Improve Your Farm Fish Pond

TEXAS A&M UNIVERSITY
TEXAS AGRICULTURAL EXTENSION SERVICE
J. E. HUTCHISON, DIRECTOR, COLLEGE STATION, TEXAS

Contents

Improve Your

Farm Fish Pond

WALLACE KLUSSMANN
Extension Specialist in Wildlife Conservation
Texas A&M University

FISHING IS ONE OF THE MOST POPULAR FORMS of outdoor recreation in the United States. Surveys show that a fisherman will spend large sums of money and travel far to enjoy his sport, regardless of the number of fish he catches. A properly managed farm pond can provide excellent fishing at home at a reasonable cost.

As a family project, the pond and surrounding area can be made into a beautiful recreational area providing swimming, boating, camping and other activities.

Pond Location

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

Pond Size and Depth

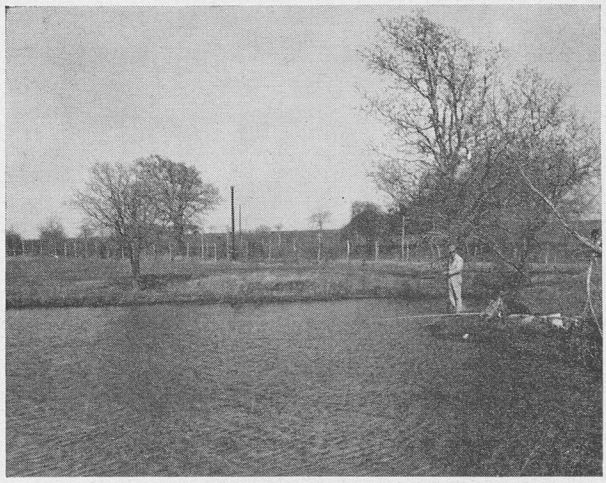
A surface acre of water makes a good family-sized fish pond. Two or 3 acres are even better. Ponds larger than 3 acres are difficult and expensive to manage. Some ponds are too small to grow many pounds of fish. If a pond is less than about one-third of a surface acre in size, fish management is hardly worthwhile.

The depth of the pond should range from shallow to deep. The pond should be about 3 to 5 feet deep around the margin or water's edge when full. This provides for evaporation during the summer. This depth also will permit fishing at the water's edge and assist in controlling weeds, mosquitoes and mosses around the margin of the pond. The water area of the pond might be divided into one-third shallow water, one-third medium and one-third approximately 10 to 12 feet or more in depth.

Dam and Spillway

The ground where the levee will be should be plowed first to obtain a seal between the levee and the ground. Remove roots and plants. Allow nothing in 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 the 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 pond can be made into a family recreational area.

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

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

Since all ponds eventually need draining, a drain pipe should be provided through the dam at construction time. Pour a concrete water seal around this pipe in the center of the dam to prevent seepage. Place hardware cloth funnels 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." When the pond is drained, fish collect at this point. The water level can be lowered for weed control or the pond drained by tilting over the drain stand pipe. Fence the pond and water livestock at a trough below the dam. Water may be piped through the dam and the supply controlled by a float in the trough.

Pond Seepage Control

Stopping water seepage is a problem in certain areas. If the pond is located over substrata of gravel and coarse sand, seepage often is so great that the pond will not hold water. Gradual seepage from new ponds when first filled may cease after silt has had time to settle and blanket the bottom. Sometimes it is necessary to drain and rework the floor of the pond.

Bentonite, a soft, porous, moisture-absorbing mineral clay, is an excellent product to seal 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 cover adequately 100 to 200 square feet of the bottom of the pond. When worked into the soil and upon contact with water, it swells to many times its original size and stops seepage by filling in between the soil granules.

Method No. 1

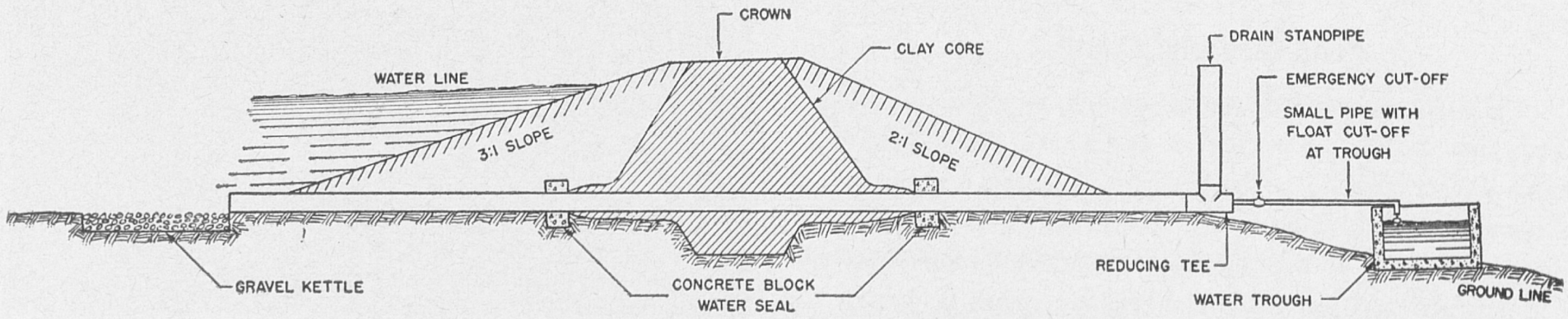
Drain the pond area to be sealed and let it dry. Fill holes and crevices and remove large stones, rocks and roots. Plow or disc to a depth of about 6 inches. Level the area and mark off in squares of 200 square feet. Spread 100 to 150 pounds of bentonite product evenly over the surface of each square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

Method No. 2

When it is not practical to drain the pond, use the crushed form of bentonite. Spread the coarse particles of bentonite over the surface of the water at a 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. It may not be necessary to treat the entire bottom of the pond.

How to Clear Muddy Water

In parts of Texas, muddy pond water is a problem. Muddy or turbid water prevents maximum growth of fish-food. Careful observation normally



Cross section of dam showing water trough and drain lines. Turn drain stand pipe down to lower water level or drain the pond.

will reveal the source of silt causing the turbidity. The first step is to eliminate this source. (See Table 1.)

One of the following treatments can be applied in combination with those in Table 1 if necessary. (Repeat applications may be necessary with either method.)

1. Broadcast agricultural gypsum on the pond surface at the rate of 75 to 100 pounds per acre-foot of water.

2. Broadcast aluminum potassium sulfate (commercial alum crystals) on the pond surface at the rate of 5 to 15 pounds per acre-foot of water.

3. Broadcast hydrated lime on the pond surface at the rate of 20 to 40 pounds per acre-foot of water.

4. Broadcast mowed cuttings of grass or hay on the pond. The rate should be about the amount of grass obtained from an area of land equal to the area of water or about 1 to 2 tons of hay per surface acre of water.

A definite treatment rate cannot be given since the rate depends upon the amount of colloids or clay particles in suspension. This will vary from one pond to another. Begin with the lowest rate and repeat with successive treatments until the water clears. Treatments 1, 2 and 3 are suggested for waters that are highly turbid (person's hand disappears when submersed 3 to 6 inches below the water's surface). Treatment 4 usually will not give the desired results unless the water is only slightly turbid.

Table 1. Common Causes of Muddy Water and Recommended Treatment

Causes	Treatment
Barren clay soil or cultivated fields of the pond watershed.	Divert run-off from fields with terraces, sod remaining watershed.
Wave action against clay dams or pond banks.	Sod banks and dam with grass or line the banks and dam with rocks where wave action occurs.
Livestock wading in shallow water, stirring up mud.	Fence the pond and provide watering trough for livestock.
Rough fish, such as carp, buffalo and shad, stirring up silt.	Use rotenone to remove rough fish from pond.

