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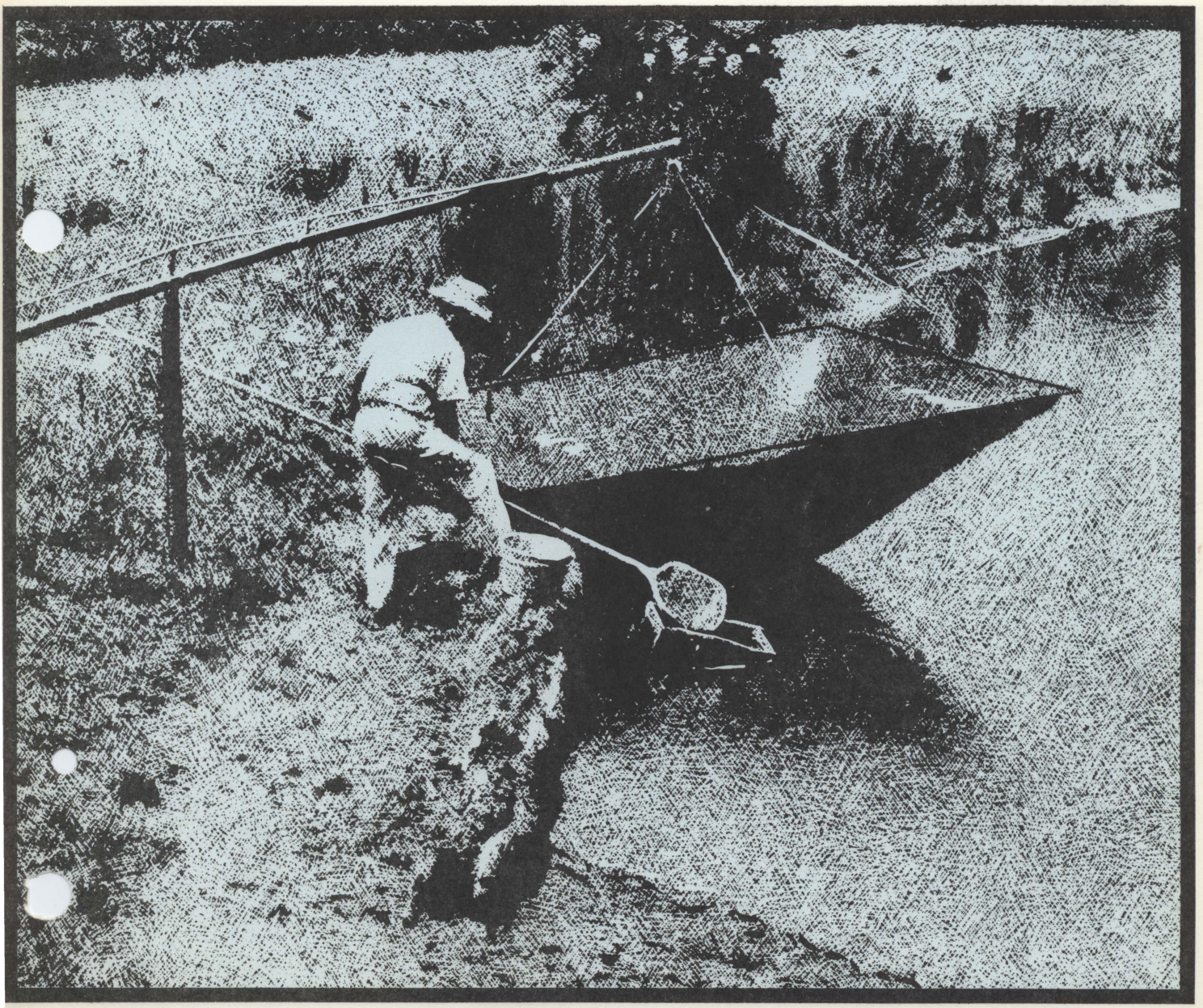
RAISING MINNOWS



TEXAS AGRICULTURAL EXTENSION SERVICE • THE TEXAS A&M UNIVERSITY SYSTEM
DANIEL C. PFANNSTIEL, DIRECTOR • COLLEGE STATION, TEXAS

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RAISING MINNOWS

S. Ken Johnson and James T. Davis*

The culture of bait minnows is one of the more rewarding forms of aquaculture. A large number of fish may be produced at relatively low cost, and if a market can be obtained the returns are very good. This publication is written for persons interested in raising minnows, and discusses basic techniques for minnow production. Beginners may encounter certain problems that can be overcome with experience and ingenuity.

Texas fishermen buy baitfish all over the state and especially in areas with good crappie fishing. The most widely used baitfish is the golden shiner, *Notemigonus crysoleucas*. The goldfish, *Carassius auratus,* the fathead, *Pimephales promelas,* and the carp, *Cyprinus carpio,* are marketed to a very limited extent.

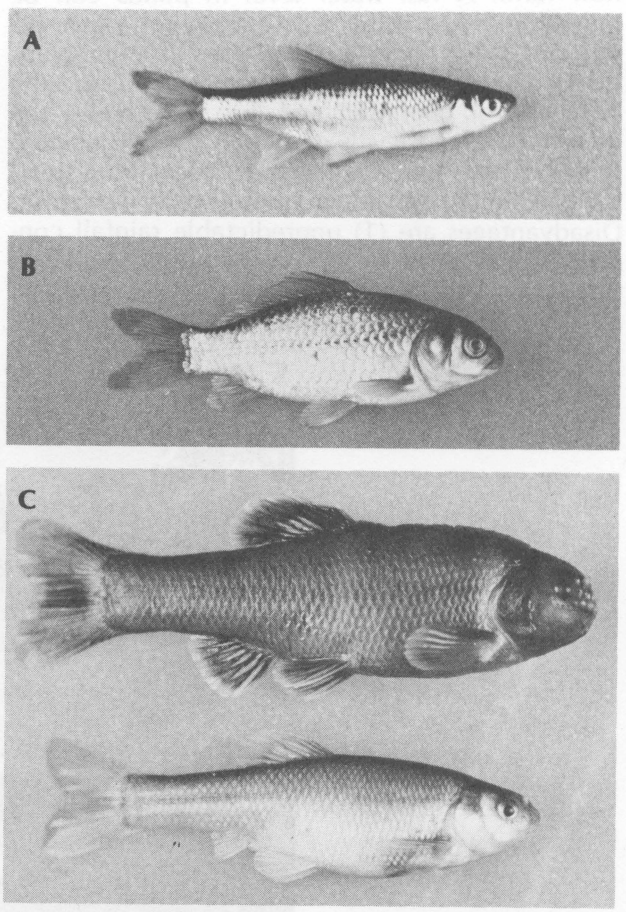

Fig. 1. Fishes used for baitfish: (a) golden shiner (b) goldfish (c) fathead (male above). (Photos courtesy Alabama Agricultural Experiment Station, Auburn University.

Market Studies

Before starting a bait minnow farm, determine which market outlets are available. Talk with wholesale and retail bait dealers to determine what types of minnows they use and what quantity over and above those already available would be used if a dependable grower could supply them. At the same time realistically determine what services the dealers would require, such as night and weekend deliveries, mixed sizes, etc.

