamins and minerals. Feeds containing 32 to 36 percent protein are most commonly used by commercial producers.

Sinking (pelleted) or floating (extruded) feed can be fed to catfish. Both types give adequate growth under normal conditions. Floating feeds are most expensive, but allow the producer to observe feeding activity, which helps in determining fish health and vigor. A mixture of 15 percent floating and 85 percent sinking feeds can cut costs and still allow you to observe feeding activity.

Fish feeds come in various sizes. Feed crumbles (crushed pellets) when fingerlings are less than 3 inches long. For fish larger than 3 inches use a 3/16-inch pellet until they reach the market size of one pound. When fish reach one-half pound a ¼- or %-inch pellet can also be used until harvest.

One of the biggest problems that most producers encounter is knowing how much food to feed each day. Feeding too much wastes feed and can cause water quality problems. Catfish will grow at their maximum rate when fed at near appetite capacity; however, the risk of accidental overfeeding is greater than when they are fed at a lower rate. Research has shown that catfish grow most efficiently when fed at 90 percent of all they would voluntarily eat. This optimum point is generally reached when catfish are fed what they will eat in 5 minutes. Feeding at least a portion of the daily feed allowance as a floating feed allows the producer to feed fish efficiently.

Another way to estimate the amount to feed during summer months is to calculate the total initial weight of fish in the pond and feed approximately 3 percent of that weight each day for two-week periods. Every two weeks the weight gain can be estimated and the ration adjusted.

When fish approach three-fourths pound the daily feeding rate can be reduced to about 2 percent of their body weight during summer. To minimize low oxygen problems caused by high stocking densities and high feeding rates, feed no more than 35 pounds of feed per acre of pond each day. If effective aeration equipment is available for use in the emergencies that are likely to arise, feeding rates of 50 to 60 pounds of feed per acre per day can be used.

Table **1** is a guide for feeding catfish during the spring, summer and early fall growing seasons.

Table 1. **TYPICAL SPRING, SUMMER, FALL FEEDING SCHEDULE FOR CHANNEL CATFISH IN PONDS, STOCKED WITH FIVE-INCH FINGERLINGS AND HARVESTED AT 1.1 LB.**

Date	Water temperature °F	Fish size lb	Feed allowance per day, percent of fish weight
4-15	68	0.04	2.2
4-30	72	0.06	2.8
5-15	78	0.11	3.0
5-30	80	0.16	3.0
6-15	8 3	0.21	3.0
6-30	84	0.28	3.0
7-15	85	0.35	3.0
7-30	85	0.42	2.8
8-15	86	0.60	2.4
8-30	86	0.75	2.0
9-15	83	0.89	1.8
9-30	79	1.01	1.6
10-15	73	1.10	1.2

Feeding fish twice daily can be advantageous when fish are less than three-fourths pounds during May, June and July. When fed twice daily catfish will eat and gain more than when they are fed once daily and will consume the feed more vigorously.

Growth of channel catfish slows during the winter. However, if fish are held over winter they should be fed, or they will lose weight and will be less resistant to disease when the water begins to 'warm in the spring. Catfish feed at low temperatures, but not as often. Therefore, a satisfactory winter feeding schedule for catfish in ponds would be to feed about **1** percent of their body weight every other day when water is at any temperature below 65 degrees F. Also, feeding 1 percent of body weight on all days when pond water temperatures are between 54 and 65 degrees F. should be satisfactory. Use sinking pellets in winter.

Catfish will eat at nearly any time of day; in the summer, however, feeding around 9:00 a.m. is a good practice. Do not feed after sundown because the fish's oxygen requirement increases after feeding, and oxygen levels normally decrease at night. Once a feeding time is established it should be maintained, as catfish become accustomed to regularity. For the same reason, try to feed in the same location each day.

Many producers feed 6 days per week. It has been shown, however, that catfish grow proportionately faster when fed 7 days per week.

Feed is used more efficiently when spread out over a large area in the pond. This allows smaller fish a better chance to find feed, resulting in better size uniformity at harvest. Wide distribution of the feed in large ponds is extremely important because of the large number of fish. Figure 3 shows three common ways of feeding catfish.

FIGURE 3. FEEDING CATFISH FROM SHORE, FROM A BOAT, AND WITH A BLOWER.

Conversion of feed to fish depends a lot on how good a manager you are. If you practice the above suggestions you should be able to obtain conversions of 1.5 to 2 pounds of feed to 1 pound of fish gain.

Store feeds in a cool, dry place. Damp storage rooms cause mold to grow on feeds and heat causes loss of vitamins. Do not use feeds that have been stored for more than 8 weeks during summer.