Desirable Kinds of Fish

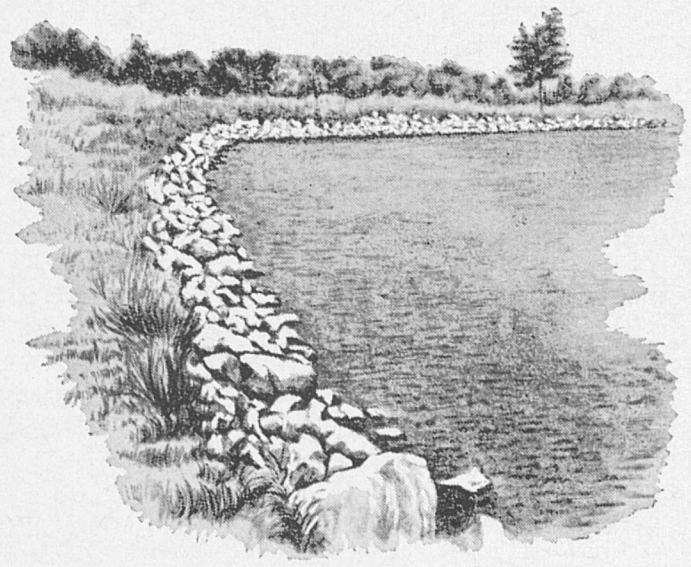
The fish used most commonly for farm pond production are sunfish, largemouth bass and channel catfish. The channel catfish rapidly is becoming the number one warm-water pond fish in Texas. It does well if stocked alone or in combination with bass and/or sunfish. The redear is the most adaptable sunfish for Texas waters. Unlike bluegills, redears usually do not overpopulate a pond in one or two years. Sunfish often are stocked as forage fish, but this practice is not essential. Largemouth bass and channel catfish grow well in properly managed ponds without the aid of other forage species.

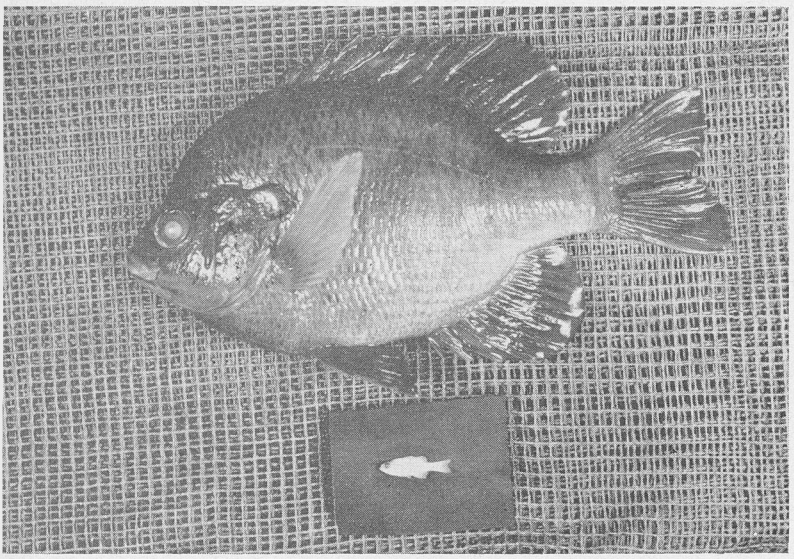
Stocking Farm Ponds

Stock ponds with the kinds, numbers and combinations of fish suited to the particular body of water. The kind of fish you prefer is an important consideration. The proper combination of fish will assist in maintaining the proper balance in the fish population. Overpopulated fish ponds result in a food shortage and too many small fish. When the pond is badly out of balance, drain it or remove all fish and start over with the right kinds in balanced proportions. If a pond is stocked properly when new and then managed properly, restocking should not be necessary.

Fish suitable for stocking ponds may be secured through state and federal fish hatcheries without charge. Stock fish may be applied for at any time, but preferably before April of the year in which you want to stock the pond.

Direct requests for fish through the state hatcheries to the Parks and Wildlife Department, John H. Reagan Building, Austin, Texas. Requests for fish through the federal hatcheries should be directed to the Regional Office, U. S. Fish and Wild-





Effect of rates of stocking on size of bluegills one year after stocking. Larger fish is from a properly stocked pond; smaller fish from an overstocked pond.

life Service, Box 1306, Albuquerque, New Mexico. These agencies provide application cards. Do not apply for fish for the same waters through both hatchery systems, since a cross check is made and this only causes delay.

When filling out a fish application card, always indicate the exact number of surface acres of water in the pond. Fish hatchery personnel use the surface acreage of water as a basis for determining the correct number of fish. The pond owner indicates the type of fish he desires and the amount of water present.

Dumping quantities of fish which have been seined from local waters or releasing bait fish from minnow cans into the pond upsets the desired balance. Stocking ponds with adult fish rather than with fry or fingerlings has proved unsuccessful.

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

The following combinations and number are suggested for fertilized ponds:

Ponds less than ½ acre in surface area

50 channel catfish and 50 redear sunfish

75 channel catfish

Ponds from ½ to 10 acres in surface area

100 largemouth bass and 75 channel catfish per surface acre

100 channel catfish and 100 redear sunfish per surface acre

100 black bass and 100 redear sunfish per surface acre

100 black bass, 100 redear sunfish and 75 channel catfish per surface acre

150 channel catfish per surface acre

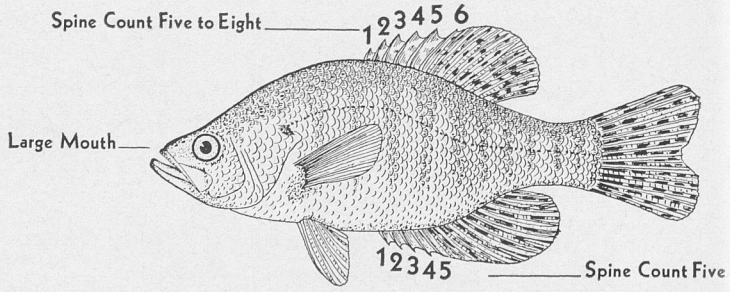
200 black bass per surface acre

Lakes over 10 acres in surface area

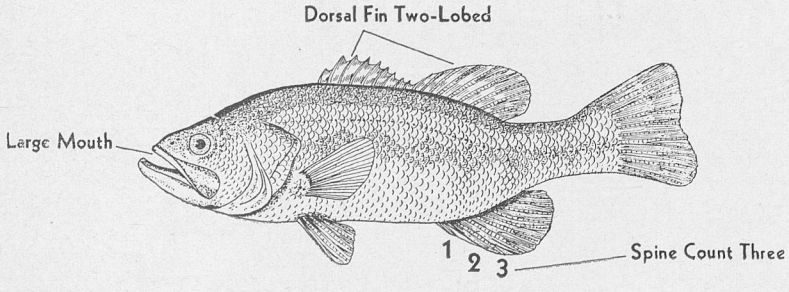
Any stocking ratio listed for the ponds from ½ to 10 surface acres