Study these outlets and your competition to determine if you can really give better service, furnish a better minnow or help increase a retailer's net return from bait minnow sales. Most sales to retailers are based on a dependable continuous

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supply. Don't sell minnows you don't have (and may not be able to buy) at a price that is so low you will have to go out of business.

Finally, consider what advertising, if any, you will do and what the cost will be. Remember that the $50,000 you invest in a 25-acre minnow farm will not bring in any profit if no one knows you have minnows for sale.

Water Supply

An adequate water supply is essential in establishing a minnow farm. The amount of water required will vary according to the size of the ponds and the total size of the farm. Sufficient water must be available to change the entire water volume in a pond in 2 days or less. Because water flow-through is beneficial, it is best to plan for at least 15 gallons of water per minute for each acre in production. If this much water is not available, production per acre must be lowered to prevent feed buildup and low oxygen levels in the ponds.

Wells have numerous advantages for the minnow farm. A full water level in ponds can be maintained and water is available for water exchange. Well water is also free of contagious parasites. Principal disadvantages of wells are the high cost of operation and, for some wells, the presence of high levels of carbon dioxide or iron.

Watershed runoff is suitable for minnow rearing and has the advantage of no pumping expense. Disadvantages are (1) unpredictable rainfall conditions, (2) peculiar construction requirements that may later interfere with harvest, and (3) absence of emergency replacement water. These disadvantages may be overcome by construction of a water supply reservoir and then tapping this supply by gravity flow for minnow-rearing ponds.

Streams provide adequate water, but pond construction in a stream basin may result in frequent flooding of rearing ponds. Other disadvantages are costs of pumping and the possible introduction of parasites and undesirable fishes. If water comes from a lake or stream, a filter must be used. Sand filters and sock-like fiber filters (with material of 52 mesh/square inch) are frequently used.

Pond Design and Construction

Careful examination of soil samples should be made to determine if enough clay is present to retain water. Samples can be taken with a soil auger or posthole digger. The Soil Conservation Service Conservationist or an agricultural engineer can determine the probability of water retention prior to pond construction.

The design of minnow ponds depends upon the production requirements of the total operation. For most minnow farms a size range of 1/4- to 1-acre surface area is best. If large orders (over 1,000 pounds) are anticipated then larger ponds should be considered.

Pond design should provide a separate water intake and outlet for each rearing unit. If an intake is located near the outlet it is possible to introduce clear water into a small holding area created as water is drawn down for final harvest. An intake situated across the pond from the outlet makes flushing much easier. Therefore, two intakes may be considered. Ponds should be

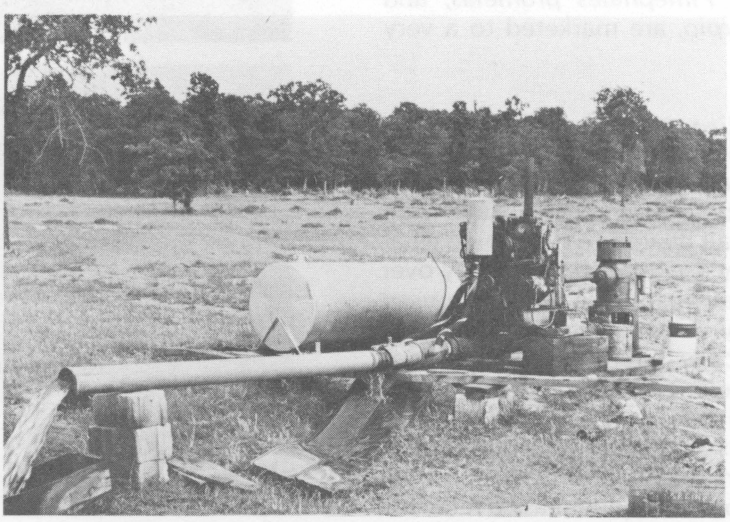


Fig. 2. Good quality ground water available at shallow depths and in abundant quantity provides great advantage to the successful minnow farm.

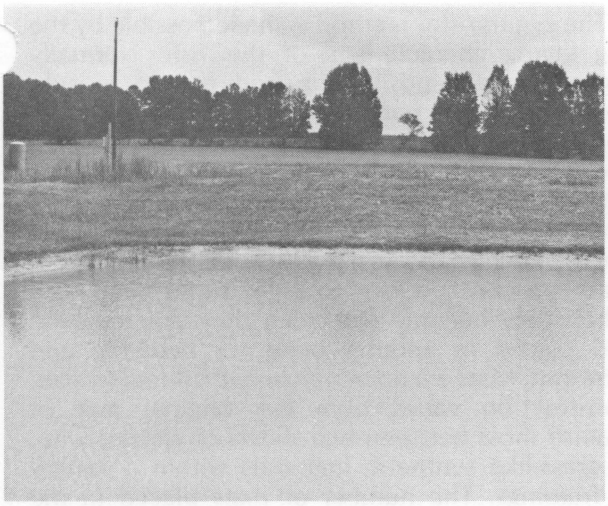


Fig. 3. A gently sloping terrain allows for maximum use of gravity flow.

arranged to take full advantage of gravity flow because pumping costs decrease total farm profit. Partial harvesting with lift nets, seines or traps until fish numbers are reduced and then draining the pond is the harvest method used by most minnow producers. Pond design should facilitate harvesting.

Minnow farms that transfer newly laid eggs to new waters will utilize two types of ponds: brood ponds and grow-out ponds. Some consideration should be given to construction of brood ponds near grow-out ponds to facilitate handling of egg mats.

If an external water supply (weil, stream, reservior) is to be used, ponds should be built in a rectangular shape to facilitate harvest. The bottom should be leveled and sloped to a depth of 4 to 5 feet in the deep end and not less than 30 inches in the shallow end. The bottom should be cleared of stumps or roots that would obstruct seining.

Levees should be constructed with 3:1 slopes with a 12-foot crown to accommodate vehicles. Depending on the soil type at the construction site, clay cores may be required in the levees to prevent horizontal seepage. Sodding with grasses appropriate to the local soil type will retard levee erosion, but to avoid wind damage at the water line, rip-rapping may be required. An additional benefit of sodding is that weeds will not establish as they will in rip-rapping. Weedy edges around ponds are unattractive, interfere with many routine fish culture operations and provide a habitat for snakes.

A livestock pond may also be used for minnow production. Although several management techniques such as egg removal are not feasible, a sizable minnow crop may be produced.

Rearing Methods and Food

Minnows begin life by feeding on microscopic plant and animal life, collectively called plankton. As they become larger, immature insects and other small aquatic animals are added to their diet. The available food will be cropped off until it becomes scarce and minnow growth slows. If unmanaged, a pond will produce approximately the same weight of fish each year. Increasing the food in the pond will produce more fish weight. In minnow culture, food is increased by fertilization and/or by feeding. Fertilization increases the amount of plant life. Feeding provides food directly to the fish and will further increase production.

