B-213

Farm Fish Ponds

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TEXAS AGRICULTURAL EXTENSION SERVICE

G. G. Gibson, Director, College Station, Texas

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Farm Fish Ponds

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Fresh water resources of Texas include more than 150,000 farm ponds, many of which are suitable for growing fish. To these may be added about 1,100 lakes five acres or larger in size with a total lake area of over 365,000 acres. There are 12 rivers in Texas with a total length of 7,000 miles, and 39,224 miles in tributaries. If properly managed, this vast pond and lake area, together with the many miles of fresh water streams, will produce much fine meat rich in food value and will add variety to the home meat supply. These acres of water can be made the beauty spots of the farm and thus provide camping, swimming, boating and fishing for the family and friends.

Pond Location

Ponds should be located where the soil will hold water. A clay soil is best. Gravelly sites should not be used. The pond should have a grass sod or woodland watershed, if possible. Cultivated watersheds usually silt up and shorten the life of the pond. Ponds may be located at the head of a draw, but it is unwise to locate the pond in the main bed of a stream where the watershed may prove to be too great during floods. Twenty-five to 50 acres usually furnish enough watershed area for an acre pond. This depends on the annual rainfall of the section. A watershed that can be controlled is best. Should the drainage area prove to be too great for the spillway and dam, control terraces may be used to turn away part of the water entering the pond.

**In Collaboration with Dr. W. B. Davis, head, Department of Wildlife Management and Dr. George K. Reid, assistant professor, fisheries, Texas A. & M. College System.*

Size and Depth of the Pond

A surface acre of water makes a good family-sized fish pond. Two acres or more are even better. Some ponds are too small to grow many pounds of fish.

The depth of the pond should range from shallow to deep water. The pond should be about 2 or 3 feet deep around the margin or water's edge when full. This provides for evaporation during the summer before the pond shrinks in size. This depth will permit fishing at the water's edge and also assist in controlling weeds and mosses around the pond margin. The water area of the pond might be divided one-third shallow water, one-third medium and one-third about 10 to 12 feet or more in depth.

Dam and Spillway

The ground where the levee is to be located should be plowed in the beginning to obtain a seal between the levee and the ground. All roots and plants should be removed. Allow nothing to go into the dam that will decay and weaken it.

The core of the dam should be filled with clay soil removed from the excavation. The clay core should meet with clay at the base of dam. The dam on the water side should have at least 3 feet of slope to every foot in the height of dam, and a two to one slope on the other side.

The crown or top of the dam should be 5 feet wide plus one-fifth of the height of the dam. Thus a dam 15 feet high should have a crown at least 8 feet in width.

The spillway should be wide enough to care for maximum flood water periods. Few fish will escape over wide spillways with shallow overflow. Those that do escape are usually small ones, and the loss of a few small fish will help prevent overstocking. The screening of a properly constructed spillway is not necessary. In fact, such may prove dangerous to the dam during floods if screens become choked down with brush or other trash.

Since all ponds need draining in the course of time, a drain pipe should be provided through the dam at the time of construction. A concrete water seal should be poured around

this pipe in the center of the dam to prevent seepage. Hardware cloth funnels should be placed around the drain pipe to prevent crayfish from burrowing alongside the pipe and causing seepage.

The bottom of the pond at the point where the drain pipe projects into the lake should be the lowest point, often called the "kettle." In draining the pond, fish will be collected to this point. The water level can be lowered for weed control or the pond drained by tilting over the drain stand pipe as shown on pages 14 and 15. The pond should be fenced and livestock watered at a trough below the dam. Water may be piped through the dam and the supply controlled by a float in the trough. For more detail information on the construction and maintenance of farm ponds see Extension bulletin B-222, *Farm Ponds—Their Construction and Maintenance*, available through the Extension Service or at local county agent's offices.

Kinds of Fish

Pond fish may be divided into two groups: (1) "rough" fish such as carp, suckers, shad and golden shiners; (2) sport and pan-fish for meat, such as sunfish, crappie (white perch), bass and catfish (bullhead and channel catfish).

The rough fish sometimes produce more pounds per acre but are not as desirable for food. Fish most commonly accepted for production in farm ponds are the two species of sunfish (bluegill and redear), large mouthed black bass, white and black crappie and channel catfish. Sunfish will produce pounds of excellent meat for food. They also will serve as a forage for other fish at the same time. Thus either bluegill or redear sunfish might be considered the foundation fish to be stocked with bass, crappie or channel catfish.

Fish Population and Food Supply

Two of the most important things in fish pond management are the control of the fish population (kinds and numbers) and the production of food for the fish. The most practical way to provide food for fish is to grow it in the pond where the fish live. This consists of plant and animal life

found in the water. The production of microscopic plant and animal life often referred to as plankton or "bloom" is the first and most important step in the whole food chain. An abundant supply of plankton can be produced in water containing lots of plant food such as all fertilizers contain. This plant food normally finds its way into the pond by being dissolved from the soil as the water flows in from over the watershed. The plant food in the water is largely determined by the fertility of the watershed over which the water flows. Poor land means poor water and poor water means little food for fish. To increase the production of food in the pond, the acres of water are fertilized the same as land is for crops. The same kinds of fertilizers may be used. Therefore, by controlling the fish population with balanced stocking, proper harvesting and by increasing the food supply through a pond fertilization program, many pounds of edible-sized fish can be grown.

Fertilizers for Farm Ponds

Various mixtures of fertilizers may be used to fertilize ponds.

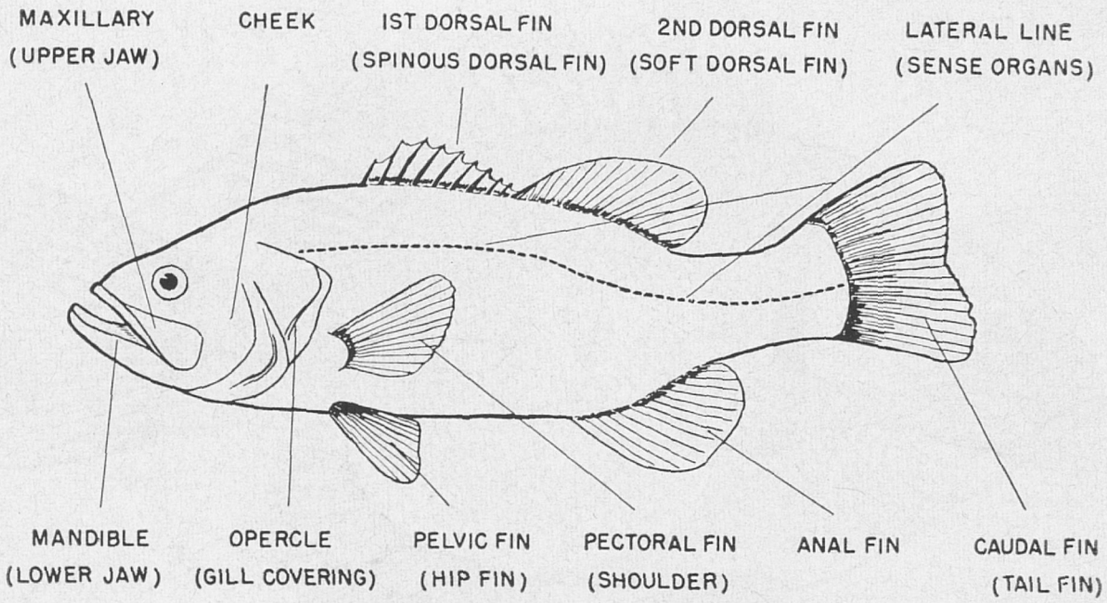
1. 400 pounds cottonseed meal plus 200 pounds 20 percent superphosphate. The 600 pounds of this mixture is the suggested amount for one surface acre of water for one year. Apply as follows: first application — 300 pounds broadcast over pond in early spring; second, third and fourth applications of 100 pounds each at four to six-week intervals.