100 black bass, 100 redear sunfish and 50 crappie per surface acre

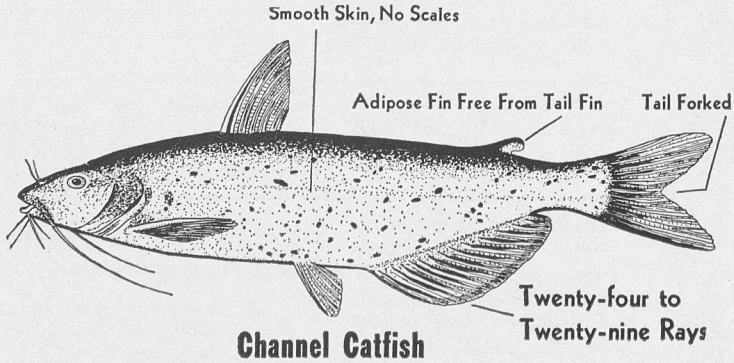
50 channel catfish, 100 crappie and 100 redear sunfish per surface acre



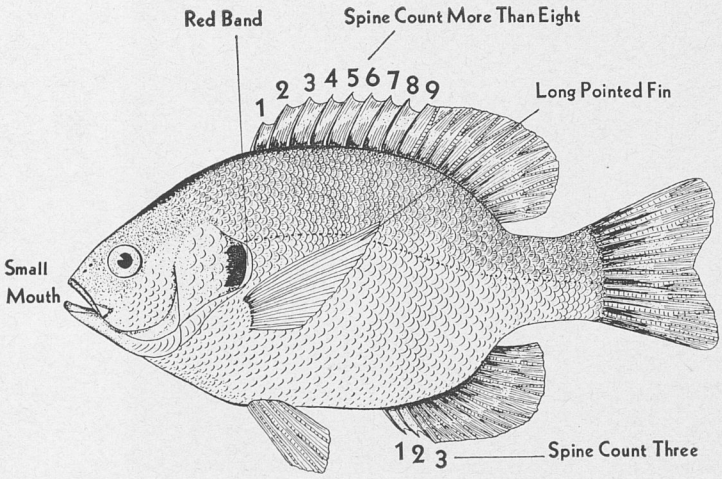
Crappie



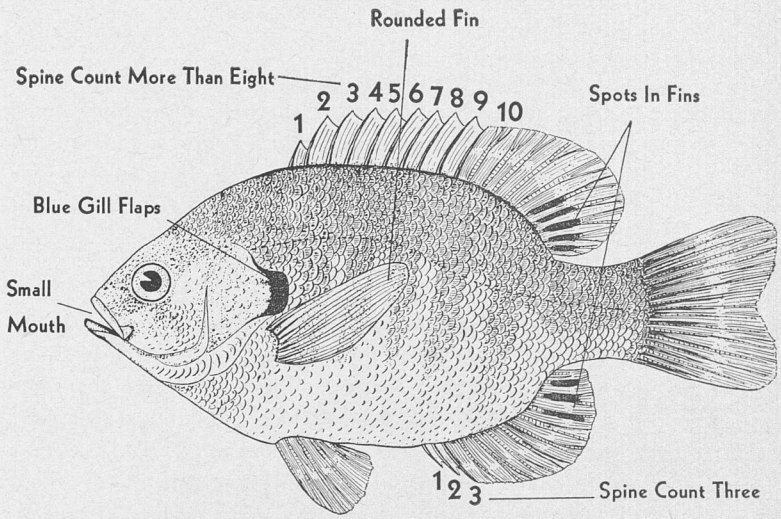
Large-Mouthed Black Bass



Channel Catfish



Redear Sunfish



Bluegill Sunfish

Crappie are prolific and usually overpopulate small ponds rapidly. For that reason, they usually are not recommended for farm ponds. Because bluegill sunfish also are prolific, redear sunfish usually are more desirable.

Fish Food Supply

To produce a maximum number of large, healthy fish in the shortest time, a pond must have an adequate fish food supply throughout the year. Nature's answer to this problem is a food chain which begins with microscopic plant and animal life called plankton or "bloom." Plankton is the food supply for small fish and the next link in the food chain is water insects and other organisms upon which small fish feed. With sufficient food, the small fish develop into large fish or provide an abundant supply of food for larger fish already present.

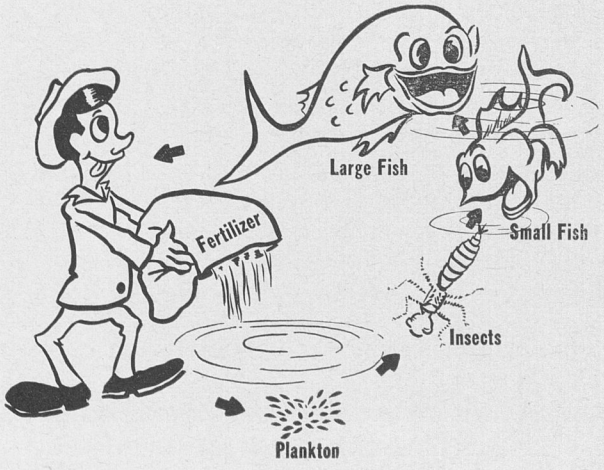
Plankton must have fertile water to be abundant. Water draining into ponds from fertile watersheds sometimes supplies sufficient plant foods for plankton growth. However, ponds usually must be fertilized for maximum fish production just as cropland must be fertilized for maximum crop production.

If the pond is new, often it is wise to begin fertilization before fish are stocked. Thus, an abundant food supply will be available upon delivery of the young fish.

Pond Fertilization

Commercial inorganic fertilizers are used commonly to increase fish production. Large numbers of small farm ponds used for sport fishing have received the major impact of this practice. In more recent years, larger impoundments used for bait and food-fish production also have benefited from fertilization programs.

Occasionally, fertilization programs fail to produce the benefits expected for various reasons. Growths of rooted plants and filamentous algae can decrease the effectiveness of fertilizer and in many cases reduce yields below those expected with no fertilizer. Kill undesirable aquatic plants before beginning a fertilization program. Once they are brought under control, proper fertilization will help keep them controlled. The control is the result of turbidity created by the dense population of plankton organisms. This turbidity inhibits penetration of sunlight and, thereby, shades out many undesirable aquatic plants. This, plus greater fish production, are

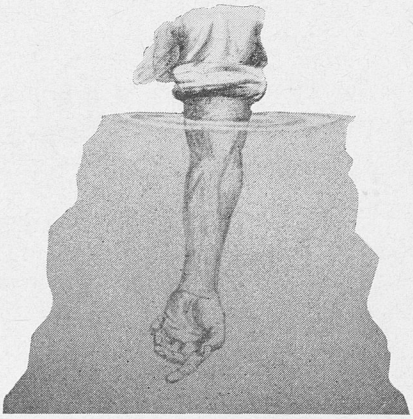


the prime benefits of a proper pond fertilization program.

Many fertilization programs are ineffective because of failure to follow through with applications of fertilizer at the proper time. Once a good plankton bloom has been established, the nutrient level for maintaining the bloom must be regulated. This can be accomplished only by regular additions of needed nutrients to the water.

Phytoplankton (floating microscopic plants) is the starting point in the natural food cycle for fish. The nutrients required by these water plants are the same as those required by plants which grow in soil; namely, nitrogen, phosphorus and potassium. To assure a continuous supply of a minimum amount of these nutrients, applications of fertilizer must be repeated.

The complete solution of the problem of pond fertilization is unknown. The most economical method of producing the most pounds of fish per acre also is debatable. Limited research and the experience of pond owners in Texas indicate that nitrogen and phosphorus are the two most essential elements. Most Texas soils contain adequate potassium to supply the small amount needed by phytoplankton. If in doubt about the potassium content of the soil or water, include a small amount in the fertilizer. The amount of fertilizer needed will vary from pond to pond and from one area of the State to another. Most Texas waters respond to an initial treatment of 100 pounds of 20-20-5 fertilizer per surface acre followed by successive treatments of 20 to 40 pounds per surface acre. Fertilizer, such as 16-20-4, can be substituted if the recommended analysis is not readily available. If the soil contains abundant potassium, use 20-20-0 or 16-20-0.