WATER QUALITY

The most serious threat to catfish in ponds is poor water quality. Low dissolved oxygen is by far the most common problem. On sunny days algae (tiny plants that give a green color to water) produce oxygen and put it into the water. At night no oxygen is produced, and respiration of both algae and fish, and decomposition of fish and feed wastes, take oxygen from the water.

Most low oxygen problems occur in July, August and September. During this time temperatures are warm, feeding rates are high and fish are growing rapidly. This may result in more oxygen being taken out of the water at night than is being produced during the day. Also, cloudy days may reduce the amount of oxygen produced. That is when an 'oxygen depletion can occur. The result can be dead fish.

Oxygen levels should be above 4 parts per million (ppm) at all times if catfish are to grow well. Growth can be severely affected when oxygen levels remain below 3 ppm for long periods. Stress caused by these conditions may also lower resistance to parasites and diseases.

Oxygen test kits which pond owners can use to check oxygen content are commercially available. More expensive oxygen meters are also available (Figure 4). Good pond managers monitor oxygen every day at daybreak and at nightfall during the growing season. Decreasing morning oxygen levels from day to day or low evening readings usually warn of future problems. Keeping a chart of daily oxygen readings will help you detect developing water quality problems.

The same factors that contribute to low dissolved oxygen levels contribute to high carbon dioxide levels. A concentration of over 25 ppm of carbon dioxide in pond water is generally harmful to catfish and may contribute to death. Aeration is one way to help rid the water of carbon dioxide and increase oxygen levels.

There are other potentially harmful chemical compounds that producers should be aware of. Copper and zinc in small concentrations can be extremely toxic to fish. Galvanized equipment, such as pipes, containers, screens and tanks used in holding and transporting fish may give up enough zinc to be toxic. Copper from pipes and other equipment can also be toxic to fish.

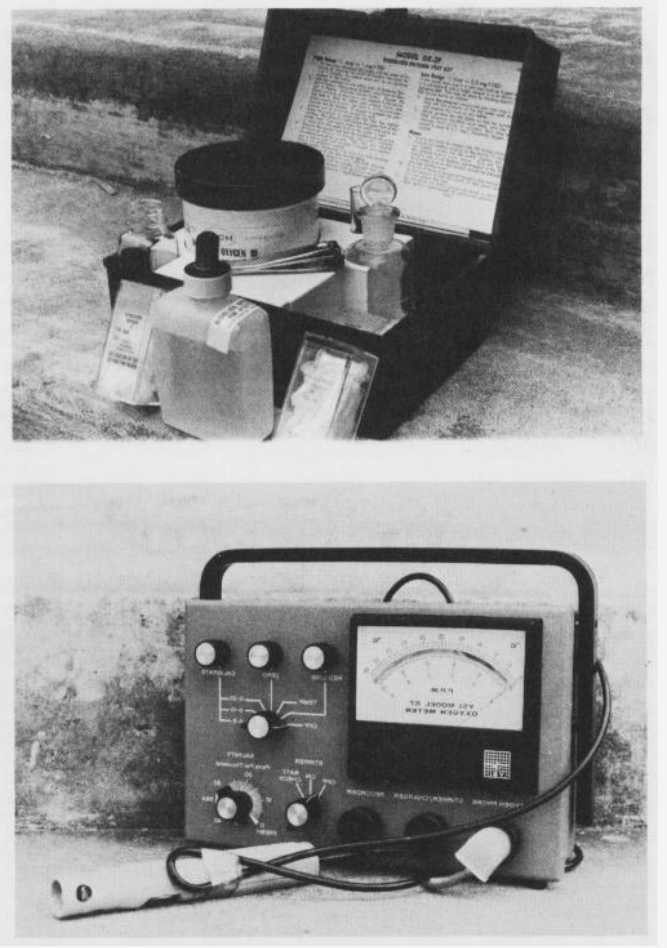

FIGURE 4. AN OXYGEN TEST KIT AND AN OXYGEN METER.

Catfish are very sensitive to chlorine. Water from city supplies should not be used to fill ponds or haul fish. Some pesticides are also toxic to fish. Fish in ponds built on cultivated watersheds are always in danger of pesticide poisoning. Before stocking fish in these ponds find out the chemicals used and their toxicity to fish. If vegetative barriers exist between fields and ponds and if applicators avoid chemical drift by proper application, risk can often be reduced. However, constant chemical use near ponds will eventually cause a problem.