The fundamentals of feeding allow for two rearing methods. For the *extensive* method ponds are stocked with larger than natural, but moderate numbers of fish, and fertilization is used with limited supplemental feeding. This rearing method is suitable for the isolated farm pond or for fish farms with restricted water supplies. Advantages include low labor and feed costs, but disadvantages include low return per acre, a large water acreage requirement and some harvesting difficulties.

Intensive methods use daily feeding and water exchange to maintain good water quality. Intensive rearing requires more management control but results in easier harvesting and more fish per acre. Disadvantages of intensive methods include higher labor, feed and pumping costs, as well as increased possibility of oxygen depletion and disease. Unmanaged baitfish ponds produce approximately 100 to 300 pounds per acre, whereas extensive and intensive rearing may yield up to 600 or 1500 pounds per acre, respectively.

Fertilizers having a 4-4-1 ratio of nitrogen, phosphorus and potassium seem to give highest plankton production most economically. An application rate of 10 pounds of phosphorus per

Fig. 4. Fertilization allows for a larger poundage per acre of pond.

surface acre is recommended. An example application would be 50 pounds of 20-20-5 per surface acre. This can be broadcast on the lake surface.

Initial application should be made 2 to 4 weeks before stocking. Subsequent applications of half the initial rate should be made at 2- to 4-week intervals or as indicated by plankton production. Over-fertilization during summer months may cause oxygen depletion. If a large supply of fresh water is not available to flush the pond, discontinue fertilization by June 1. Always discontinue fertilization in the fall at the coming of the first frost.

Feeding should take place during the morning hours before 10 a.m. If the producer selects a shallow water area and feeds there each day, the minnows will congregate at feeding time. A beginning rate of 10 pounds of feed per surface acre per day is suggested. Do not exceed 30 pounds per surface acre during summer months unless continual water exchange is practiced.

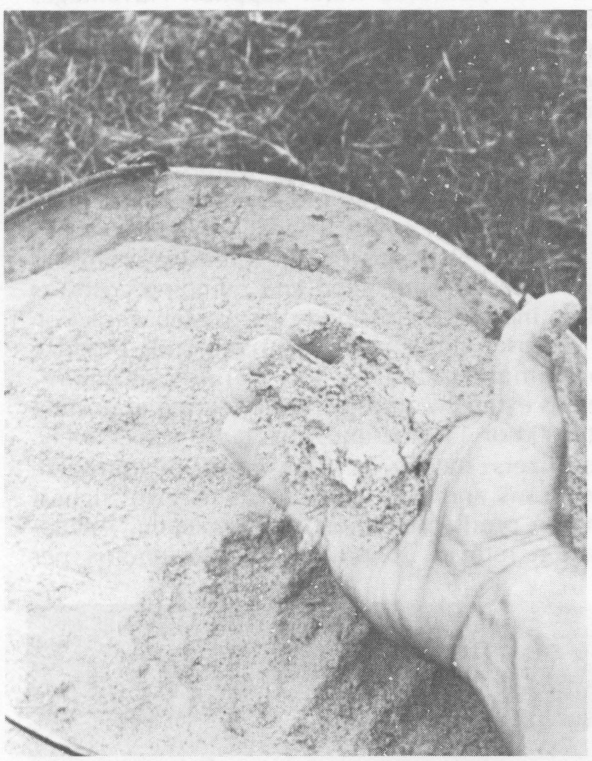


Fig. 5. Feeding with a finely ground commercial feed that is 33 percent protein encourages a large and fast growing crop.

Golden Shiner Production

There are three basic types of production for the golden shiner. These are by (1) egg transfer, (2) open or free spawning and (3) fry transfer.

The egg transfer method is made possible by the egg laying characteristic of the fish. Normally the eggs are deposited on and adhere to submerged objects, particularly aquatic vegetation. For the egg transfer method, ponds are cleaned and stocked with brood fish at 400 to 500 pounds per acre. Spawning mats are placed in the pond when water temperatures reach 68 degrees F, since spawning occurs from 65 to 85 degrees F. Mats are checked two to eight times each day. When they become egg-laden they are removed and placed in another pond for hatching and grow-out. Mats are approximately 2 x 4 feet in size. Construction varies from the original mat of spanish moss between two sheets of welded wire, to grass-like synthetic materials within a variety of framings. The number of mats placed in the brood pond is determined by the intensity of the spawning activity. Too many mats results in few eggs per mat. Too few mats results in overloading of eggs and increases the possibility of egg destruction by fungus. Mats should be moved from the brood ponds to the grow-out ponds within 7 days.

The open or free-spawning method can be used in ponds with suitable spawning material (aquatic vegetation, flooded grass) already present. Laying, hatching and grow-out occurs in the same ponds with the original broodstock. The difficulty of this method is the wide size variation in fish. This requires grading and the return of small fish to the pond. The rate of stocking of brood fish for open spawning is 200 medium to large individuals per surface acre.

The fry transfer method utilizes fish from (1) hatching ponds that have been intentionally overstocked with eggs obtained from brood ponds, or (2) ponds where open spawning has taken place. Since large numbers of small fry represent small weight, minnow ponds in early spring can sustain numerically large populations. When the fry are of suitable size (800/pound), they are captured by fine meshed seines, traps or umbrella lift nets and moved to grow-out ponds. The fry transfer method allows better control of stocking numbers than the other two methods.

Fry transfer requires an accurate estimate of number. To estimate the number of fry, the number of wet fish per ounce of volume is counted. Then the required number of ounces is transferred to give the desired stocking rate of 3 to 5 individuals per square foot of pond surface. By stocking at different rates, fish of desirable size will be ready over an extended period of time.

Some young fish should be saved from each year's crop for broodstock. These fish should not be graded since grading selects for one sex. Brood fish over 2 years old should not be used if the parasite *Pleistophora* is present (see page 13).

Fathead Production

In contrast to golden shiners, fatheads deposit their eggs on solid objects beneath the water. If roots or rubbish are present in the pond they will provide suitable spawning sites. Otherwise, solid objects such as tiles, boards or flat rocks should be added. The male will fertilize eggs from several females and pick them up in his mouth to affix them to a solid object. This nest, which may exceed 3 feet in diameter, will be guarded by the male. Soft drink cases work well for spawning sites because the partitions discourage fighting between males.

Their spawning characteristics make fatheads suitable for production using open spawning or fry transfer methods. For open spawning, 500 to 1,000 fatheads of 2- to 3-inch size should be stocked per surface acre. For fry transfer, 200,000 fry per acre will give good production. Fatheads are short-lived and therefore must be held over for brood fish. Spawning begins as water temperature reaches 60 degrees F.

Goldfish and Carp Production

Methods discussed for golden shiners also are suitable for goldfish and carp. These species reach a larger adult size than the golden shiner so larger broodfish may be used. They will begin spawning at a 4- to 5-inch size. Crowding of broodfish in a trash-free wintering pond will prevent premature spawning on warm winter days. These species usually begin spawning when temperature reaches 68 degrees F. Placing the broodfish in fresh water triggers spawning. For open spawning, vegetation around pond margins should be flooded to provide spawning sites.

Fig. 6. Filling a pond so that the water floods above the grass line will provide a start for spawning of goldfish in the spring.