The Plankton bloom is sufficient if a person's cupped hand disappears when the arm is emersed to elbow depth (about 18 inches).

Placing fertilizer in a floating device allows the nutrients to dissolve directly into the water.

Application of the same fertilizer recommended for surrounding soil may not give optimum plankton production. Experience and research indicate that large amounts of nitrogen and phosphorus are necessary regardless of soil analysis.

Make the initial application in March or April or when the water temperature reaches 60 degrees F. Follow initial application with smaller applications at 2-week intervals until a desirable bloom is attained. A desirable bloom is one that shades out a bright object at approximately 18 inches below the surface. (A common shiny tin can lid attached to the end of a stick can be used to make this determination.) The desired bloom usually appears in 1 to 5 weeks after the initiation of the program. Subsequent applications should be made only as needed to maintain the bloom.

Commercial inorganic fertilizer may be applied by broadcasting over the water surface or by placing whole bags around the edge of the pond. These bags should be slit to allow wave action to distribute the dissolved nutrients. Probably the best method of application is to support the fertilizer near the surface of the water to prevent the rapid tie-up of nutrients in the bottom soil. This can be done by using stationary platforms or floating devices. This method of application allows the nutrients to dissolve slowly into the water and to maintain a more even bloom, often with less fertilizer.

Organic fertilizers, such as barnyard manure, will increase small animal life (zooplankton), but usually it will not increase phytoplankton to the desired level unless very large amounts are used.

Fertilizer can be poured into shallow water.

The fertilization program should cease in most areas of Texas about June 1. It may be continued a few weeks longer in cooler areas of the State. As hot weather approaches, there is the possibility of a fish kill resulting from oxygen deficiencies. Warm water holds less dissolved oxygen than cold water and a heavy plankton bloom can result in reduced oxygen supply. Such fish kills usually result after two or three overcast, windless days. Often the fish are found dead or dying in the early morning hours (about daybreak) when the oxygen supply is usually at its lowest level.

In certain acidic waters of East Texas, it is beneficial to add lime, alone or in combination with fertilizer. Rate of application usually varies from 500 pounds to 2 tons per surface acre. Check the pH (acidity or alkalinity) after each application. A pH of 6 or above is desirable for optimum benefits from fertilization.

Fishing the Pond

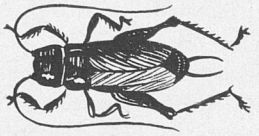
If a pond is not fished heavily, the fish population will rapidly deplete the food supply, resulting in stunted fish. Research studies show that an acre of pond water needs from 300 to 500 man-hours of fishing each year to keep fish production at a maximum.

After a pond has been stocked, begin fishing when each species has reached edible size or sexual maturity. In Texas, this normally takes about 1 year. After the fish have spawned, fish the pond heavily. Make a few drags with a seine in shallow water in June or July. If the fish have spawned successfully, you should catch young fish of each species stocked.

Since sunfish, including redear, tend to overpopulate farm ponds, catch as many as possible. For every bass or catfish removed from the pond, at least 10 to 12 sunfish should be removed. Do not return small sunfish that are caught to the water. Fish for sunfish in their nesting beds throughout the warm weather.

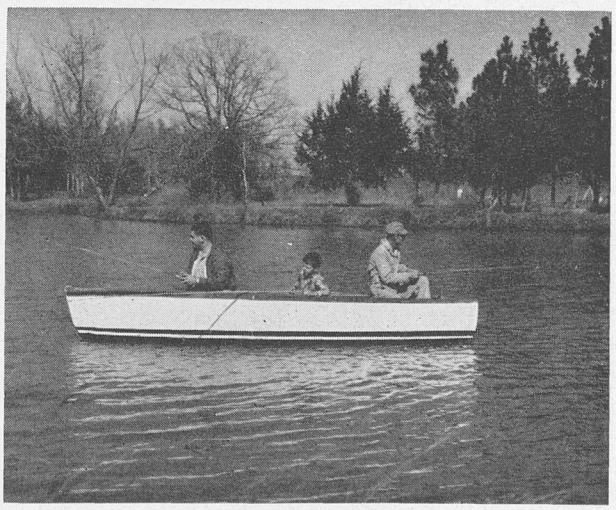
If your family cannot fish the pond as heavily as it should be fished, invite your friends to fish. Each fish removed means more available food for those remaining.

Water temperature, availability of natural food, seasonal activities of fish and skill of the fisherman are a few factors which influence fishing success. Alternating periods of good and poor fishing are to be expected. Even the best fisherman will not always catch fish. Submerged piles of brush concentrate the fish. Crappie and catfish frequently gather in such areas.



BASS

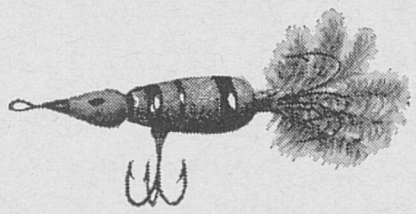
Spring, summer and fall are good seasons for bass fishing. Good fishing periods are early morning, late afternoon and night. Bass usually are not



Fish the pond heavily.

active in cold water during the winter. Minnows, crayfish, frogs, grasshoppers and other insects are excellent live baits for bass.

Deep running artificial baits frequently attract bass in the cooler months when they normally inhabit deeper water. Silver spoons with bucktails or pork rind strips also have been successful.



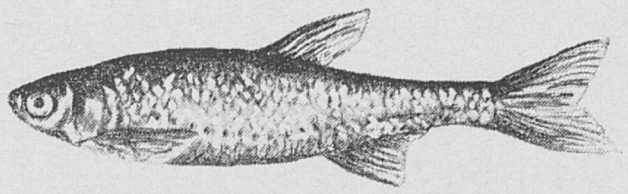
In warmer months, bass usually stay around the edge of the pond feeding in shallow water. Casting with surface lures, shallow-running lures or plastic worms is effective. Most experienced fishermen agree that an artificial bait should be reeled in slowly and allowed to lie still occasionally. Some fishermen suggest the following technique: cast the bait, let it lie motionless for a few seconds and then flip the rod to give the bait a kicking or swimming action; retrieve slowly; stop and flip the rod again. If you fail with one bait, try another.

SUNFISH

Spring and summer usually offer the best action. Excellent live baits include worms, grubs, grasshoppers, small crayfish and crickets. Use a light cane pole with a small hook. Many fishermen prefer using no weight on the line. The bait is flipped out as far as possible and allowed to sink slowly. Movement of the line will indicate when the sunfish has taken the hook.

In warm months, sunfish build nests in shallow water which are easily visible to the fishermen.

Fishing with flyrods, using dry or wet flies, often is effective in the summer.

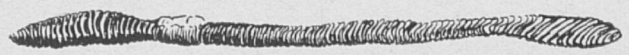


CRAPPIE

Crappie can be caught during most of the year, but with more success in early spring. In the winter, they frequently are caught in deep water; during the warmer months, in shallow water. Early morning and late afternoon seem to be major feeding periods. Crappie normally feed around submerged brush.

Small minnows are the best bait for crappie. Most fishermen use small, sharp hooks and retrieve hooked crappie gently since their mouth parts are tender. Once the fisherman locates the exact area and depth at which crappie are feeding, often it is easy to catch the legal limit of fish.