Soybean meal may be substituted for cottonseed meal, if desired.

2. Five hundred pounds to 800 pounds of high grade commercial fertilizer per surface acre of water per year. Apply as suggested under No. 1.

3. Barnyard manure may be used as a pond fertilizer with 500 pounds per application per acre with two or three applications per season.

Some pond owners begin the fertilizing program in early spring and complete before July 1. Others prefer light application at four to six-week intervals throughout the year. Avoid heavy applications during July and August, especially in ponds heavily infested with submersed pond weeds.



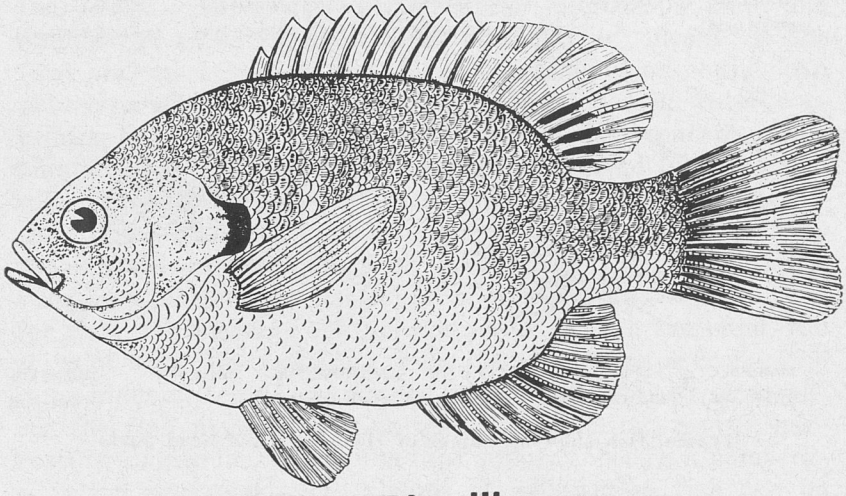
Typical fish showing names of fins, body and head parts.

Stocking Farm Ponds

Ponds should be stocked with the kinds, numbers and combinations of fish suited to the particular body of water. Only a few fingerling fish are necessary to stock an acre of water in the beginning. The right combination of fish will assist in maintaining the proper balance in fish population. Over-populated fish ponds will mean a shortage of food and too many small fish will result. When the pond is too badly out of balance, drain it or remove all fish and start over with the right kinds in balanced proportions.

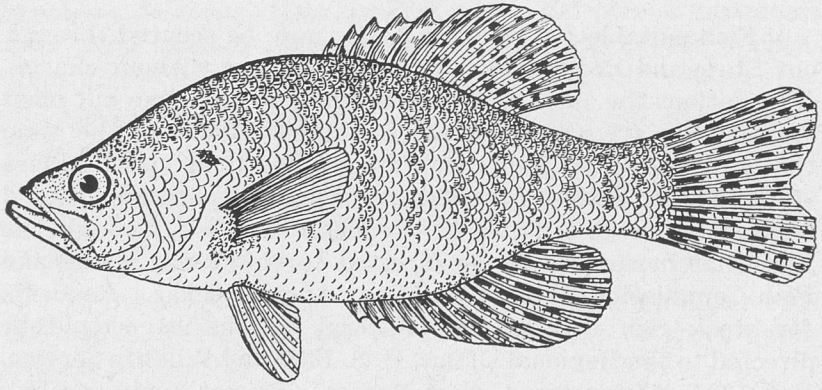
Fish suitable for stocking ponds may be secured through our State and Federal Fish Cultural Stations without charge. Applications for stock fish may be made at any time but most applications are processed after August 1, and at the time the spring-hatched fish reach finger-length in size. Where stock fish are desired for the current year, applications should be made prior to August 1. Requests for fish through the State hatcheries should be directed to the Texas Game and Fish Commission, Walton Building, Austin, Texas. Requests for stock fish through the Federal Hatcheries, should be directed to the Regional Office, U. S. Fish and Wildlife Service, Box 1306, Albuquerque, New Mexico. Do not apply for fish for the same waters through both hatchery systems as a cross check is made and this can only cause delay.

Old ponds containing rough and undesirable fish with a fish population badly out of balance should first have all fish



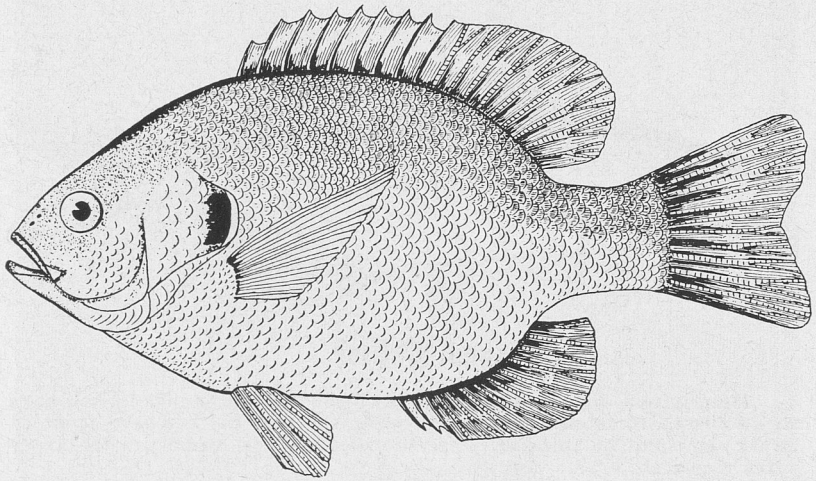
Bluegill

Description—small mouth; gill flap short and blue-black; olive back with light greenish lavender sides; belly sometimes yellow. Size—5 to 10 inches up to 1 pound maximum weight. The green sunfish, sometimes mistaken for bluegill, has a large mouth and bluish-green or emerald markings on the cheeks.



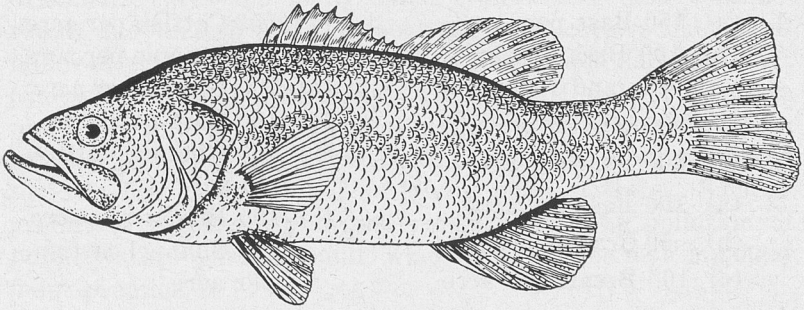
Crappie, or White Perch

Description—Shaped very much like the black crappie. However, black crappie have higher arched backs than white crappie. Silver mottled with green with dark markings on body form vertical bars. Size—average size between 7 to 18 inches long, with usual weight 1 to 2 pounds.