Harvest

Most baitfish are harvested from grow-out ponds by seining or lift-netting. Lift or umbrella nets are broad circles or squares of netting resembling inverted umbrellas. The net is attached to a boom that extends out over the pond. For harvest, the net is lowered below the surface. Fish are fed over the net and after a period of time the net is lifted, trapping the fish. The fish may be graded as they are removed from the lift net, and small fishes returned to the pond.

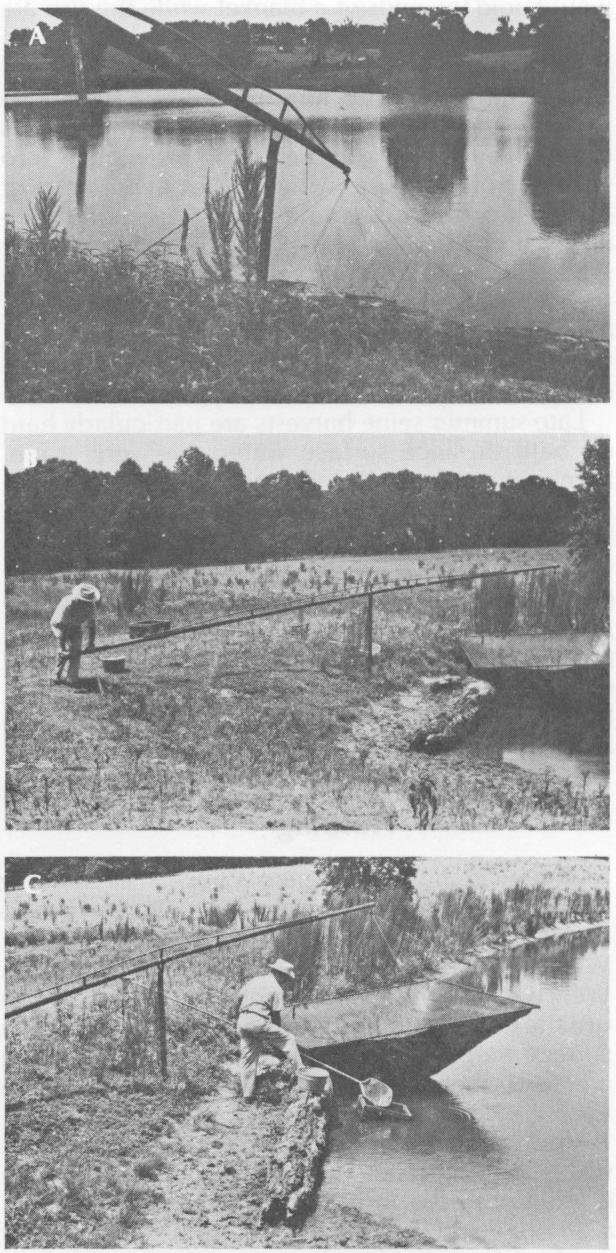


Fig. 7. Use of the umbrella lift net: (a) net in place with feed broadcast on water surface over net; (b) lifting net; (c) grading fish from lift net while at the pond.

Seining is the most popular harvest method because it is faster than lift-netting. The size of the fish determines the mesh size of the seine to be used. If the mesh is too large the minows will go through the seine and/or become gilled. If the mesh size is too small the seine will be hard to pull. In seining, fish are first attracted near the shore with a small amount of feed. Then one end of the seine is pulled out in a crescent shape to encircle the fish. The seine is brought to the shore and the fish are gathered to the center of the net. This center portion of the net (which may be a specially constructed bag) is then held as two people would hold the ends of a blanket while the fish are carried back to deeper water. The edges of the fish bearing portion of the seine are then staked above the water with long metal rods that have forked ends. This frees the hands of the seiners to remove fish with dip nets. Fish are dipped into floating holding boxes with walls of nylon netting. If only a certain size of minnows is required minnows can be graded at the pond by using floating graders. When the proper number and size of fish are obtained the holding boxes are carried to the hauling truck. Seiners should make certain that fish are not so crowded that stress or physical damage occurs.

Late summer seine harvests are particularly hard on baitfish since surface waters are very warm. Pumping cooler water of good quality into the seining and dipping area will help prevent losses in summer harvest.

A catch basin is needed if minnows are harvested by draining the pond. A cement box located just beneath the drain pipe inside or outside the pond will collect the fish for easy dipping. Good quality water piped into the catch basin will greatly improve water conditions and result in less stress and loss of minnows harvested in this manner.

Holding

A typical holding facility consists of holding vats made of poured cement or concrete blocks under a roof to protect the vats from the sun. Water is supplied to the vats where fish are held. Well water is the best for holding fish since it is usually cooler and of a more constant quality than surface water. About 1 gallon per minute should be added to the vat per 100 gallons of water in the vat.

Vats vary in length but are generally 2 to 3 feet wide and 18 to 24 inches deep. Pure concrete is grouted to the inside walls and bottom to give a smooth surface. Some fish farmers paint the insides of vats with a latex or masonry paint to make the vats smoother. The drain is usually a 4-inch pipe collar cemented in an end wall or bottom. Attached to this is a stand pipe for water level maintenance and draining. New vats often

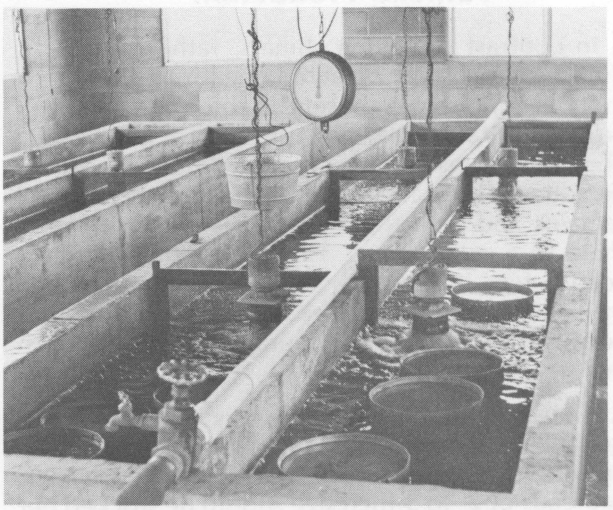


Fig. 8. Holding facility: note blocking screens and suspended agitators.

release alkalis into the water and should be seasoned by adding a pint of glacial acetic acid per 200 gallons of water. This solution will neutralize the alkalis if held in the vat for several days.

Holding rates of minnows in the vats vary from light to heavy. A heavy load would be 1 pound of fish per 5 gallons of water. Such a load could be expected to keep fish in good health if held at 70 degrees to 75 degrees F for no longer than one week with an adequate supply of fresh water. Agitators are supplied at 4- to 5-foot intervals along the vat. For heavy loading, 1 agitator should be supplied for every 100 pounds of fish at 60 degrees and the number of agitators should be increased at higher temperatures up to 2 per 100 pounds at 80 degrees F. If possible, holding water temperatures should not exceed 75 degrees F.