EMERGENCY AERATION

Low dissolved oxygen is the most common water quality problem experienced by catfish producers. Emergency action is sometimes necessary to prevent fish from dying. The following measures will usually not put oxygen into all the pond

water, but will create oxygen-rich areas that fish will seek.

Pumping water from a well, stream or an adjaceut pond with a high oxygen content is a good way to prevent fish kills. However, well water is often low in oxygen and must be splashed against a hard surface or sprayed into the air before it enters the pond. Water from streams or ponds is not as desirable as well water, because it can be a source of wild fish and parasite and disease contamination.

Equipment that will pump at least 100 gallons per minute for each acre of water is necessary to aerate ponds in this way. Draining some water from the ***pond*** bottom while adding water at the surface is more effective than allowing excess water to pass through the pond spillway.

Water can also be sprayed into the air to add oxygen. Pumps should be placed with intakes just beneath the water surface. This method is most successful when water is made into a fine spray. A Crisafulli pump powered by the power-take-off (PTO) of a farm tractor (Figure 5) is an example of an effective aerator.

Paddlewheel aerators (Figure 6) powered by a tractor are considered the most effective commercially available emergency aeration devices for use in ponds. They agitate the water, creating a fine spray and a current that help water absorb oxygen from the air.

Spray-type surface aerators (Figure 7) are not as effective as paddlewheels and pumps in emergency situations. However, they may be useful in very small ponds in maintaining sufficient levels of oxygen during the growing season.

Motorboats twisting and turning at high speed in a pond have been used for pond aeration. Large, tractor-powered rotary mowers have also been used by allowing mower blades to agitate surface water. The effectiveness of these methods is limited.

Claims that chemicals such as potassium permanganate and phosphate fertilizers alleviate oxygen problems are unfounded. No chemicals are recommended for use in fish ponds when oxygen levels are critical.

Once aeration has begun, it should be continued until the oxygen level is about 2 parts per million and the fish no longer gasp at the surface for air. This usually occurs after an extended period of aeration, when sunlight appears after dawn or when clouds break up during daylight.

PARASITES AND DISEASES

Low oxygen, handling, transporting, p o o r nutrition, and crowding all cause stress in fish, making them more susceptible to parasite and disease infestations. If your fish appear sick and begin to die, take time to analyze the situation.

Is low oxygen the culprit? How about pesticide pollution? If these can be eliminated, then observe the behavior of the fish closely. Are ***the fish:*** Not eating? Lying lazily in shallow water or at the surface and not moving off rapidly when disturbed? Nervous?

Catch some fish that appear sick. Do they have: Worn away areas on gills, fins, mouth or skin? Open sores? Heavy mucous or slime production covering parts or all of their bodies? Protruding eyes? Swollen or sunken bellies?

Figure 8 illustrates several outward signs of parasite and disease infestation. If you observe any of these signs, get a diagnosis performed on the fish as soon as possible.

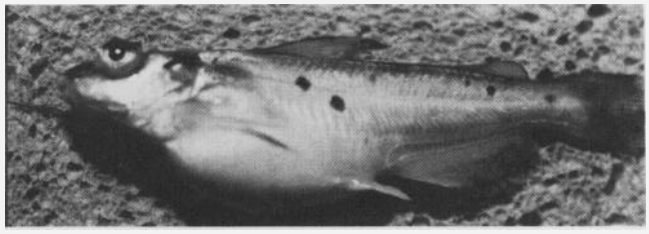

FIGURE 8. CHANNEL CATFISH SHOWING PROTRUDING EYES AND SWOLLEN BELLY (DISEASE SIGNS).

The Southeastern Cooperative Fish Parasite and Disease Project at Auburn University diagnoses fish at no cost to the pond owner. The service is available during working hours Monday through Friday. Send samples to:

Fish Disease Laboratory
Fisheries Building
Auburn University, AL 36849
telephone :(205) 826-4786

Bus transportation is most reliable when shipping. A telephone call advising of the shipment is helpful.

Results of bacterial diagnosis take two to three days. When results are obtained the pond owner will be notified and treatments will be prescribed.

SELECTING FISH FOR DIAGNOSIS. Sick fish should be used in diagnosis to get best results. Here is a rating of samples to use.

EXCELLENT SAMPLE

Fish showing abnormal behavioral signs as described above. They may be hard to catch but will be the best specimens.

Fish showing other bodily signs as described above.

FIGURE 5. AN IRRIGATION PUMP AERATOR.