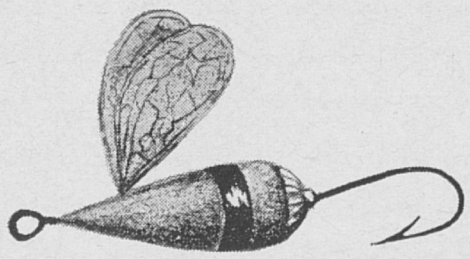
Flys, spinners and strips of pork rind are good fly-casting baits for crappie.



CHANNEL CATFISH

Catfish can be caught the year around. Under certain conditions, they bite during the day but night fishing usually is best.

Fishing methods include the use of trot lines, cane poles and rod and reel. Crayfish, crickets, minnows, worms, grasshoppers, shrimp, chunks of fresh fish, dough-bait and liver are good baits. Catfish normally are caught near the bottom of the pond. Fishing over sand or gravel beds usually is good and deep-running artificial baits sometimes are successful.



Fish Shelters and Spawning Aids

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

Sand and gravel beds 2 to 3 feet in diameter located around the shore in shallow water make ideal nesting sites for some fish. Gravel nests also may be made with shallow boxes about 3 feet square and 4 to 6 inches deep. The boxes should be filled with sand and gravel and placed in shallow water up to 5 feet deep.

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 for this 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 formed is desirable. The milk

cans or nail kegs should be staked around the margin of the pond at depths of 2 to 6 feet, with the open end, slightly raised, toward deep water.

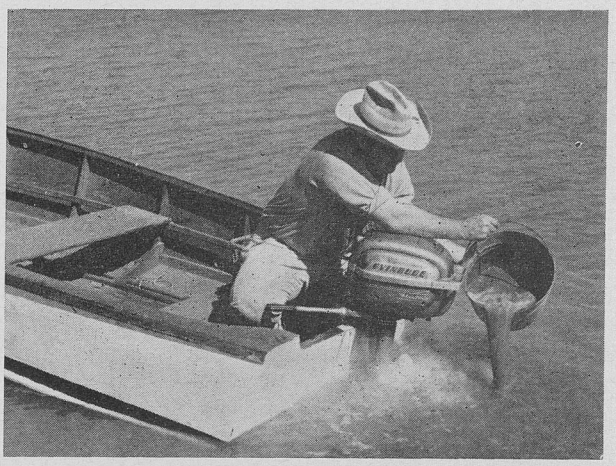
Clearing Ponds of Rough Fish

When the fish population becomes badly out of balance with small, stunted fish and rough and undesirable fish such as shad, carp, suckers and bullhead catfish in a pond, it is often best to remove all fish and start over with a balanced stock. The use of rotenone (Derris) powder is an easy and practical method to remove fish from privately owned ponds. Emulsifiable rotenone also can be used. The use of rotenone or other matreials toxic to fish is permitted in privately owned ponds where the pollution of public waters will not result and when it is done as a management practice.

Use 5 pounds of 5 percent rotenone powder to each acre-foot of water (1 surface acre, 1 foot deep). If the water temperature is well above 65 degrees F., 3 pounds of rotenone per surface acre usually is sufficient. A surface acre of water averaging 3 feet deep equals 3 acre-feet and requires 15 pounds of the rotenone powder. Mix the rotenone powder with enough water to make a thick paste or dough. Then add water until the mixture is about the density of milk. Place solution in tubs. With the use of a boat, pour the solution into the water as the boat is rowed or motored. Begin on the windward side of the pond so that wave action will assist in covering the pond. The entire surface area and the deep water of the pond must be treated with the solution for effective results.

Since rotenone affects only the gills, fish killed by this method may be eaten if cleaned while fresh. This treatment is harmless to livestock or humans using the water. The rotenone will have lost its strength within 7 to 14 days and the pond can be restocked. For large areas, 50-gallon drums with a spigot on the end may be placed on the side at the front of the boat. Outboard motors will assist in distribution when the spigot is opened. Poor results usually occur when ponds are treated with rotenone in cold weather. Treat ponds during late spring or summer when the temperature is 65 degrees F. or higher, and when the water is at its lowest yearly level.

Rotenone usually does not give complete kills of bullhead catfish. In private ponds where populations of bullheads exist, other more toxic chemicals may be necessary. See your local county agricultural agent for alternative controls.



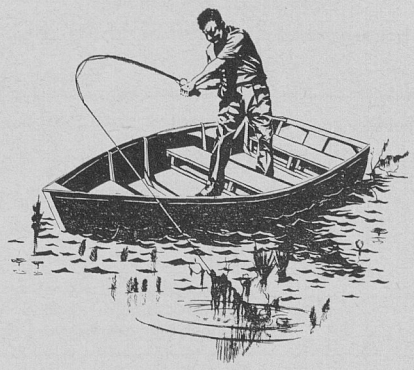
Pouring rotenone solution behind an outboard motor gives good distribution.

Aquatic Plant Control

Aquatic plants in a pond produce oxygen for fish. They provide areas for the production of small aquatic organisms which are important links in the fish-food chain. Plants offer small fish protection from large predatory fish. Certain fish spawn on the roots and leaves of aquatic plants. Decaying plant matter also adds to the fertility of a pond. Certain plants offer food and cover for desirable wildlife, especially waterfowl.

But when aquatic plants become too abundant, partial control is necessary. Dense growths of aquatic plants interfere with boating, fishing and swimming. Small fish then have so much protection that larger fish are unable to feed upon them, which upsets the population balance. Dense growths of aquatic plants and decaying vegetation under certain conditions deplete oxygen in the water. When this occurs, many fish die.

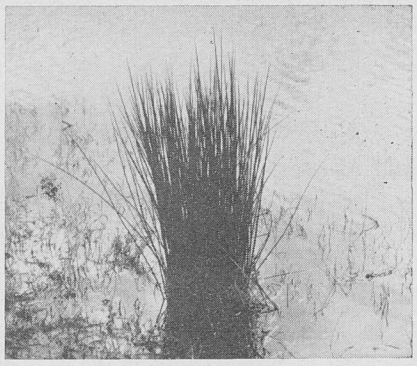
If a pond is constructed without extensive shallow water areas and the pond is fertilized properly, aquatic vegetation probably will not be a serious problem.



Emergent and Floating Vegetation

Emergent vegetation includes cattails, bulrushes and water lilies that normally grow along the margins of a pond in shallow water. Water hyacinths are floating plants. Often manual control, such as by hand, pitchfork or rake, can be used to control certain obnoxious plants if removed as soon as they appear.

Cattails and bulrushes occasionally can be controlled if they are cut at maximum growth before the seed matures. Cut near the rootstock with a briar hook scythe. Several cuttings in the same and successive growing seasons may be necessary for complete control.



Emergent vegetation should be controlled when it first appears.

The use of systemic herbicides such as 2,4-D is restricted by law in certain counties. Obtain complete information on permits and clearance from the State Commissioner of Agriculture, Austin, Texas.

Chemical control of emergent and floating plants may be necessary when large areas become infested. Certain species of plants must be controlled by specific chemicals. Thus, the pond owner first should identify the plants and then use the proper chemical formulations. Table 2 gives suggested controls for some aquatic plants. (See Extension Bulletin 1018, *Common Aquatic Plants, Identification and Control.*)

TABLE 2. CHEMICAL CONTROL OF COMMON AQUATIC PLANTS*

Submerged Plants (other than algae)

Plant	Control
Bushy pondweed Coontail Milfoil Fanwort	Endothal, 2.0 gal. per acre-foot Endothal + Silvex, 1.0 gal. per acre-foot Silvex (ester), 1.0 gal. per acre-foot Dilute each of the above chemicals with enough water to permit spraying evenly over the pond.
Waterweed (Elodea) Bladderwort Pondweeds (Potamogeton) Water star grass Wild celery (Vallisneria)	Endothal + Silvex, 1.0 gal. per acre-foot. Dilute with enough water to permit spraying evenly over the pond.