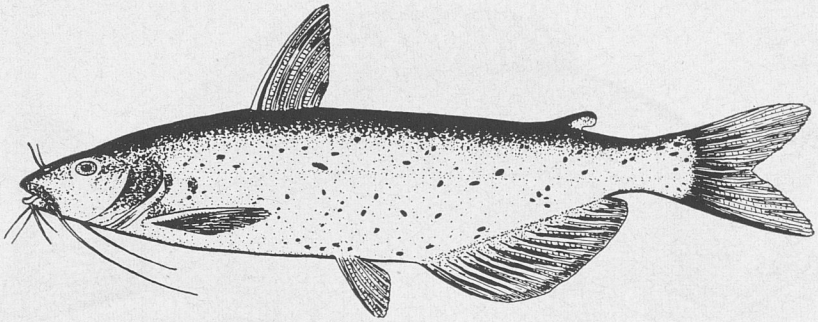
Redear Bream

Description—Males have bright red and females a yellow band behind the opercular spot. Pectoral fins are long and pointed. Size—Up to 12 inches in length and 1¼ pounds.



Large Mouthed Black Bass

Description—very large mouth; elongated body, rather narrow from top to bottom; no scales between the rays of the soft dorsal and anal fins. Smallmouth and spotted bass do have scales on these fins. Size—1 to 7 or 8 pounds, sometimes larger.



Channel Catfish

Description—long and slender with forked tail. Channel catfish have 27 to 29 ray count on the anal fin while the blue catfish have from 30 to 34 ray count on this fin. Size—1 to 10 pounds, usually with larger sizes recorded.

removed prior to restocking with hatchery fish in balanced numbers. A sure way to upset such a balance would be to dump quantities of fish into the pond which are seined from local waters. Undesirable fish often find their way into a pond in this manner.

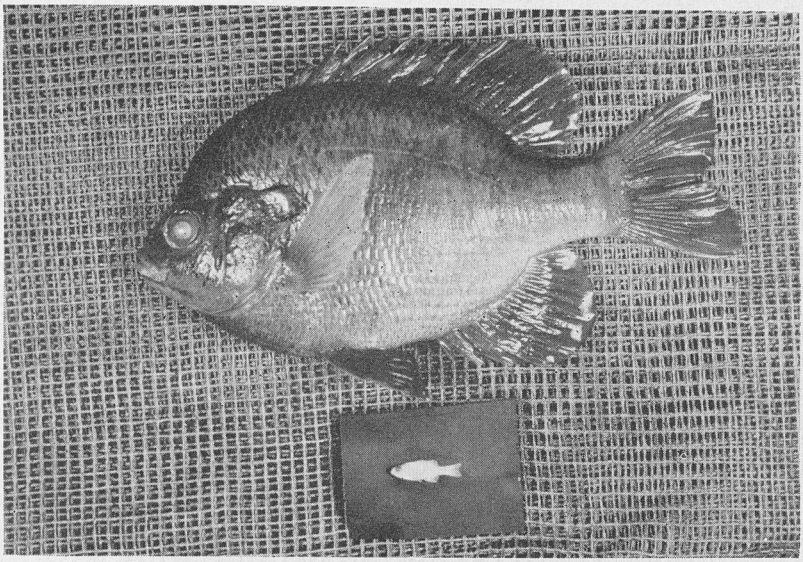
It is wise to stock unfertilized ponds with fewer fish in the beginning. Since fertilized ponds will produce more food, more fish may be included in the initial stocking.

The following combinations and numbers are suggested by both State and Federal Fish Hatchery systems as a guide for each surface acre of water in fertilized ponds:

1. (a) 150 Bass per acre
   (b) 100 Bream (bluegills and redears per acre
2. 200 Bass per acre
3. (a) 100 Bass per acre
   (b) 50 Crappie per acre
   (c) 100 Bream per acre
4. (a) 50 Catfish per acre
   (b) 100 Crappie per acre
   (c) 100 Bream per acre
5. (a) 100 Bass per acre
   (b) 50 Channel catfish per acre
   (c) 100 Bream per acre
   75 Channel catfish per acre

(Use calico in clear, acid water and white crappie in alkaline, muddy water. Use warmouth bass in muddy water and rock bass in clear water.)

Note: Bluegill sunfish may be used instead of redear in the combination, but they are prolific and are apt to overcrowd



Effect of rates of stocking on size of bluegills. Upper—Average-size (4.0 ounces) one year after stocking with 1,500 bluegills per acre. Lower—Average-size (0.02 ounce) one year after stocking with 180,000 bluegills per acre. (Photo courtesy Alabama Experiment Station.)

the pond. Redear are very active on the hook and are becoming more and more popular in this State.

Clearing Ponds of Rough Fish

When the fish population in a pond becomes badly out of balance with too many small stunted fish and contains rough and undesirable fish such as shad, carp, suckers and bullhead catfish, it is often best to remove all fish and start over with a balanced stocking. The use of Derris or rotenone powder is an easy and practical method in removing fish from privately owned ponds. The use of rotenone or other materials toxic to fish is prohibited by law in public waters. Such is permitted in privately owned ponds where the pollution of public waters will not result, when such is done as a management practice.

Use 5 pounds of five percent rotenone powder to each acre foot of water. A surface acre of water averaging 3 feet deep would require 15 pounds of the rotenone powder. Mix the rotenone powder with just enough water to make a thick paste or dough. Then add water until mixture is about the thickness

of cream. Place solution in tubs. With the use of boats pour the solution into the water as boat is rowed or motored along. Start on the windward side of pond and wave action will assist further in covering the pond. All fish killed in this way are perfectly good for food if taken while still fresh. This treatment is harmless to livestock or human beings using the water. The rotenone will have dissipated its strength within seven to 14 days and the pond is ready to be restocked. For large areas, 50-gallon drums with spigot on end may be placed on the side in front end of the boat. Outboard motors will assist further in distribution when the spigot is opened. Emulsifiable rotenone can be distributed by airplane on large jobs. Since rotenone acts slowly in cold weather it is best to treat ponds during late spring or summer.

Fish Shelters and Spawning Aids

Fish shelters can be made with brush, logs or with piles of rocks and boulders. Shelters can be made by anchoring down clumps of brush. Brush will last for a long time under water. The location of all shelters should be remembered as they provide excellent fishing spots. Shelters should be scattered over the pond at various depths with some of them placed in deep water.

Beds of sand and gravel located around the shore make ideal nesting sites for some fish. Gravel nests may also be made with the use of shallow boxes about 3 feet square filled with sand and gravel. The gravel boxes should be placed in the shallow water and up to five feet in depth.

Channel catfish do not spawn in the average farm pond, unless provided with nests. Channel catfish nests may be made by submerging old milk cans, nail kegs or concrete boxes made to serve the purpose. Nail kegs can be made into ideal nests by pouring a small amount of concrete mixture in the kegs and turning them on the side until the concrete sets. The rough, flat surface thus formed is desirable. The milk cans or nail kegs should be staked down around the pond margin at depths of about 2 feet, with the open end toward deep water. The open end should be raised slightly.