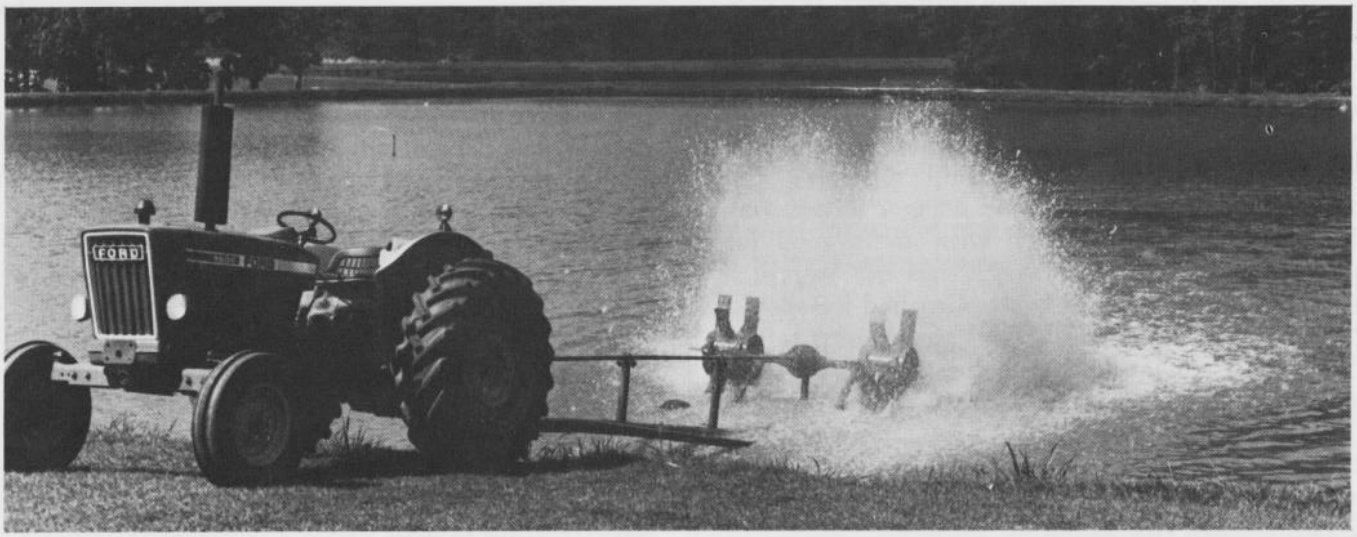

FIGURE 6. A PADDLEWHEEL AERATOR.

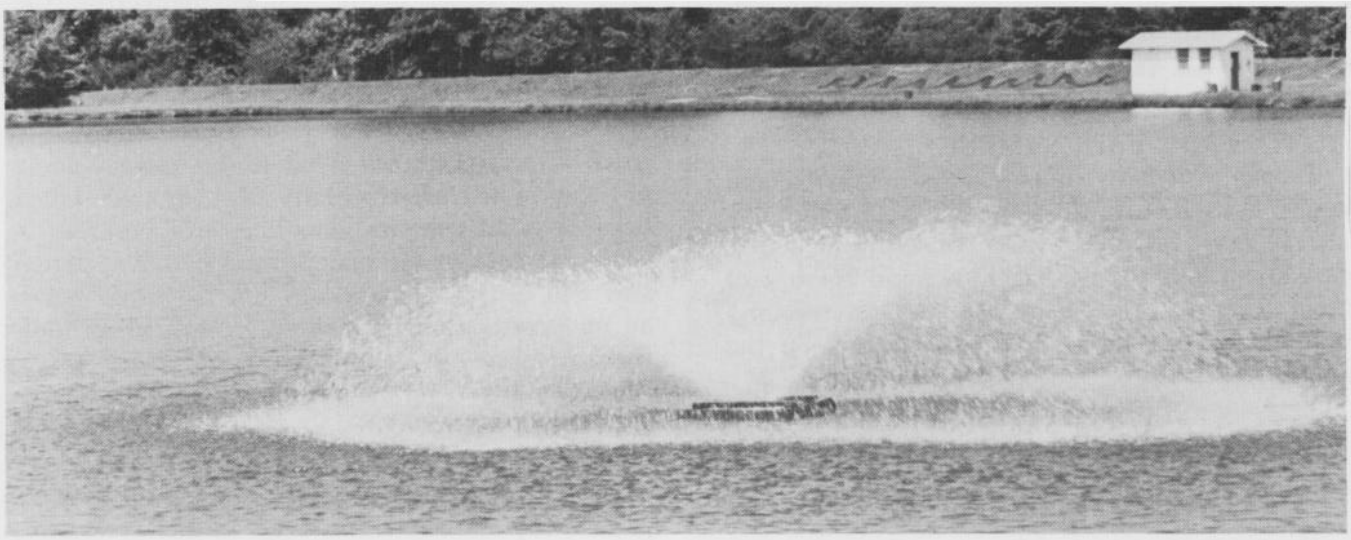

FIGURE 7. AN ELECTRICAL SPRAY-TYPE SURFACE AERATOR.