Grading

Since fish are sold by size, grading is necessary to separate baitfish into lots. The most popular method is the use of mechanical bar graders. These graders utilize 3/15-inch aluminum or bronze rods built onto a frame. The rods are parallel and are separated by measured distances. The fish swim through those spaces that the widths of their bodies permit.

One type of bar grader is built in the form of a basket. Fish are placed into the grader and the smaller ones swim through the bars into the open water of the vat. The retained fish are moved to one end of the vat or dipped into another holding unit. If the same vat is to be used, a blocking screen is used to keep grades of fish from becoming mixed. A blocking screen is usually a framed piece

Fig. 9. Basket type grader.

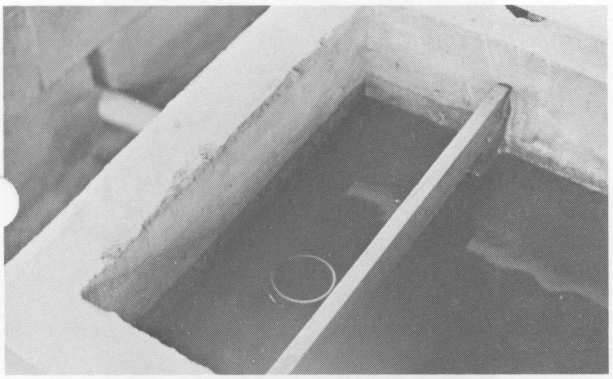


Fig. 10. Drain with blocking screen placed in front.

of hardware cloth or screen the exact width of the vat.

Another type of grader is designed like the blocking screen but has spaced rods and is slid along the vat. The fish are crowded to one end of the vat and are graded as the smaller fish move through. This method is slower than basket grading but requires less labor and moving of fish.

Fish are sold wholesale by grades on a price per thousand basis. Grades commonly used in the trade are *small* (crappie bait), *medium* and *large* (bass or trotline bait). The number per pound determines the price within a grade. Spacings between bars of graders are in 64ths of an inch. A grader with 14/64-inch spacing is called a number 14. A 15/64-inch spaced grader is called a number 15, and so on. Small or crappie minnows pass through number 13 to 15 graders, medium minnows pass 16 to 18 and anything over 18 yields the large size. Minnows that pass through a number 12 grader usually are returned to ponds as unsaleable.

After the minnows are graded, the next step is to determine the weight of 1,000 minnows. Since counting damages the minnows and is too time consuming, minnows are weighed for sale. To determine how much 1,000 minnows of a specific grade weigh, weigh out 1 pound of minnows and then count the number of fish in the sample. Use the following formula:

$$\frac{1{,}000}{\text{fish in sample}} \times \text{weight of sample} = \text{pounds per } 1{,}000$$

If grading has not been done or "pond run" minnows are being sold, several samples should be counted. This will help insure that the retailer gets all the minnows he has bought. He resells at a fixed price per fish; therefore, an accurate count is essential.

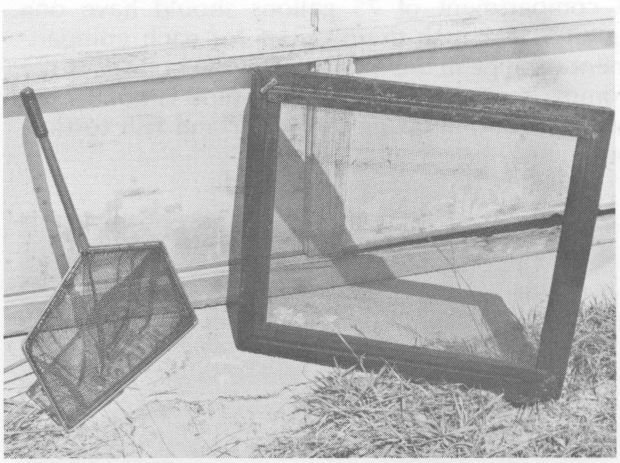


Fig. 11. Dip net and blocking screen.

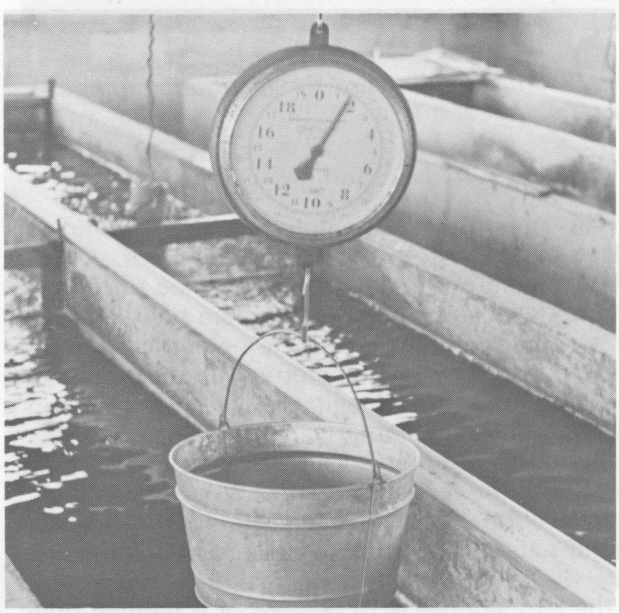


Fig. 12. Typical spring balance for weighing fish.

Hauling

Before transport, baitfish should receive special treatment to condition them. The fish are not fed for 2 days prior to harvest. The effort they expend in seeking food during these 2 days tends to toughen them. After harvest, they are transferred to the holding unit and are not graded until the following day. By then the digestive tract is cleared of waste. After grading they are ready for transport.

Transport tanks vary in size depending on the size of the transport vehicle. Common materials for construction are plywood, fiberglass, or aluminum. Large transport tanks usually are divided into separate compartments. Each compartment should have one or two agitators, depending on compartment size. The agitators are placed through a hole in the tank cover and the cover is approximately 2 inches above the water surface during transport. A compartment of 75 gallons should have one agitator. A 4-inch drain outlet for each compartment must be in the outer wall at the bottom of the compartment. For unloading, a pipe is connected to the outlet, allowing the water and fish to flow out.

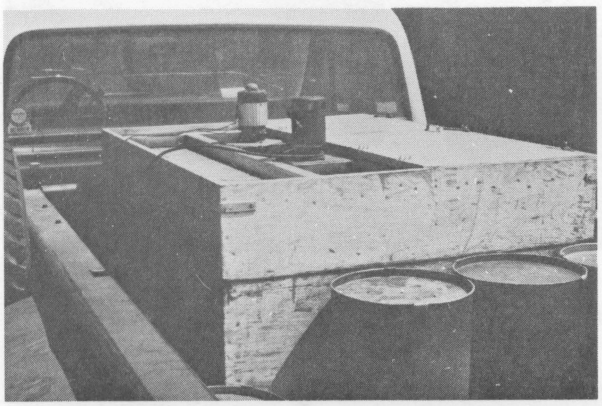


Fig. 13. Small hauling box for distributing minnows to retailers.

The agitators may be powered by the vehicle's electrical system or by another generator. A gasoline generator mounted on an outside surface of the vehicle can be used as the main power source or as a back-up. If the vehicle's electrical system is used, a 100-amp alternator will provide enough current for a dozen agitators. A less common method of oxygenating water in transport tanks is bubbling compressed air or oxygen. This may be used as the primary system or a back-up system.