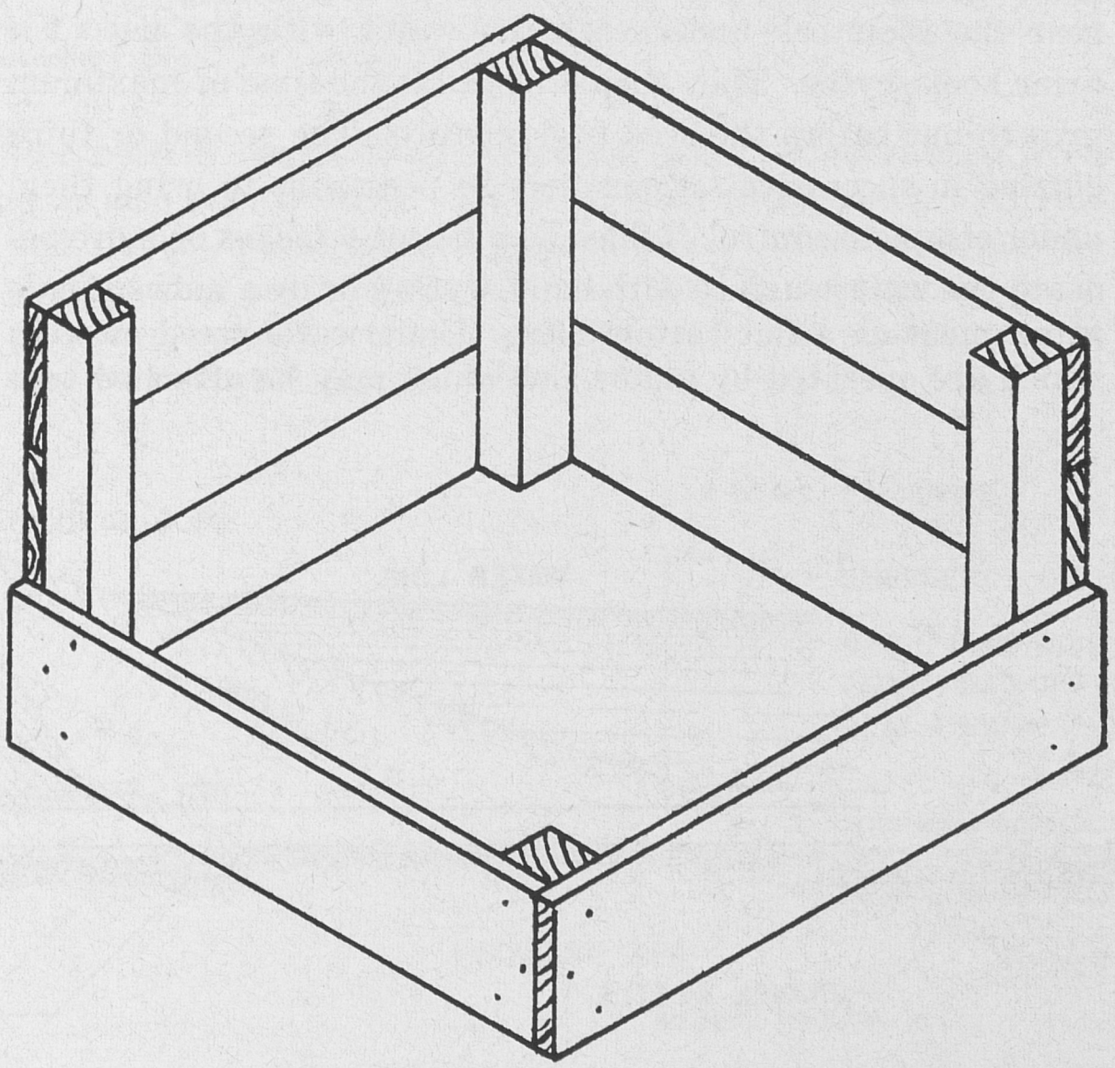
Pond Weed Control

Pond weeds under control assist in providing habitat for the tiny crustaceans and water insect life so valuable as fish food. They also afford some protection to smaller fish. Pond weeds help in clearing up ponds that might otherwise be muddy. However, pond weeds should never be allowed to choke down and take over the pond.

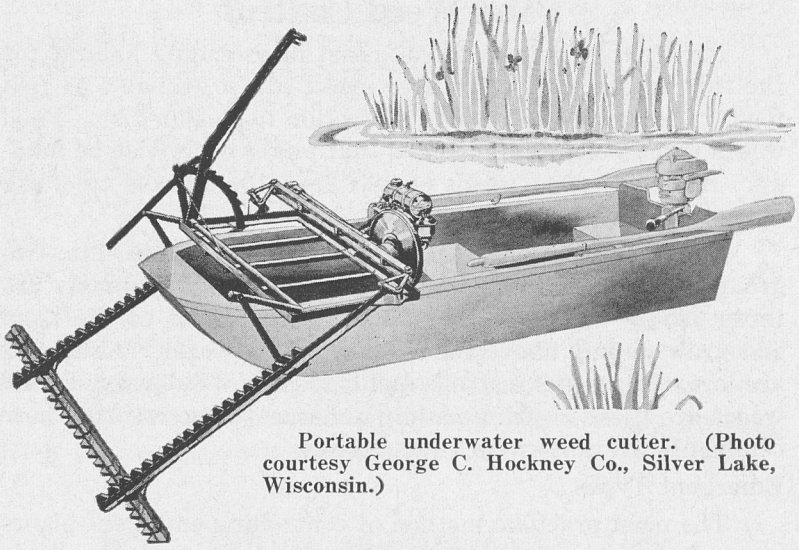
For the purpose here, pond vegetation is divided into two groups—emergent and submersed. The emergent plants are those usually rooted in the shallow bottom area of the pond and grow mainly above the surface of the water. Examples are lotus (lily pads), cattails and bulrushes. Submerged pond weeds are those growing mainly underneath the water. These commonly are known as pond mosses.

Emergent Types

The most practical method of controlling emergent plants on small areas appears to be through manual control methods

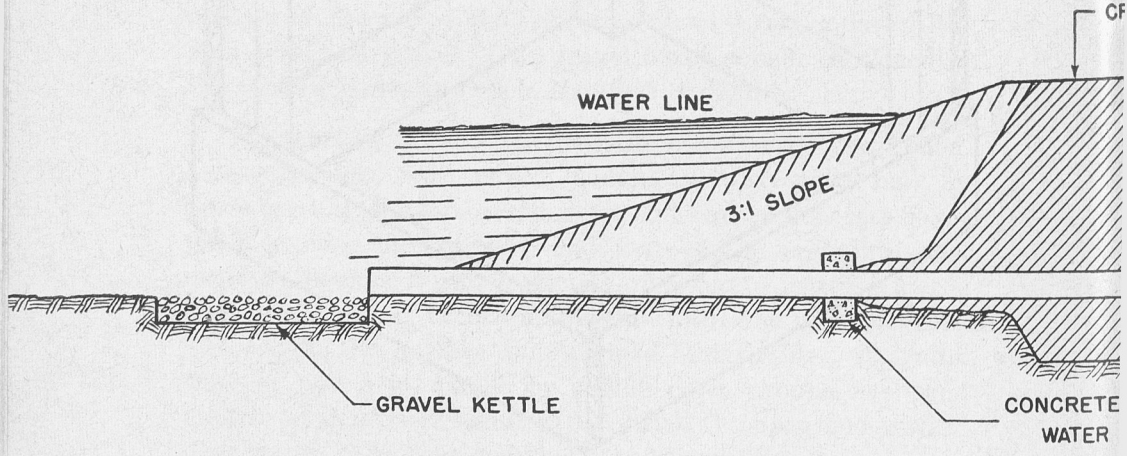


Artificial spawning nest frame without bottom for holding gravel.