FAIR SAMPLE

Dead fish that have red gills, normal color and mucous and clear eyes.

Fish taken in a seine haul. The quality of the sample improves if fish with obvious signs of infection are selected from those captured.

POOR SAMPLE

Fish caught by hook and line. Healthy fish bite better than sick fish.

UNUSABLE SAMPLE

Dead fish that have lost their body color, gill color and mucous.

Water samples for disease diagnosis.

TRANSPORTING SAMPLE. Ability to perform a good diagnosis depends on proper sample collection and transporting. Samples must be transported quickly. The following a r e ratings of methods for transporting fish samples:

EXCELLENT SAMPLE

Live ***fish*** can be shipped or delivered personally to the diagnostic laboratory. Place the smallest sick fish captured into a strong plastic bag. Put in just enough water to completely cover the fish. Fill the bag with pure oxygen if possible. Tie securely. (A bag filled with air is good for short trips of a few hours.) Place the bag in a strong box (Styrofoam is best). Crushed ice should be packed in a plastic bag and placed next to the fish. Mark "Scientific Specimens-Perishable" and ship by bus or deliver the sample personally.

Live fish to be delivered personally over a distance of only a few miles can be placed in well-oxygenated water and transported. Ice may be added to cool the water.

Iced ***fish.*** Sick fish captured live may be placed in a plastic bag. Immediately seal the bag and surround with 10 to 15 pounds of crushed ice in an insulated, water-tight container. Use this method only when live fish cannot be shipped.

FAIR SAMPLE

Frozen fish are difficult to work with and should be used only when means for shipping live fish are not available. After collecting sick fish, place them in a plastic bag in a small amount of water. Freeze. Ship in an insulated. (Styrofoam) container. Five pounds of dry ice will keep the sample frozen up to 36 hours.

POOR SAMPLE

Fish preserved in ten percent formalin or alcohol.

UNUSABLE SAMPLE

Frozen fish without dry ice around them.

Iced ***fish that may be delayed*** in getting to the laboratory.

INFORMATION TO **SEND WITH** FISH SAMPLES

1. County
2. Pond owner
3. Phone number
4. Address
5. Pond acreage
6. Average pond depth (or maximum pond depth)
7. Number of each species lost each day
8. Estimated percentage of population lost
9. When the losses started (day, time of day)
10. Number of fish stocked in pond
11. Description of symptoms or signs of sickness

CHEMICALS

Chemicals should be used in fish culture only when no alternative exists. Parasite and disease control is the most common situation requiring chemical treatment. Chemicals for sterilizing the pond, altering water quality, eliminating undesirable fish, and controlling undesirable insects and weeds are also used. Not all chemicals are approved for use in food fish ponds. Check with your county agent for latest recommendations.

How does a person calculate the amount of chemical needed to reach a required concentration? Before you treat any body of water you must consider the following things.

1. THE FISH—What are the tolerable limits of the fish to the chemical?

2. THE WATER—What water quality factors characteristic to your water will affect the chemical being used? Could hardness or cloudiness increase the effect of, or render ineffective, the chemicals being used?

3. THE CHEMICAL-What percent active ingredients does the chemical have?

4. THE POND SIZE—What is the exact volume of water to be treated? Many fish have been killed because pond volumes have been exaggerated. A slight increase in calculated pond size over actual size will cause an overdose. On the other hand, an underestimation in size may result in an ineffective treatment.

Know the volume of your tanks and ponds. Keep this known volume as a future reference for treating.

To calculate the volume of a square or rectangular body of water, multiply length x width x depth of water. This will give you cubic meas-

urements for volume. Cubic feet (ft^3) is the measurement most commonly used. Remember to use the same units of measure for each unit to be treated.

To obtain the volume of a pond, determine the surface acreage and the average depth of the pond. Multiply the number of surface acres by the average depth in feet to get the volume of the pond in acre-feet. Since one acre-foot of water weighs 2.7 million pounds, then 2.7 pounds of any material dissolved in one acre-foot of water gives a solution of one part per million (1 ppm).

The following are weights of chemicals that must be added to one unit volume of water to give one part per million.