Fish normally are hauled during the warmer months at a temperature of 65 degrees F. A loading rate of 1 pound of fish per gallon is suggested. If the temperature is 75 degrees or if hauling time is more than 24 hours, only ½ pound of fish should be loaded per gallon. In summer, hauling water is cooled to 65 degrees F by icing. Exchange of wate may be beneficial for hauls of 24 hours or more, but water temperatures of the new and old water should be similar. Also, new water may contain enough chlorine to kill the minnows. Addition of sodium thoisulfate will neutralize the chlorine. One-half ounce of a 50 percent solution of sodium thiosulfate will dechlorinate 100 gallons of water.

For delivering small orders of fish, plastic bags containing oxygen and water are used. Normally, 1 to 2 pounds of fish per gallon of water with a 3:1 ratio of oxygen space to water will give satisfactory results. Always protect the bags of fish from heat or direct sunlight because overheating will kill the fish quickly.

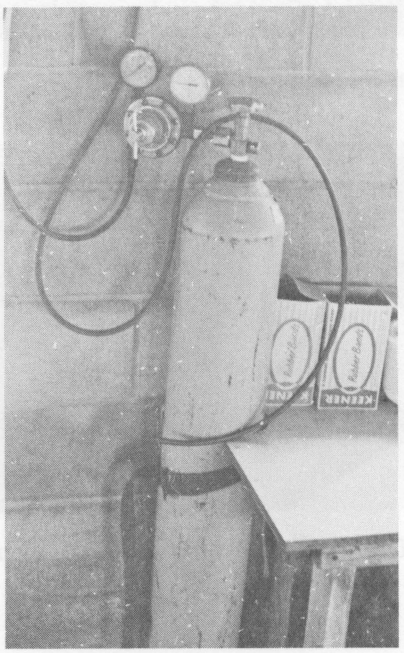


Fig. 14. An oxygen bottle for filling plastic bags for small order delivery.

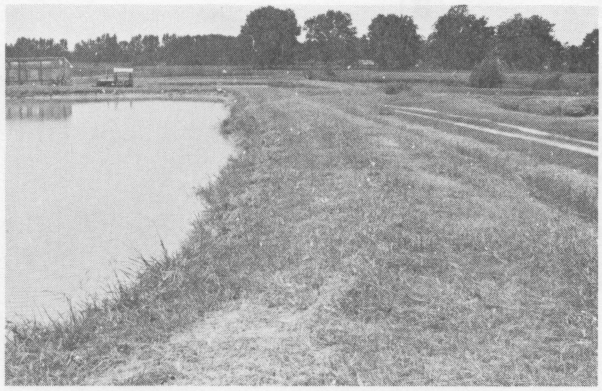
Predator Control

Birds, snakes, frogs, wild fish, crawfish and predatory insects will destroy some of the minnows produced.

Herons and kingfishers commonly become a nuisance on baitfish farms. Eliminating shallow wading areas discourages herons. Since the kingfisher often dives into the water from a perch, eliminating limbs that overhang the pond usually causes kingfishers to move to other feeding areas.

Snakes like cover. Closely mowed banks discourage snake populations and allow better removal of fish. Adult frogs can be controlled by

trapping or shooting. Removing frog egg masses educes the tadpole population.



ig. 15. Well kept levies such as this will discourage snakes.

Wild fish can be removed from filled ponds by application of rotenone during the summer months. If the pond is drained to a small pool, the application of a bag of hydrated lime will kill all fish present. Blocking entry of wild fish into rearing ponds is important. Spillways with 4-foot drops or standpipe drains large enough to handle outlow will prevent wild fish problems. Where creek or lake water is used as a water supply, passing the water through sand filters or fine mesh screen boxes will help prevent fish or egg introductions.

Insects can be controlled by adding 5 gallons of diesel fuel per surface acre of water twice weekly until control is achieved. Apply fuel by pouring or spraying on calm days.

Oxygen Depletion

Pond water obtains its dissolved oxygen from the air and from plant photosynthesis. Of the two sources, the air in contact with the pond surface contributes by far the most dissolved oxygen. Oxygen is used up by fish and plants, and upon decomposition of dead organisms and wastes. Ponds that are overstocked or fed maintain a lower dissolved oxygen level. If an event such as stirring p of excess bottom wastes or sudden death of pond plants occurs the small amount of oxygen in the pond may be totally depleted. When there is an oxygen depletion the minnow culturist must act quickly to save the fish. Pumping is the best course of action. A pump should be set up so that the inlet s placed at a shallow depth and the outlet blows water across the pond. This will set up a current in the pond that continually exposes new water to the air. An outboard motor, run in a fixed position, does a fair job of circulation if it doesn't stir up the bottom. Various other devices such as paddlewheel aerators are also effective in establishing circulation.

Temperature

Fish are cold-blooded animals and, therefore, can't cope with quick changes in or extremes of temperature. At harvest, water temperature may be very high near the bank where the fish are held in a seine. The same may be true in catch basins. Precautions such as adding fresh water or moving the seine to deeper water prevent temperature extremes.

Sudden temperature changes also may occur when fish are moved from the hauling truck to holding vats. Tempering can reduce the detrimental effect of a quick temperature change. In this process, a bucket is used to slowly add water from the vat to the hauling compartment. This allows fish in the compartment to slowly become accustomed to the new temperature and water quality. Another method is to cool the holding tank to the temperature of the hauling tank.

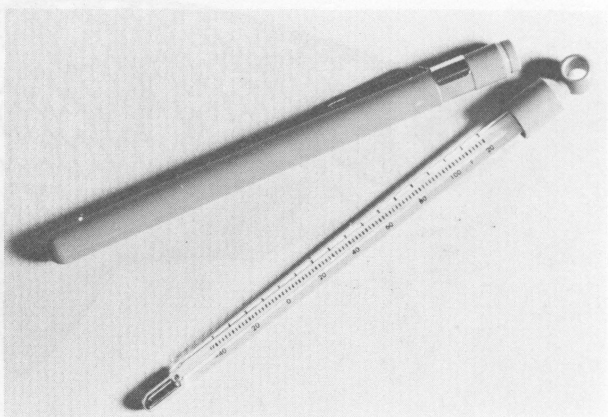


Fig. 16. A pocket thermometer should be owned by all fish culturists.

Diseases

Diseases usually result from poor culture conditions. Crowding, excessive handling and waste build-up cause the fish to become weakened, and may lead to disease outbreaks by several kinds of bacteria and the protozoans *Ichthyobodo, Chilodonella* and *Trichodina*. Treatment includes removal of conditions causing weakening and the application of a chemical to reduce parasite numbers.