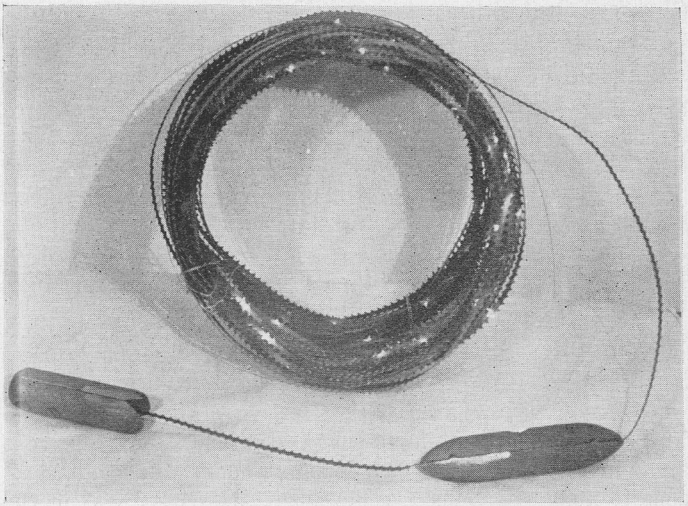


Portable underwater weed cutter. (Photo courtesy George C. Hockney Co., Silver Lake, Wisconsin.)

—cutting and pulling Cattails and bulrushes should be cut near the rootstock underneath the water with the use of a briar hook scythe. They should be cut at the time of maximum growth but before the seed pods mature. The second or third cutting in successive seasons may be necessary to bring them under complete control. Lillies may be cut 6 inches or more beneath the water surface with hand scythes or by a mower blade attachment on a flat bottom boat. Underwater weed mowers which are operated by motor and which may be attached to a

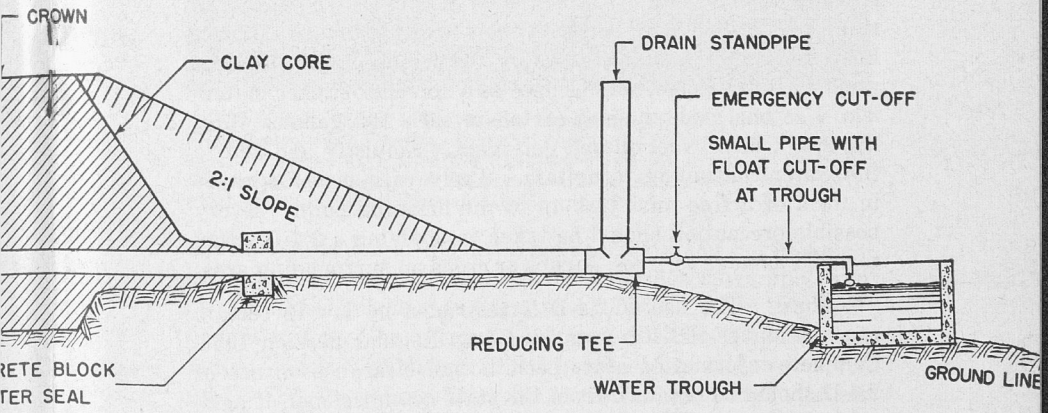


Cross section of dam showing water trough and drain lines. Tur



Fifty-yard length of the Ziemsen Weed Cutting saw. Note end clamp and weight arrangement for dragging saw from a boat. (Photo courtesy Aschert Bros., La Canada, Calif.)

flat bottom boat are now manufactured. Underwater weed saws also are available. Blades of these weed saws are narrow and ribbon-like with teeth on both sides. Weed saws may be purchased in any lengths. This saw may be operated by hand, with two operators working in cross-cut saw fashion, or it may be operated from a boat.



Turn drain stand pipe down to lower water level or to drain the pond.

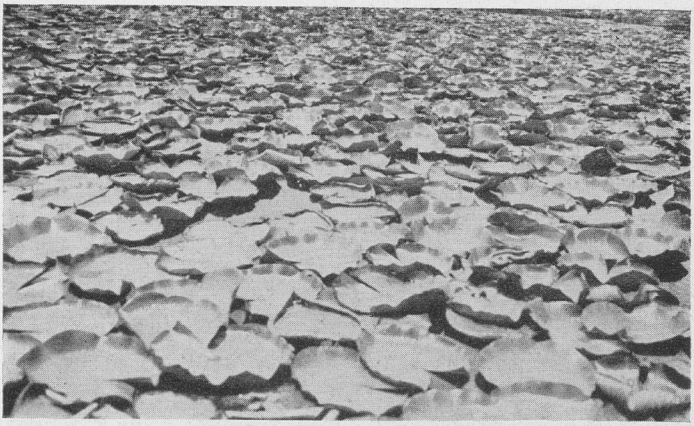
Chemical Control:

Use of chemical sprays for control of emergent pond vegetation is still in the trial stages in this State. The use of 2,4-D and other phenoxyacetic compound sprays is a new method in control of emergent vegetation. Eugene W. Surber, Fishery Research Biologist, U. S. Fish and Wildlife Service, has experimented with the above mentioned compounds. A complete report on this work with recommendations has been published and is available in Fishery Leaflet No. 344 "Control of Aquatic Plants in Ponds and Lakes," U. S. Fish and Wildlife Service, Washington 25, D. C.

Mr. Surber and his co-workers of the Fish and Wildlife Service found that 2,4-D with tributylphosphate as co-solvent and kerosene as a carrier is effective in control of cattails. This spray may be made as follows: 2 pounds of 5 percent 2,4-D in 2 quarts of tributylphosphate added to enough kerosene to make 5 gallons. Apply with a power sprayer in the form of a fine mist just to the dripping point. Apply this spray with caution as an excess amount may prove toxic to the fish.

Good results have been obtained in the control of cattails and lily pads along with other pond weeds of the emergent group including water hyacinth and duckweed with a 2,4-D spray made as follows: 2 quarts 2,4-D and 10 gallons diesel fuel oil added to 90 gallons of water, thus making about 100 gallons. To each 100 gallons add 3 ounces of commercial spreader-sticker liquid. A spreader-sticker is necessary to make the spray adhere better to the slick leaf surface. Household detergent washing powders, commonly used in dishwashing in the home, may be used as a spreader-sticker material. Use one medium-sized carton to each 100 gallons. Mix the 2,4-D, diesel fuel oil and detergent. Emulsify and add to the water continuing to agitate. Apply with power sprayer in form of a fine mist just up to the dripping point. Every possible precaution should be taken in applying a 2,4-D spray to avoid damage to trees, shrubs or crops on surrounding area.