Amount Active Ingredients	Unit of Volume	Parts per Million
2.7 pounds	acre foot	1 ppm
1,235 grams	acre foot	1 ppm
1.24 kilograms	acre foot	1 ppm
0.0283 grams	cubic foot	1 ppm
1 milligram	liter	1 ppm
8.34 pounds	million gallons	1 ppm
0.0038 grams	gallon	1 ppm

The following conversions may be helpful to you in calculating treatments in water.

1 acre-foot = 1 surface acre of water 1 foot deep
= 43,560 cubic feet
= 2,718,000 pounds of water
= 326,000 gallons of water

1 cubic foot = 7.5 gallons
= 62.4 pounds of water
= 28,355 grams of water

1 gallon = 8.34 pounds of water
= 3,800 cc
= 3,800 grams of water

1 quart = 950 cc
= 950 grams of water

1 pint = 475 cc
= 475 grams of water

1 cup = 240 grams of water

1 tablespoon = 14.8 grams of water

1 teaspoon = 4.9 grams of water

1 pound = 454 grams
= 16 ounces

1 ounce = 28.35 grams

1 liter = 1000 grams of water

HARVEST

METHODS. A market for fish must be arranged before harvesting. Most buyers prefer fish that weigh between ¾ and 1¼ pounds with an average weight of 1 pound. Before harvesting, cook a sample of fish from each pond to check for poor flavor. Do not market fish that may be rejected by the consumer.

Two harvesting methods are generally used, complete *harvest* when all the fish are taken out of the pond, and a *partial harvest* when only a portion of the fish are taken out of the pond at one time.

A complete harvest is usually done by draining the water from a pond. As the pond water drains the whole pond is seined to reduce the numbers of fish. The remaining fish are captured by seines and dip nets from a small remaining pool of water called the harvest or catch basin.

Draining is the best way to harvest all of the fish at one time. However, water is lost, and if pumping is required to refill the pond, the cost can be high. In the case of watershed ponds, refilling depends mainly on rainfall, which can be lacking at certain times of the year.

Concentrating fish in a small area when water is drawn down may cause an oxygen depletion which can kill fish. Careful supervision is required during this procedure. Equipment that can pump large quantities of water from a nearby source is desirable during harvest in the event of oxygen problems. If all your fish cannot be hauled from the pond to market in a reasonably short time, be sure to have adequate facilities to hold the remaining fish.

PARTIAL HARVEST can be done by angling, trot line, trapping or seining. Angling, trot lines and box traps are usually too inefficient for commercial harvest. Seining ponds without draining is difficult in most Alabama ponds. Most hill ponds are too deep and uneven to seine. Ponds which have stumps and other obstructions on their bottoms also cannot be seined. However, partial harvesting by using a seine for trapping can be very effective. This method is especially useful when fish buyers want small quantities of fish for local sales.

Generally, a seine 150 to 200 feet long and 6 to 8 feet deep should be used for trapping. Set the seine in a location that has a smooth bottom and is not deeper than 3 to 4 feet at a distance of 50 feet from shore. Stretch the seine parallel to the shore at a distance of approximately 50 feet. Coil 50 feet of the seine at each end and connect a rope from each coiled end to the shore.

Begin feeding normally between the seine and the shore. Sometimes feed must be spread on the water outside the catch area to lead fish into the trapping area. After several days, or when fish are well accustomed to feeding within the area, they will be ready to trap. When you are ready to

FIGURE 9. SEINING AND LOADING CHANNEL CATFISH.

market the fish, simply feed the fish within the area and pull the seine ends to shore. Then carefully draw the entire seine to shore and dip the fish for loading (Figure 9).

The trap seine method of partial harvest usually cannot be used more often than once in 7 days because fish become too wary of the net. However, harvesting can be alternated among ponds or at different stations within larger ponds. Remember to feed fish at the time of day you plan to trap.

EQUIPMENT. The type and size of harvest equipment you will use depends on the size of your operation and the market served. While some producers harvest their own fish, many fish buyers will handle harvesting the fish, reducing the producer's need for equipment.

Three feet of seine length is required for every 2 feet of pond width to be seined. The same ratio applies to pond depth: 3 feet of seine for every 2 feet of maximum pond depth to be seined. Floats can be of Styrofoam or plastic attached on 18-inch centers.

For most catfish seining operations a mud line is necessary on the bottom of the net. It is made of many strands of rope bound together (Figure 10). As the seine is drawn across the pond bottom, the mud line stays on top of the mud, eliminating the digging effect of lead-weighted lines.

Seine material should be of polyethylene or nylon. Catfish spines will not catch in polyethylene material. Nylon netting requires a net treatment to prevent spines from catching.