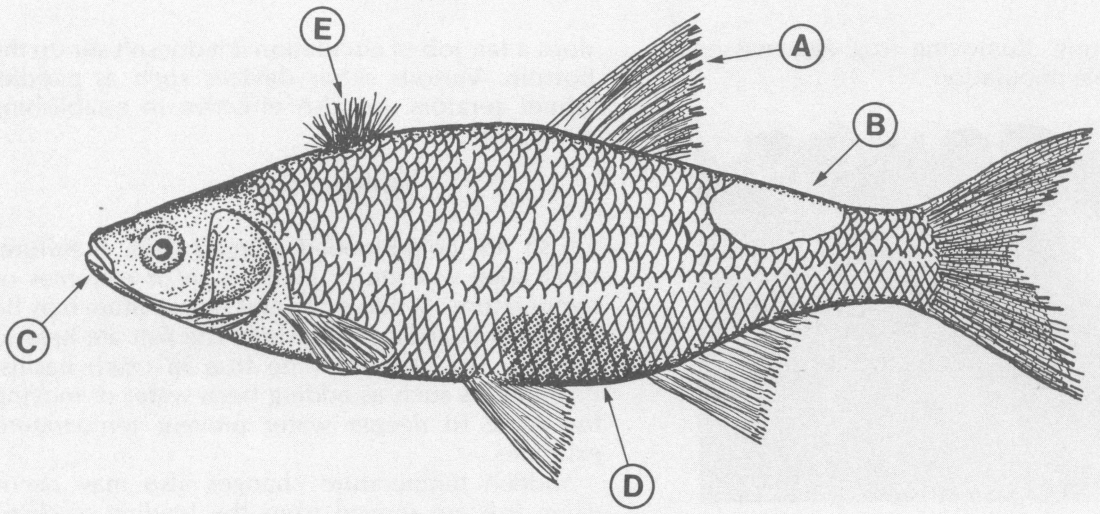


Fig. 17. Signs of bacterial disease in minnows: (a) frayed fins; (b) open sores or discolored areas of body; (c) whitish lips; (d) reddish vent; (e) a fungus patch, cottony in appearance and not a sign of bacterial disease.

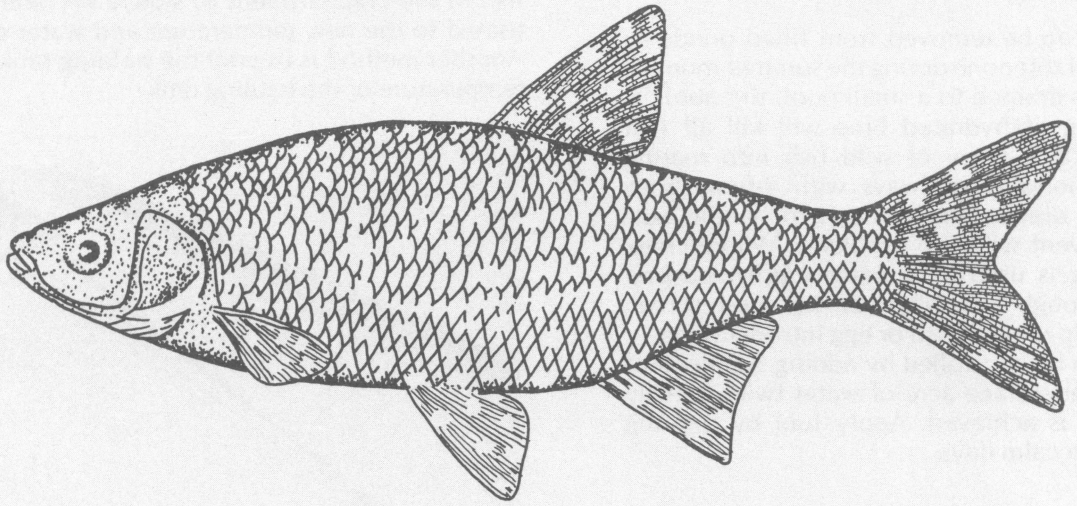


Fig. 18. Ich disease of minnows.

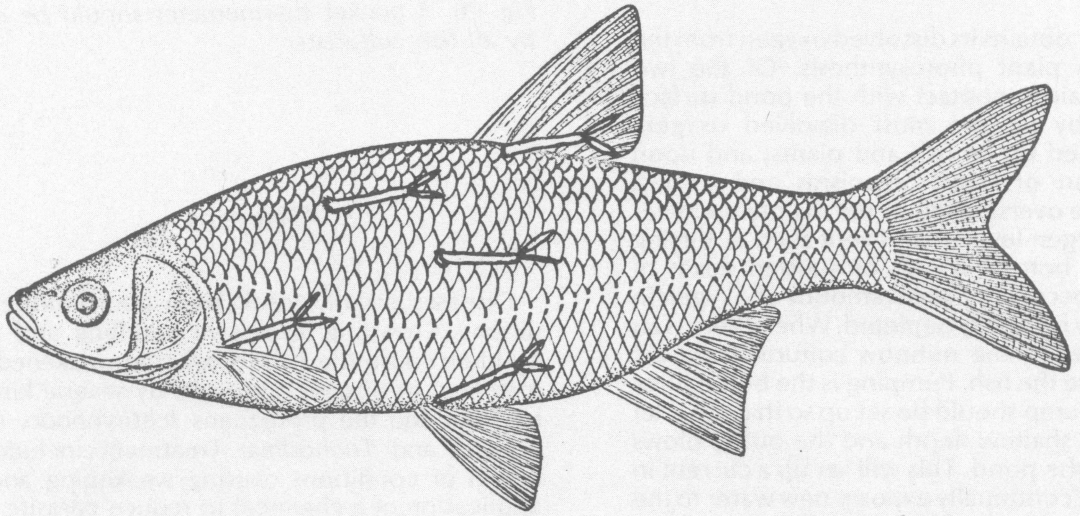


Fig. 19. Anchor parasite.

Several parasites commonly establish in baitfish populations, whether or not the fish are weakened. Included in this group are *Ichthyophthirius,* monogenetic trematodes, *Lernaea* and *Pleistophora.*

Ichthyophthirius or "Ich" is the cause of what is commonly called whitespot disease. This disease may become severe in heavily stocked ponds. Fish become covered with white spots the size of pin heads.

Monogenetic trematodes are very small, wormlike external parasites, which usually can be seen only under a microscope. They move about the surface of the fish or on the gills and cause irritation. They may be removed by dosing the pond water with *Masoten* according to the product label.

Larnaea, commonly called the anchor parasite, is visible to the naked eye and appears as a small splinter protruding from the skin of the fish. The parasite population in a pond may become very large and cause the loss of many baitfish. Anchor parasites may be controlled with *Masoten.*

Pleistophora is a tiny microparasite of the golden shiner's ovaries. When the parasite concentration is heavy it causes partial or complete loss of reproductive ability. Older fishes usually are more heavily parasitized than younger stock. There is no treatment available for this parasite, but minnow culturists may avoid the problem by using younger brood stock.

Aquatic Weeds

A good fertilization schedule will maintain a bloom of algae on a pond and aquatic weed problems usually will not occur. The algal bloom will shade the bottom and utilize nutrients, thus restricting establishment of rooted vegetation.

Aquatic weeds trap minnows as water is drawn down at harvest. They also compete for nutrients with the algal bloom of the pond. A pond with a good algal bloom is more productive than one with weed growth.