Floating Plants

Duckweed Watermeal	Diquat, ¾ gal. per surface acre of plants. Mix with 8 oz. of nonionic spreader/sticker and 50 gal. of water. Spray evenly over plants.
Water hyacinth	Endothal + Silvex, 1.0 gal. per acre-foot. Dilute with enough water to permit spraying evenly over plants.

Rooted Plants with Floating Leaves

Yellow water lily	2,4,5-T, 1 gal. per surface acre of plants. Mix with 8 oz. detergent, 50 gal. of water, spray evenly over plants. Repeated application may be necessary. 2,4-D ester, 1½ gal. per surface acre of plants, mix with 8 oz. detergent and 50 gal. of water. Spray evenly over plants. Repeated application may be necessary. Silvex, 1 gal. per surface acre of plants. Mix with 8 oz. detergent and 50 gal. of water. Spray evenly over plants. Repeated application may be necessary.
White water lily	2,4,5-T, 1 gal. per surface acre of plants. Mix with 8 oz. of detergent and 50 gal. of water. Spray evenly over plants. Silvex, 1 gal. per surface acre of plants, mix with 8 oz. detergent and 50 gal. of water. Spray evenly over plants.
American lotus	2,4-D, 1½ gal. per surface acre of plants, mix with 8 oz. of detergent and 50 gal. of water. Spray evenly over plants.

Emersed Plants

Cattails Cut-grass	Dalapon, sodium salt, 7½ lb. per surface acre of plants. Mix with 8 oz. detergent and 50 gal. of water. Spray evenly over plants.
Bulrush Rush Waterleaf Water primrose	2,4-D (ester or acid), 1½ gal. (4 lb. acid per gal.), per surface acre of plants. Mix with 8 oz. detergent and 50 gal. of water. Spray evenly over plants.
Black willow Buttonbush Smartweed Arrowhead (Sagittaria)	2,4,5-T, 1 gal. per surface acre of plants. Mix with 8 oz. detergent and 50 gal. of water. Spray evenly over plants.

*See Extension bulletin 1018, **Common Aquatic Plants, Identification and Control,** for plant identification characteristics and alternative control measures.

Before using chemicals remember to:

1. Apply during the plant growing season before the seed or fruit are formed (spring and early summer).

2. Choose a hot, calm day for spraying.

3. Check local and state regulations regarding use of the chemical.

4. Be sure you have the proper chemical.

5. Avoid inhaling or contact with chemicals.

6. Avoid treating water to be used for irrigation.

7. **Follow directions on the label.**

Equipment

For large and medium sized areas, a power sprayer is recommended. Equipment consists of a drum to hold the chemical; a pump to draw dilution water from the pond and the chemical soultion from the drum; a spray boom through which the dilute chemical is distributed evenly over the water surface. The boom can be made of a ¾-inch pipe with ⅛-inch holes, space 12 inches apart.

For small areas and where a boat cannot be used, a 5 gallon pressure-type sprayer is recommended.

Good results depend on a sufficient chemical and its even distribution in the water. Once treatment begins on a given area, complete it quickly. Any delay causes some decrease in the chemical concentration already applied, which may prevent good results.

Treat only a section of the heavily weed-choked waters at a time, allowing about a week between treatments. Too rapid decay of vegetation reduces the oxygen supply in the water. When this occurs in the entire pond, fish die of suffocation. Suffocation is more hazardous to fish than the herbicides. An early sign of oxygen depletion is congregation of fish along the shore or at the surface. If this occurs, run or pump fresh water into the pond or pump the old water out and spray it back into the pond.

A few days after spraying, treated plants turn brown, become limp and sink to the bottom where they begin to decay. Water may turn brown and turbid during this period. The plants remain on the bottom where they gradually disintegate without objectionable odor.

Extensive shallow water areas create weed problems.

About 7 to 10 days following decay, bloom of algae is likely to appear in the treated area. This lasts a short time and usually requires no treatment.

Use of Sodium Arsenite

Sodium arsenite is no longer generally recommended for aquatic plant control. It is an inexpensive chemical that controls a wide variety of plants. In fact, it will kill most any plant.

Sodium arsenite is not recommended because: (1) it is a dangerous caustic poison; (2) animals like its salty taste (it takes only a little to kill a domestic or wild animal or a person); (3) residual effects may remain in the bottom soil for a long time; and (4) fish and other aquatic life are killed easily by it.

When expense prohibits use of other herbicides, such as in large lakes, and sodium arsenite is to be used, hire someone experienced in its use.

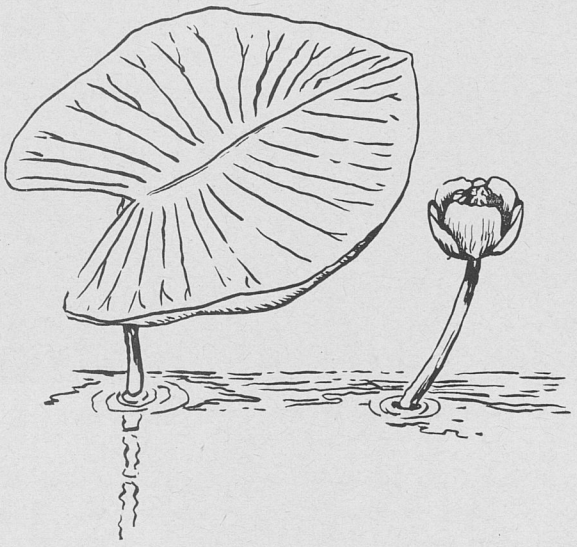
How to Determine Volume in Acre-feet

An acre-foot is equivalent to 1 surface acre of water 1 foot deep.

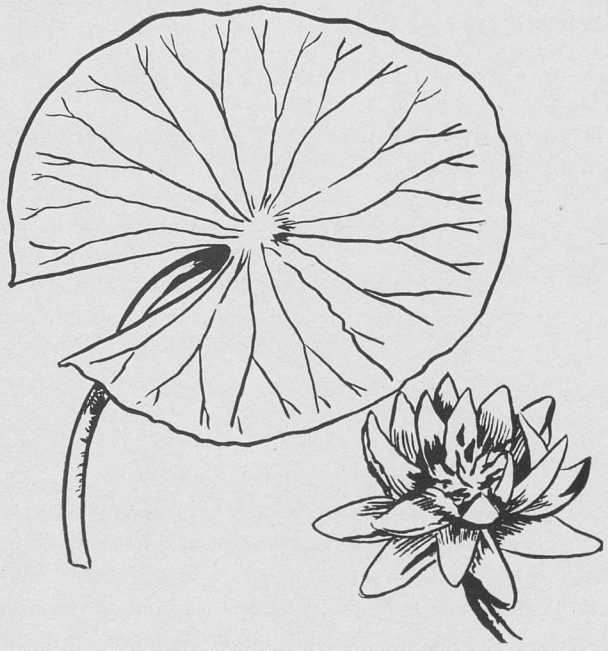
1. Determine the surface area of the pond in acres. This measurement must be fairly accurate. Your local Soil Conservation Service Office has aerial maps from which the surface area of any pond shown often can be determined with a planimeter.