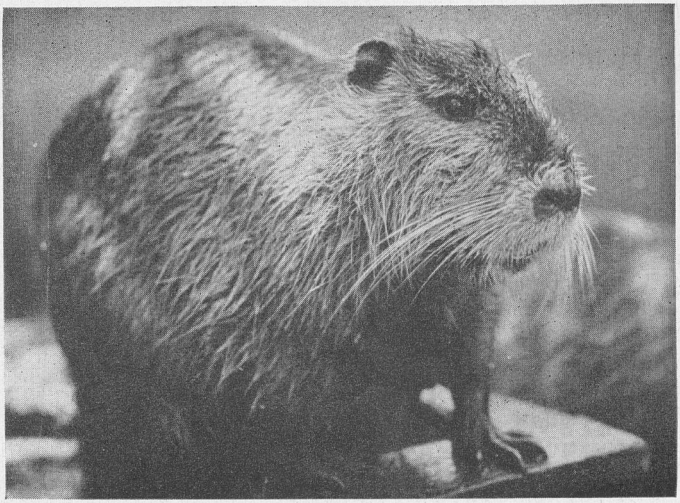
Note: The use of 2,4-D is restricted by law in certain counties under HB-402 Acts 53rd Leg. Regular Session 1953. Complete information as to permits and clearance on use of 2,4-D should be obtained from the state commissioner of agriculture, Austin, Texas.



Dense growth of lilies cover from 8 to 10 acres of this lake's surface. The water varies in depth from 1 to 8 feet.

This same lake, 15 days after spraying, with 99 percent of the lilies destroyed. Floating stems and dead leaves covered the entire area. Nineteen days later the wind had blown the debris to shore and the surface was clean with the exception of a few scattered small leaves which appeared to be transmutations.

Nutria, muskrat-like little animals, native of South America, are now well established in the marshes along the coast in southern Louisiana and Southeast Texas. They are vegetarians and feed upon aquatic vegetation. Plants of the rush family—such as cattails and bulrushes—seem to be preferred food. They have been observed to eradicate first cattails and bulrushes, including cut grass and then turn on the lily pads.



Adult female nutria

Many pond owners and lake clubs who have stocked nutria in their ponds are now in position to trap a surplus for others who desire to stock them. Nutria increase rapidly with an average of more than two litters of three or more young per year. With the spread of nutria in the ponds and lakes of Texas, their full value in controlling emergent pond weeds should be realized soon.

Submersed Types

The use of sodium arsenite weed killer in controlling pond mosses has proved satisfactory. The following steps are suggested in treating ponds with sodium arsenite.

1. Compute volume of the pond in cubic feet. Determine the number of square feet in the surface area of the pond and multiply by the average depth and the product will be the cubic feet of pond volume. To determine the average depth take depth measurements at frequent and regular intervals checkerboarded over the pond. The total of all depth measurements made, divided by the number of depth measurements made, will give an approximate average depth of the pond. The more depth measurements made, the more accurate the average depth figure will be.

2. Remove all livestock from area. Sodium arsenite is poisonous. Keep livestock from the pond area at least 14 days. After two weeks there should be no danger. Livestock could drink the treated water as suggested without harm. However, cattle sometimes are attracted by the salty spray residue left on weeds and grasses around the pond margin and they might eat enough to damage them.

3. Apply sodium arsenite weed killer over the surface of the pond. Sodium arsenite weed killer is manufactured in liquid form in different strengths. Use only the 40 percent or the 4-pound strength (4 pounds arsenious oxide to the gallon). Use 1 gallon of this chemical to each 20,000 to 30,000 cubic feet of pond volume. Mix the chemical with an equal amount of pond water and apply in the form of a coarse spray under low pressure near the surface of the water, using a 3 to 5-gallon capacity compressed air-type sprayer. Avoid any "drift" that might come in contact with the operator. This size sprayer can be carried in the average boat and the mixture applied over the front end of the boat as it is rowed along. Avoid spilling chemical on and around the pond margin. Should any of the spray mixture be spilled, fork up or spade under all vegetation on the spot to protect livestock later. This chemical is caustic. Use rubber gloves and goggles or face masks for protection. Any chemical touching the skin should be washed off immediately.

The above procedure will give between two and four parts arsenious oxide per million parts of water. Fish can tolerate such up to around eight parts per million. The moss should begin to die, break up and float to the surface within three to four days after application. The rapid decay of this vegetation during hot summer months and after the pond has become choked down with moss, may deplete the oxygen supply in the water to the danger point for fish. Should fish show signs of depleted oxygen supply, rapid stirring of the water with outboard motors will help correct this situation. The best time for treating a pond is during April and May, or at the time the submerged vegetation definitely appears but before it chokes down the pond. The above treatment should bring the submerged weeds under control for the year. Consult your county agent for information on latest developments in the use of chemical sprays in the control of pond vegetation.

Pond Seepage Control

How to stop water seepage loss is a problem in certain areas. If the pond is located over substrata of gravel and coarse sand, seepage often occurs to such a degree that the pond will not hold water. Newly constructed ponds having a gradual seepage when first filled, may correct themselves as silt has had time to settle and blanket the floor of the pond. Sometimes it is necessary to drain and rework the pond floor.

Bentonite, a soft porous moisture-absorbing mineral clay rock is an excellent product to seal off seepy ponds. (Bentonite products are sold under several trade names in coarsely crushed and powdered form in 100-pound bags, by the ton or car lot.) One hundred to 150 pounds of the bentonite powder will adequately cover 100 to 200 square feet of the pond bottom. When worked into the soil and upon contact with water it swells up to many times its original size and stops seepage by filling in between the soil granules.

Method No. 1

Drain the pond area to be sealed and let dry. Fill all holes and crevices and remove large stones, rocks and roots. Plow or disc to depth of about 6 inches. Level the area and mark off in squares of 200 square feet. Spread evenly over the surface the 100 to 150 pounds of bentonite product on each square and rake or disc in to a depth of 3 to 4 inches. Roll the area several times to pack the surface. The project is ready for flooding again. Local county agents may have additional information that will be of assistance.

Method No. 2

Use this method when it is not practical to drain the pond. Use the crushed form of bentonite and not the powdered form. Spread the coarse particles of bentonite over the surface of the water at rate of ½ to 1½ pounds per square foot of surface. If the most pervious area is known, treat it first at the maximum rate. As the particles settle to the bottom a gel is formed which finds its way into the crevices to seal them off. In this way it may not be necessary to treat the entire floor of the pond.

Clearing Muddy Ponds

The first step in the production of food for fish in a pond is the production of an abundant supply of plankton or "bloom." This plankton is made up of microscopic plants and animal life and it is the first link in the food chain for the fish. It is necessary that sunlight penetrate the water surface in order to grow an abundant supply of "bloom." Turbidity shuts out sunlight and reduces the crop of plankton in muddy waters.

Ponds having watersheds of barren clay soil or cultivated fields often develop high turbidity due to silt with the finer clay particles remaining in suspension. The first step would be to remove the cause by diverting run-off from such areas with diversion terraces. Wave action against clay dams that have not been riprapped with rock may also cause trouble. Correct the cause, if possible, as the first step.