The mesh size to be used varies according to the minimum size fish to be captured. Buying the proper mesh seine for your operation allows you to capture only fish that are large enough for your market. The following chart tells you what size fish are caught by various mesh sizes. Size of fish held varies somewhat with mesh diameter, fish condition and activity. All sizes are given as bar mesh which is the smallest distance between knots.

l-inch mesh holds fish 8 ounces and larger
Winch mesh holds fish 10 ounces and larger
1⅜-inch mesh holds fish 12 ounces and larger
1½-inch mesh holds fish 14 ounces and larger
1⅝-inch mesh holds fish 1¼ pounds and larger
Winch mesh holds fish 1⅝ pounds and larger

Live storage of fish is sometimes necessary if the market cannot transport all your catch in one

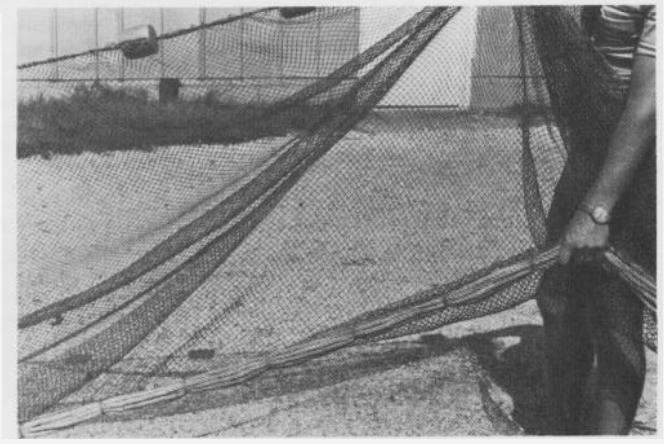

FIGURE 10. A SEINE WITH MUD LINE.

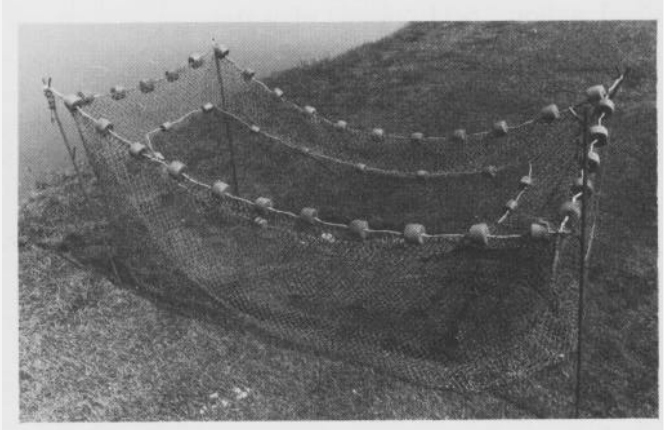

FIGURE 11. A LIVE CAR FOR HOLDING FISH.

day or there is a delay between capture and hauling the fish to market. Often, catfish producers may want to sell fish directly to consumers. In these cases catfish can be held in live-cars. Live-cars are net enclosures that can be placed in a pond to hold fish temporarily (Figure 11). They

FIGURE 12. EQUIPMENT USED TO HARVEST AND TRANSPORT FISH.

are made of the same materials as seines.

Use caution when holding fish in live-cars. Diseases, weight loss and poaching are common problems encountered. Limit the time the fish are held to only a few days to reduce weight loss and prevent disease. Disease can occur during any season but is much more prevalent when water temperatures are highest. Poachers, of course, can easily steal fish from unguarded holding facilities.

Other equipment needed to harvest fish may include sturdy dip nets, baskets, boots or chest-waders, scales, a tractor-mounted boom and fish hauling tanks (Figure 12).

WHEN TO HARVEST. Coordinate your harvest date to meet the needs of your markets whether they are processors or your own private outlet. Make sure that fish are of the size demanded by your buyer. Fish weighing between ¾ and 1¾ pounds are generally preferred. However, there are markets, such as live-haulers, that desire larger fish.

Most catfish are stocked in winter or early spring and harvested in the fall or winter. This schedule often results in a glut of fish ready for market in the fall. To avoid this situation, fingerlings of varying sizes can be stocked in different ponds at different times of the year. This may not result in optimum growth, but higher prices generally paid for market-size fish during the spring and summer can make up for any loss in growth.