It is important to know what kind of weed is present in a weedy pond, because chemical controls differ according to the kind of weed. For plant identification and discussion of various chemical controls consult your county Extension agent or Extension Bulletin B-1018.

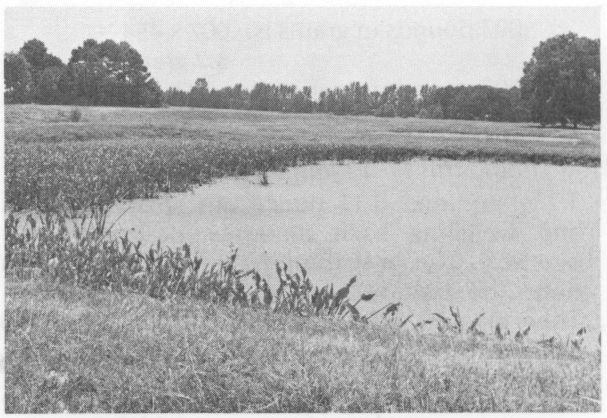


Fig. 20. Aquatic weeds can take over a pond, bind up nutrients needed by fish and interfere with harvest.

Calculating Treatments For Fish Vats, Hauling Tanks and Ponds

What is a ppm?

This is an abbreviation for parts per million. In treatment of baitfish water, 1 ppm means one part treatment chemical per million parts water.

Treating vats and hauling tanks

Example: A vat is 10 feet long and 4 feet wide with a water depth of 3 feet. How much chemical should be added to attain a concentration of 1 ppm?

First calculate the weight of the water in the tank

Water weight = L x W x D x 62.4
10 x 4 x 3 x 62.4 = 7,499 pounds
(L = length, W = width, D = depth, 62.4 pounds/cubic foot)

Next calculate the weight of chemical needed by comparing the known ratio and the unknown ratio.

1 ppm = 1/1,000,000
1/1,000,000 = (N) pounds/7,488 pounds

By cross multiplication the following is obtained:

1,000,000 x (N) = 1 x 7,488
N = 1 x 7,488/1,000,000 = .007 pounds

There are 454 grams in a pound and also 16 ounces in a pound.

.007 pounds in grams is: .007 x 454 = 3.2 grams
.007 pounds in ounces is: .007 x 16 = 0.112 ounce

How should this be added?

3.2 grams and 0.11 ounce are small amounts and weighing such amounts is usually impractical. The best thing to do is to weigh ten times the amount needed and add it to water. Then take 10 percent of this solution and add it to your vat.

For example: Use a measuring pitcher to measure out about 8 ounces. Add 1.1 ounces of chemical to make a solution. Fill to 10 ounces. Add one ounce of the solution to the vat. The result will be that you added 0.11 ounce of chemical to the vat.

The purpose of this procedure is to allow for the initial accurate weighing of the chemical since commonly available scales do not weigh in very low amounts.

What if the chemical to be added is a mixture already?

Example: Suppose the chemical is 25.6 grams active material in a 4 ounce (113 grams) package. In the problem above, 3.2 grams were needed for 1 ppm in the vat.

The amount needed may be calculated by comparing the known ratio to the unknown ratio:

3.2 grams/(N) ounces = 25.6 grams/4 ounces
N = 3.2 x 4/25.6 = 0.5 ounces = amount needed

Another example: A powder is 4.59 percent active ingredient. How much should be added to get the 1 ppm in the above problem?

Since the powder is only 4.59 percent active ingredient the amount of the mixture required equals the actual weight requirement (0.11 ounce) divided by 0.0459.

0.11 ÷ 0.0459 = 2.4 ounces to be added

What if the chemical to be added is formalin?

In this case use formalin as if it were a 100 percent active chemical. Since it is a liquid and is close in weight to water, the concentration may be figured on a volume to volume basis instead of a weight basis shown in the initial problem.

Ponds

The acre-foot method is one of the better ways to estimate weights of chemical needed for pond treatment. An acre-foot is equivalent to a volume of water that is 1 acre in surface area and 1 foot deep. Since an acre-foot of water weighs approximately 2.7 million pounds, the amount of chemical required to make 1 ppm in a acre-foot is 2.7 pounds. By using this relationship the amount of chemical required is caluclated after the pond's acre-footage is estimated.

Example: Treat the following pond with 2 ppm chemical.

The pond is retangular in shape with dimensions of 200 feet by 100 feet (obtained by stepping off). An acre is 43,560 square feet. It is therefore roughly 200 feet by 200 feet. Our pond, then, has slightly less than 1/2-acre surface area. It is 6 feet deep in the deepest end and gradually becomes shallowe to the surface toward the other. We estimate the average depth at 3 feet. To obtain acre footage:

estimated area x estimated average depth = acre-footage
1/2-acre x 3 feet = 1½ acre-foot

To obtain weight of chemical to apply per acre-foot:

number of ppm x 2.7 pounds
2 x 2.7 = 5.4 pounds per acre-foot

To obtain weight of application for the described pond:

5.4 pounds/acre-foot x 1.5 acre-foot = 8.1 pounds

Treating this pond with 8.1 pounds of active ingredient chemical should result in a treatment concentration of 2 ppm.

Surface acreage of ponds may be obtained from construction records or records kept by the Soil Conservation Service. An actual estimation by pacing off is sometimes more accurate because water level fluctuation may affect surface area to a large extent. Using a ruled pole from a boat will often help in estimation of average depth.

Application of chemicals to ponds should be done in a manner that supplies more treatment per surface area to the deeper areas than to th shallow. This will help to avoid unequal distribution of chemicals when a whole pond is to be treated.

Conversion Factor Table

1 cubic foot	=	7.5 gallons	acre = 43,560 square feet = 4,840 square yards
	=	62.4 pounds	acre foot = 43,560 cubic feet = 325,829 gallons =
	=	28,354.6 grams	2.71×10^6 pounds (at approximately 25 to 30 degrees)
1 gallon	=	8.34 pounds	
	=	3785 grams	
1 pound	=	453.6 grams	
	=	16 ounces	
1 ounce	=	28.35 grams	
1 ppm	=	0.0038 grams per gallon	
	=	0.028 grams per cubic foot	
	=	1 pound in 1,000,000 pounds	
	=	1 gram in 1,000,000 grams	

SELECTED REFERENCES

(Available from your county Extension agent)

L-1409, *Anchor Parasites of Fishes.*
B-1081, *Common Aquatic Plants, Identification and Control.*
L-1210, *Ich Disease of Fishes.*
B- 213, *Improve Your Farm Fish Pond.*

Also

Minnow Propagation, Its Problems and Commercial Possibilities, Parks and Wildlife Department, John H. Reagan Building, Austin, Texas.
Production of Bait Minnows in the Southeast, Agricultural Experiment Station, Auburn University, Auburn, Alabama, 1954. Circular 112.
Raising Bait Fishes, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 1956.

ACKNOWLEDGMENTS

Appreciation is expressed to W. C. and L. A. Howe of Howe Brothers Minnow Farm who made helpful suggestions while this bulletin was in preparation. W. G. Klussmann and J. T. Lock helped in reviewing the manuscript and providing other encouragement.

2M-3-81, Reprint Wm2