Good results have been reported by county agents on some colloidal clay suspensions by treating the pond with hydrated lime at rate of 20 pounds to each acre foot of water. In other instances good results have been obtained by treating ponds with aluminum potassium sulphate (commercial alum crystals) at rate of 15 pounds per acre foot of water.

Agricultural gypsum, spread over the surface of murky ponds at rate of 60 to 75 pounds per acre foot of water, has given very good results in clearing up the water. Boats may be used on small areas for spreading but airplanes might be used to advantage on larger ponds and lakes. Many lumber yards now carry agricultural gypsum.

Dr. W. H. Irwin, Oklahoma A. and M. College, Stillwater, Oklahoma, has done considerable research on methods of clearing up muddy ponds in that State. His observations and experiments concerning precipitation of colloidal soil particles from impounded waters of central Oklahoma revealed the following information:

1. Ponds receiving run-off water from sizeable feeding lots or barnyards supplied with considerable manure and urea come to have clear water year after year except for short periods during and following heavy rains.

2. Reservoirs in whose water submerged higher aquatic plants become well established during the period of clear water remain clear in like manner year after year.

3. A lake whose water continued to clear year after year for 29 years became turbid and remained so when its well established submerged aquatic plants were removed.

4. Impoundments to which considerable vegetation was added became clear in four to 14 days after treatment.

5. Waters to which manure was added became clear shortly after treatment.

6. Ponds which received regular treatments of commercial fertilizers containing superphosphate either partially or completely cleared. All ponds thusly fertilized for two years, had clear water the second year.

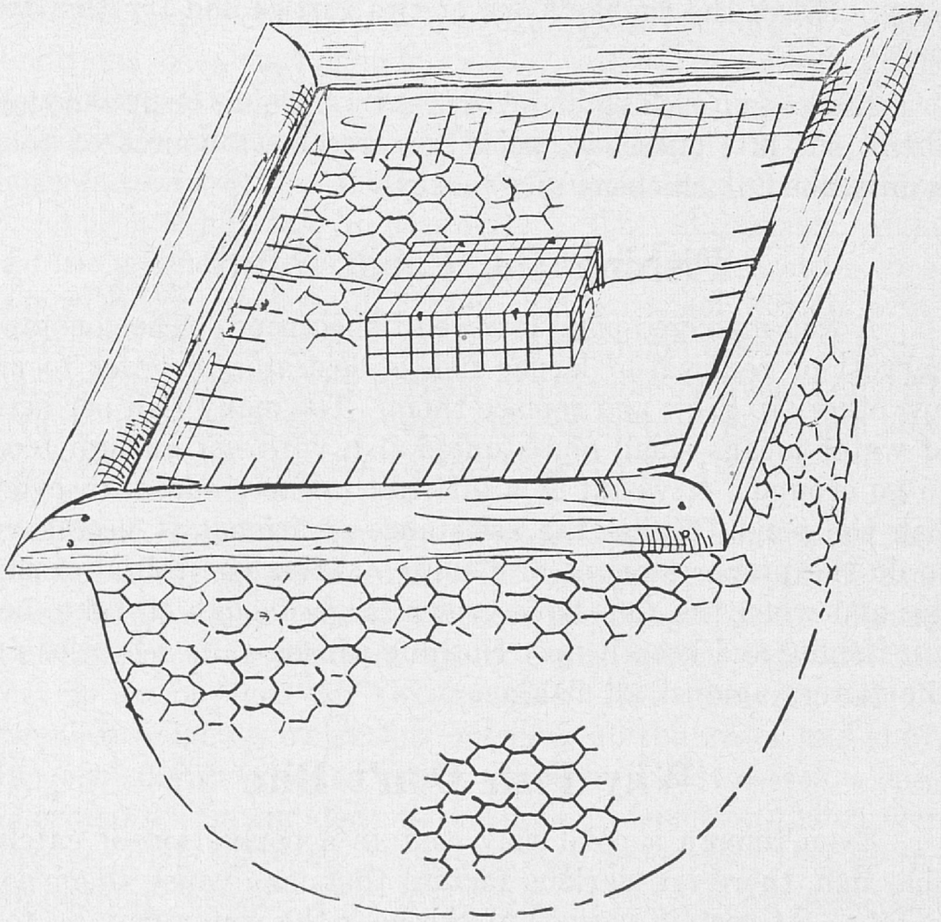
From the above it appears that a fertilizing program where barnyard manure or commercial fertilizer is used, in addition to production of more food for fish, also will assist in clearing up turbid waters. Also, the dumping of quantities of mowed vegetation into ponds is a practical means of clearing up turbidity. Such would also have a fertilizing value. Green vegetation is most affective. The value of semicured and cured vegetation would follow next in order.

Turtle Control

Turtles are found in all the fresh waters of Texas. They serve as scavengers and assist in destroying pond weeds. The young turtles are sometimes taken as food by bass. Turtles do little damage to fish eggs since the parent fish are excellent defenders of their nests. However, most pond owners do not want to raise turtles, and prefer that they be kept under control in their fish ponds.

Turtles can be controlled, but it is almost impossible to keep a pond or lake entirely free of them since they travel overland from one body of water to another. Where turtle control is desired, a simple homemade raft-type trap is suggested. One or two traps will serve the average farm pond. A series of traps may be required to control the turtles in a section of creek or stream.

Follow these steps for construction of a turtle trap: Four pieces of split logs, each about 4 feet long, are nailed together to form a rectangular raft. The logs are split in half. Light



timber is desired so that the trap will float high enough in the water. The guards which prevent the turtles from crawling out of the trap consist of 16-penny nails driven through pieces of 1″ x 4″s or 1″ x 6″s. The nails should be driven through the pieces before they are nailed to the logs. Drill holes in the boards slightly smaller than the nails so as to avoid splitting the boards. The nails are to be about 2 inches apart. They are set to slope slightly downward.

A sack about 3 feet deep is made of 1-inch mesh poultry netting, which is stapled or nailed to the log raft. Should the whole trap become so heavy that it does not float high enough in the water it may be buoyed up by tying empty corked jugs or bottles, or emptying sealed tin cans to it.

The trap may be set afloat or it may be anchored or staked at a location. Place bait in a basket made of hardware cloth and swing bait basket near center of trap and just underneath surface. Empty the catch and renew bait as often as neces-

sary. Break the shells of one or two turtles and try this for bait.

Dispose of each catch of turtles by burning or by burying them in a pit; otherwise such may become a source of contamination for chickens and turkeys.

Fishing the Farm Pond

A well-managed pond is a well-fished pond. The constant harvest or removal of larger fish is desirable in order to allow others to grow and replace them. Too many fish per acre of water means small and stunted fish with not enough food to go around. It would be a difficult matter indeed, to overfish the pond. Enlist the assistance of friends if necessary to do the proper amount of fishing. After the initial stocking and when the fish have grown large enough to take, begin fishing and keep it up. Nothing can be gained by closing the waters against all fishing.

Why Fish Don't Bite

Even though a pond may contain a population of catchable fish, there are various factors that may cause them not to bite. At certain periods of the year the water may be too warm or too cold as both extremes seem to retard the activity of the fish and the amount of food they need. During early spring, before the spawning of young forage fish, and before the rise in the aquatic insect food supply, there is apt to be a food shortage. As a result fish bite. After the young fish and insect life become more abundant, biting lets up, due to more adequate food supply. As this abundant food supply is gradually depleted, the warm-weather food needs slacken until early fall. Then, cooler weather again increases activity and need for more food at a time when there is less natural food supply. By fall the spring-hatched food fish are thinned out and the other fish are larger and require more food. Thus, they start biting again. The presence or absence of food fishes seem to be a definite factor as well as temperature.