2. Determine the average pond depth in feet. Do this by making a series of systematic depth soundings over the pond area. Make the soundings approximately 30 to 50 feet apart in straight lines across similar areas of the pond. Add the depth

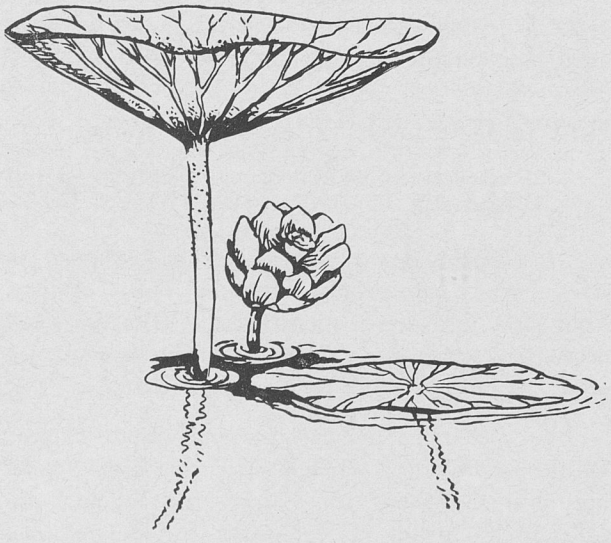
Emergent and Floating Vegetation



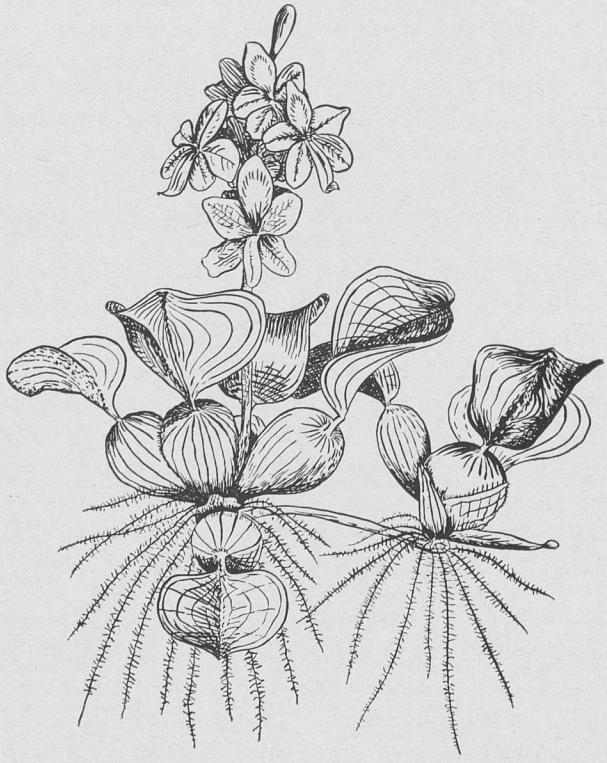
Yellow Water Lily



White Water Lily



Lotus



Water Hyacinth

measurements together and divide by the number of soundings to obtain average depth. Always begin and end each row of soundings with the zero measurements at the water's edge and add these in the number of soundings made.

3. Multiply the average depth in feet by the number of surface acres to obtain the total acre-feet of water.

Fertilizer added to a pond infested with a large amount of weeds only increases the growth of the obnoxious weeds. Once the weeds are killed, a good fertilization program will help keep them controlled.

In a new pond, the best method of controlling submerged aquatic plants is by maintaining a good fertilization program when the pond fills with water. Since fertilization increases microscopic organisms, the resulting "soupy" or darkened color filters the sunlight. If this plankton "bloom" is maintained throughout spring and early summer, submerged aquatic plants will be unable to develop into thick, troublesome masses.

When new ponds are built or when old ones are improved, elimination of large shallow-water areas will help prevent the growth of troublesome plants. However, some shallow water (3 to 5 feet in depth) should be maintained for fish spawning areas.

In recent years the nutria, a large aquatic mammal, has been introduced in ponds and lakes to control aquatic plants, with only limited success. These animals are reported to have damaged agricultural crops, native wildlife habitat and other properties to such an extent that state and federal agencies now discourage further release of them.

Control of Algae (Chara and filamentous algae)

Algae may occur in a floating mass of slimy material or as filamentous sheets. It is known commonly as "pond scum" and often covers large areas of a pond. Chara or muskgrass is a rooted, submerged alga, "crisp" to the touch and with a musky odor. It is common in clear, alkaline waters.

Algae, including chara, can be controlled with copper sulfate (bluestone) at the rate of 0.5 to 2 parts copper sulfate to a million parts of water. The easiest way to calculate parts per million (p.p.m.) is the expression of pounds of copper sulfate per million gallons of water. The first step is to calculate the volume of water in gallons. First, measure the length and width of the pond. Then make depth measurements at regular intervals across the pond using a pole or tape marked off in feet. The total of all depth readings divided by the number of readings made gives the average depth.

Then use this formula:

Length (feet) x width (feet) x average depth (feet) = cubic feet of water.

Then, cubic feet of water x 7.5 (gallons of water in 1 cubic foot) = total number gallons of water.

For **each** million gallons of water, add:

a. 1.66 pounds of copper sulfate if a strength of 0.2 p.p.m. is desired.

b. 4.15 pounds of copper sulfate if a strength of 0.5 p.p.m. is desired.

c. 8.30 pounds of copper sulfate if a strength of 1.0 p.p.m. is desired.

d. 16.60 pounds of copper sulfate if a strength of 2.0 p.p.m. is desired.

Use 0.5 or 1 p.p.m. concentration for neutral and acidic waters. Use 2 p.p.m. concentration for moderately to highly alkaline waters.

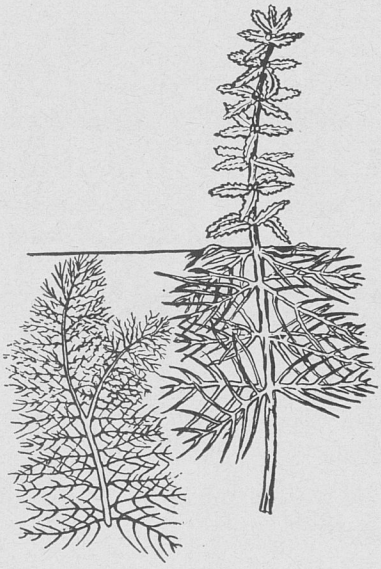
To avoid killing fish, treat only about a fourth to a third of the pond per application and wait several days before treating the next section of the pond. Fish then can move away from the treated water. If the entire pond is to be treated, use the lower concentrations such as 0.2 to 0.5 p.p.m.

Copper sulfate is toxic and should be used with caution. Too much copper sulfate is injurious to livestock, humans and fish; thus, **accurate calculations are important.** In the recommended concentrations, copper sulfate may be used without danger in waters for livestock or irrigation.

Dissolve the copper sulfate crystals in a few gallons of water in a wooden, stoneware or enamelware container. The solution then can be broadcast over the beds of chara or algae from a boat by using a long-handled enamel dipper or the solution can be distributed by a pressure sprayer. If a sprayer is used, clean it thoroughly following use to prevent corrosion.

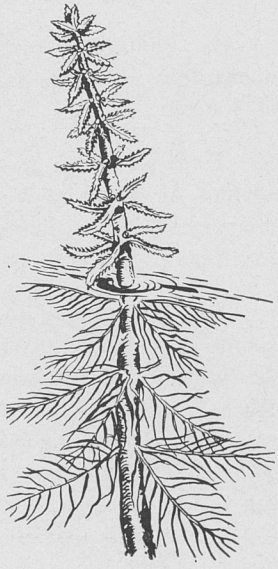
Copper sulfate crystals also can be put into a burlap bag and tied behind a boat. The crystals will dissolve as the bag is pulled through the water.