Catfish can have an undesirable, earthy or musty flavor. Selling off-flavor fish may hurt consumer demand. Cook several unseasoned fish a day or two before harvest. If off-flavor is detected, delay harvest until the flavor is acceptable. In static ponds this flavor may take days or even weeks to clear. If you have access to tanks or raceways with running water, the flavor of fish stocked in these units will improve in 7 to 14 days, depending on the seriousness of the problem. In running water fish will lose a considerable amount of weight during this time, which may reduce profits.

TRANSPORTING LIVE CATFISH

Transporting live fish requires maximum care to avoid fish losses. In transport, fish are crowded into a relatively small amount of water. Agitators, blowers, compressed oxygen, compressed air or liquid oxygen can be used individually or in combination to keep fish alive. Transport containers are usually made of wood, fiberglass or aluminum. Many kinds are commercially available.

Generally, dissolved oxygen content in the water is the factor that determines whether fish live or die. Fish should not be fed for at least 24 hours before transport so that excessive fish wastes

do not consume large quantities of oxygen during transport. Transporting fish in cool weather also increases fish survival because cool water holds more oxygen than warm water. Also, fish consume less oxygen in cool water. Fish size makes a difference, too, as large fish consume less oxygen by weight than small fish.

Fish health and survival depend on your ability to limit stress. Stress from netting, loading, hauling and stocking fish results in a weakened animal susceptible to parasite and disease problems. The more you limit stress factors, the healthier your fish will be.

Here are some guidelines for hauling live catfish. The numbers are in pounds of fish per gallon of water in tanks using agitators or blowers for aeration. Assume that water temperature is 65°F. and fish begin the haul in good condition.

Table 2. LOAD LIMITS FOR HAULING CATFISH IN POUNDS OF FISH PEH GALLON OF WATER*

Size of Fish	Duration of Transport			
	1 hr	6 hr	12 hr	24 hr
	-pounds of fish per gallon of water-			
2-inch fingerlings	2	1½	1	1
8-inch fingerlings	3	3	2	1%
14-inch adult fish	4	4	3	2

*Adapted from *Transport of Live Fish* by S. K. Johnson, Texas A&M University.

As water temperatures rise, decrease the load by 25% for each increase of 10 degrees F. The same calculation can be used for increasing the load as temperature decreases. Loads can be increased by about 25% when pure oxygen is bubbled into the water.

Ice can be used to cool water in hauling tanks. Do not use ice made from chlorinated water.

MARKETING CATFISH

Before the first ponds are built or before fish are stocked in existing ponds, all producers should know where they can sell fish. Market options now available to catfish producers include large processors, small processors, fish-out, on-farm sales, local retail sales and live-haulers. A market should be selected on the basis of potential profit according to your scale of operations. Each alternative should be carefully analyzed.

Large processors generally harvest fish for producers within a short radius of the processing plant. Some accept fish delivered live by the producer. Fish producers within range of large processing plants should arrange harvest or delivery dates before fingerlings are stocked.

Many producers want to sell their fish in the fall, creating an oversupply of fish for the processors. Catfish harvested in the spring or summer usually command a higher price due to high processor demand. By adjusting fingerling size and stocking date and by partial harvesting, some producers are able to market their fish more profitably during times of shortest supplies.

In many areas there are small-scale processors who process small quantities of catfish for sale to local businesses and individuals. These processors often produce much of their own fish but at times buy from local producers. Your county agent will have information concerning processors in your area.

Fish-out or fee fishing is another market option. Success in a fish-out operation depends largely on the number of potential customers living in the area, and on their fish-catching abilities. Fish-out ponds near cities will obviously be more in demand than remote ponds. Small, densely stocked ponds are best to use for fish-out. To keep fish biting, catfish should be replenished when stocks become low. Many successful fish-out producers buy catchable fish from other producers or produce them in their own ponds to stock fishing ponds. This results in better fishing success, more customers and more sales.

Fish-out pond owners should be aware of safety provisions necessary when opening ponds to the public. Insurance protection against liability claims is a must!

Wholesale and retail sale of live catfish is another way for producers to sell their product. Fish can be captured to order or captured and held live in holding areas for later sale. Local newspaper ads, road signs and word-of-mouth rapidly establish a good demand. Remember that customer demand can be maintained by providing a consistent supply of catfish throughout the year.

Live-haulers, persons who buy and haul live catfish from producers to retail outlets, are important buyers of farm-raised catfish. Usually these haulers want producers to harvest and load the fish onto their trucks. Live-haulers often transport fish to fish-out ponds near large cities such as Chicago or Atlanta. Live-haulers generally buy the majority of their fish during the period March through October.

If you desire more information or have a problem to discuss, contact your county office of the Georgia Cooperative Extension Service. There is always a county agent ready to serve you.

When you have a question ...

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