Why Fish Die

Fish may die naturally of old age but such could be suspected of an occasional individual and not of a mass die-off.

Fish sometimes die in mass because of one or more of several conditions—depleted oxygen supply, parasites or poison. Depleted oxygen supply in the water during hot summer months is the most common cause. The oxygen supply in the water depends on two main factors—wave action and the presence of aquatic vegetation in the water. The microscopic algae and the submerged pond mosses in their normal growing process with the aid of sunlight take up the carbon dioxide in the water and release oxygen necessary for maintaining fish life. During the calm, cloudy periods in extreme hot weather with little or no wave action or adequate sunlight, the oxygen supply may become depleted to the point where fish die.

Rapid decay of masses of pond vegetation during hot weather often causes trouble. The free oxygen supply is used up in the decaying process often to the danger point. Heavy applications of fertilizer in weedy ponds during July and August is discouraged for this reason. The fertilizer rapidly stimulates algae growth thus murking up the water and shutting out sunlight needed to sustain submerged mosses. They consequently die and decompose further, depleting the oxygen supply. Fish suffering from shortage of oxygen rise to the top gasping for air. They often drift to the shallow areas and sometimes leap out around the pond margin in their struggle to survive. Such a condition may last for 48 to 72 hours or more before correcting itself through wave action or otherwise.

The rapid stirring of the water with outboard motors is suggested to assist in correcting such situations, but often the damage is already done before the trouble is observed. The pond fertilizing program should be started in the spring, before extreme hot weather and before the advanced growth of pond mosses. A pond was observed where the owner delayed the application of fertilizer until July. He dumped in the entire amount for the year and killed all the fish. The pond also should be protected from pollution by excessive drainage from barnlots, and the pollution from oil or chemical wastes.

One of the most common parasites is the yellow grub which sometimes becomes imbeded in the flesh of bass and some of the other fishes. The life cycle of the yellow grub is about as follows: The blue heron, kingfisher and other

water birds are the most common hosts instrumental in transplanting the parasite to ponds. The adult stage of the grub is usually found in the inner mouth, throat or body cavity of these birds. The eggs from the adult worms are dropped through the body wastes of the birds into the pond. The eggs hatch out and the tiny larvae swim about in the water. The next intermediate host is usually snails. The larvae emerge from the snails as free-swimmers and fish become contaminated in this way. The water birds eat the fish, and so on around the cycle.

There are other internal parasites that infest the intestines, liver and body cavity organs of the fish. These may be grouped into four classes: Threadworm or nematodes, spiny-headed worms, tapeworms and flukes. Fortunately, none of these parasites which infest the fish in this country are harmful to man. It is obvious that from the life cycle of these parasites that it is a difficult matter to prevent a pond from infestation. There seems to be no cure for such situations. However, draining the pond and letting it stand dry for several months will help.

Fish die-off is sometimes caused by poisons. The use of chemical sprays on cotton and other field crops, sometimes causes trouble. Toxaphene and DDT are both toxic to fish. These poisons usually find their way into the pond by spraying of crops on the immediate watershed and especially so when heavy rains follow within a few days. Where toxaphene is used in grasshopper bait and scattered over the watershed and with heavy rains coming a short time afterward, the pond owner may lose fish. At the present time, we do not know just how long toxaphene and DDT are effective in the water; these chemicals are not recommended in the removal of fish prior to restocking.

Raising Fishbait

Minnows

Minnows often are stocked in fish ponds as food or forage for the other fish. Minnows also are valuable as bait fish. They can be raised by the thousands in small ponds where the pond is used exclusively for minnows.

KINDS Most popular bait minnows in Texas are the golden shiner and the fathead, sometimes called blackhead minnows.

The golden shiners are colorful and easily raised, but are soft and not as tough and hardy on the hook as some of the other minnows. Golden shiner stock minnows are available through local dealers or they may be obtained through the Texas Game and Fish Commission, Walton Building, Austin, Texas.

The fathead minnow is also a very popular minnow in Texas and brood stock of these minnows is available through commercial minnow growers. This minnow is exceptionally hardy but lacks the coloration of the golden shiner.

THE POND There is no particular size or shape for minnow ponds. They may range in size from 20 to 30 feet wide and 75 feet long up to ¼ acre or more. The number of minnows produced vary with the size of the pond. A series of small ponds is more desirable than one large pond. Such a series may be arranged so that the water supply can be fed to all ponds in the system. Each pond should be provided with a cutoff should disease break out in a particular pond. This would assist in checking the spread to the other ponds in the system. The pond should have a depth of about 1 foot at the shallow end and slope to a depth of 4 or 5 feet at the other end. All inlets and overflow pipes should be screened to prevent other fish from entering the pond.

A permanent water supply is important. For this reason springs or wells usually afford a desirable source. The minnow ponds may be located on the watershed of spring branches and the water piped from upstream by gravity flow. A water supply to keep the water level constant is all that is needed. Any excess should be bypassed and not allowed to flow through the ponds.

The pond should be stocked with only one kind of minnow at the rate of 200 to 400 minnows per ¼ acre of water. There is danger of including off-type minnows and the young of other fish when brood stock is taken from local waters. Exercise every possible precaution to avoid this.

FOOD Minnows feed upon the microscopic plant and animal life, which together, are known as plankton. The plankton growth may be increased by fertilizing the pond. Small quantities of cow or sheep manure at the rate of one bushel

to ¼ acre pond may be applied at 10-day intervals. The minnows may be fed shrimp meal, cottonseed meal, soybean meal, fishmeal, shorts, bran, tankage or dried skim milk. A mixture of some of these may be made into a mash, dried and then ground for broadcasting over the pond.

SPAWNING Water plants are necessary for vegetation-spawning minnows such as the golden shiner. They deposit their eggs over the vegetation. Artificial spawning mats may be made of bundles of straw or fine roots but aquatic vegetation is preferable. The pond weeds should be kept under control and not be allowed to take more than one fourth of the pond area.

Fathead minnows prefer to lay their eggs on the underside of rocks, boards or beneath large roots. They sometimes spawn in the deeper water on trash if preferred locations are not present. Spawning boards can be provided easily around the pond margin. More details on the raising of minnows is given in Extension leaflet 212, *"Raising Minnows."*

Earthworms

Thousands of English red wiggler worms can be raised with little trouble and expense in an earthworm bed, or they may be raised commercially for wholesale and retail trade. Worm beds may range in size from an ordinary washtub to beds of larger dimensions, depending on the number of worms needed. Oil drums cut in half are good. Drainage should be provided by cutting a 2-inch hole in the bottom of the tub and the opening covered with a patch of fine copper screen wire. Large rectangular beds may be made of lumber or concrete. Concrete beds may be built entirely above ground or partially below the ground surface. The floor of the concrete bed may be made of coarse, porous concrete to provide drainage or a screened outlet should be provided. For further details see Extension Service leaflet 196, *Raising Earthworms for Fish Bait.*

Drawings on pages 8, 9 and 10 were made by Harold D. Irby.

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