Submerged Vegetation



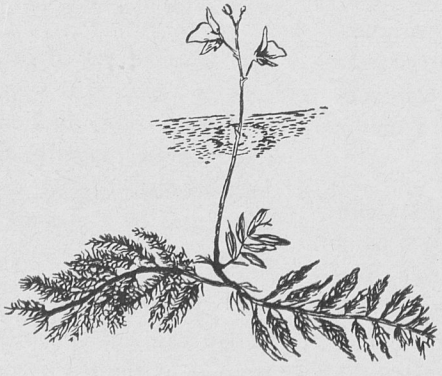
Parrotfeather

Bushy Pondweed

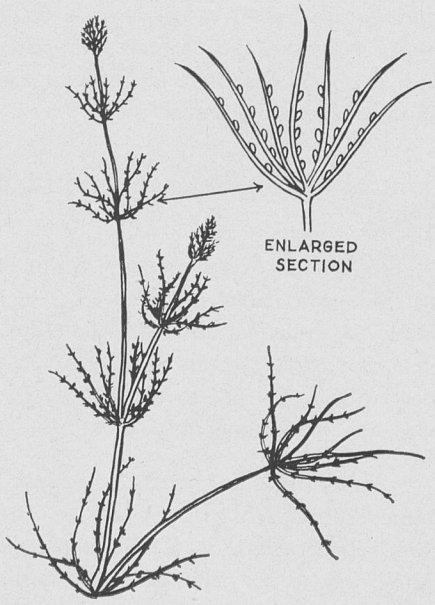


Watermilfoil

Waterweed



Bladderwort



Muskgrass

CONVERSION FACTORS

1 gallon = 8.3453 pounds
1 cubic foot = 7.4805 gallons
1 acre = 43,560 square feet
1 acre-foot = 43,560 cubic feet
1 acre-foot = 2,718,144 pounds of water
1 p.p.m. = 2.7 pounds per acre-foot
1 p.p.m. = 0.028 grams per cubic foot
1 p.p.m. = 1 pound in 1,000,000 pounds

Beautifying the Pond Area

The pleasure of having a good pond can be increased by beautifying the area.

Fencing the pond and immediate area will prevent damage by livestock and their breaking down the banks of the pond and keeping the water muddy. Also, attractive plant life will be able to develop.

Trees and shrubs planted around the pond add to eye appeal and are attractive to birds and other forms of wildlife. Trees should be far enough away from the banks so that they will not interfere with casting. They should not be planted on the dam.

The establishment of grass, such as Bermuda adds to the beauty of the area, prevents erosion and rank growth of weeds. Grass should be mowed periodically.

A barbecue pit and picnic table will add to the usefulness of the area.

Other Problems

The pond owner may encounter problems other than those discussed. Some of these problems and possible solutions follow.

Spraying submerged vegetation in a small pond with a pressure sprayer.

Turtles: Turtles do little harm to a fish population, yet their control sometimes is desirable because they steal fish baits and annoy fishermen. Ask your local county agricultural agent for plans on building turtle traps.

Fish Die-off: (a) Fish die-off may be due to depleted oxygen supply resulting from hot, cloudy weather with little wave action, large amounts of decaying vegetation, excessive algae bloom due to improper fertilization, or from heavy silt run-off following rain which clogs the gills of fish. This can be prevented by proper fertilization, killing aquatic plants in small areas over a longer period of time, or proper grass sodding of watershed. For immediate action when die-off begins, bring in a flow of fresh water or stir water vigorously with an outboard motor. If large numbers of fish are killed, remove those remaining and restock pond.

(b) Fish die-off also may be due to pollution by agricultural chemicals. To prevent this, crops in the area should be sprayed when there is no possibility of chemical drift by the wind, or water run-off from treated areas should be diverted from the pond. If many fish are killed, remove the remainder and restock pond after chemicals in the water have dissipated.

(c) If the pond is not fenced, fish die-off may be due to cattle wading in the pond after being dipped or sprayed with compounds containing chemicals such as toxaphene, chlordane and rotenone.

Fish Parasites: Yellow grubs, threadworms, spiny-headed worms, tapeworms, flukes and several

other parasites are fairly common to fish. These parasites are not harmful to man and usually are in parts of the fish that are thrown away when fish are cleaned. At present, the only practical method of controlling many of these parasites is by controlling snails which are intermediate hosts for them or by draining the pond and letting it dry for several months. Many times fish die-off due to parasitism is nature's way of controlling a crowded fish population. Contact the Department of Wildlife Management, Texas A&M University, College Station, Texas, if a large outbreak occurs.

Snakes: The most practical way to keep snakes out of a pond is to make the area unattractive to them. Keep the banks clean and closely mowed. Keep shallow water free of plants, brush or debris in which snakes can hide. A few water snakes do little or no harm to the pond. Cottonmouth water moccasins (poisonous) can be controlled by shooting.

Crayfish: Crayfish (crawfish) sometimes burrow into dams and around the banks of the pond. If control is necessary, use the following method: Combine coal tar creosote dip at the rate of 1 part to 100 parts of water. Apply 1 ounce to each crayfish burrow when the soil is wet and the water in the burrow is within 18 inches of the surface. Apply 2 ounces per burrow when soil is dry and water is below 18 inches from the surface.

Poor Fishing: Even with proper management, pond-fish populations sometimes become unbalanced. Undesirable fish, such as carp, suckers and shad find their way into the pond. Fish frequently become so numerous that the young compete for food to the extent that few fish reach edible size. The large fish then have such an abundant supply in the runted fish that they are difficult to catch. If the assistance of a fisheries biologist is obtained, the situation often can be remedied without removing all of the fish. If assistance is unavailable, the best solution is to remove all fish by using rotenone and restocking the pond. The problem of an unbalanced fish population, particularly with an overabundant supply of sunfish, is less likely to occur if the pond is fertilized properly and sunfish are removed continuously by fishing or by seining.

If pond management problems arise which the pond owner cannot solve, the following persons and agencies can offer assistance:

1. Local county agricultural agents
2. Local Soil Conservation Service
3. Parks and Wildlife Department, John H. Reagan Building, Austin, Texas.
4. Department of Wildlife Management, Texas A&M University, College Station, Texas

REFERENCES

The following publications may be helpful to pond owners. They can be obtained free of charge, except where indicated otherwise, by writing the agency listed by each.

Bulletin No. 24, UTILIZING STOCK TANKS AND FARM PONDS FOR FISH, Parks and Wildlife Department, John H. Reagan Building, Austin, Texas.

Farmers' Bulletin No. 2094, MANAGING FARM FISHPONDS FOR BASS AND BLUEGILLS, Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.—15 cents.

Circular 35, RAISING BAIT FISHES, Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.—45 cents.

L-196, RAISING EARTHWORMS FOR FISH BAIT, county agricultural agents.

L-212, RAISING MINNOWS, county agricultural agents.

B-1018, COMMON AQUATIC PLANTS, IDENTIFICATION AND CONTROL, county agricultural agents.

B-1024, CHANNEL CATFISH FARMING, county agricultural agents.

ACKNOWLEDGMENTS

Grateful appreciation is expressed to Richard J. Baldauf and W. B. Davis of the Department of Wildlife Management, Texas A&M University; to William Brown and Elgin Dietz of the Parks and Wildlife Department, who reviewed the original manuscript and made helpful suggestions; also to Marion Toole of the Parks and Wildlife Department and to the Alabama Experiment Station for permission to use drawings and photographs.

BLANK PAGE IN ORIGINAL

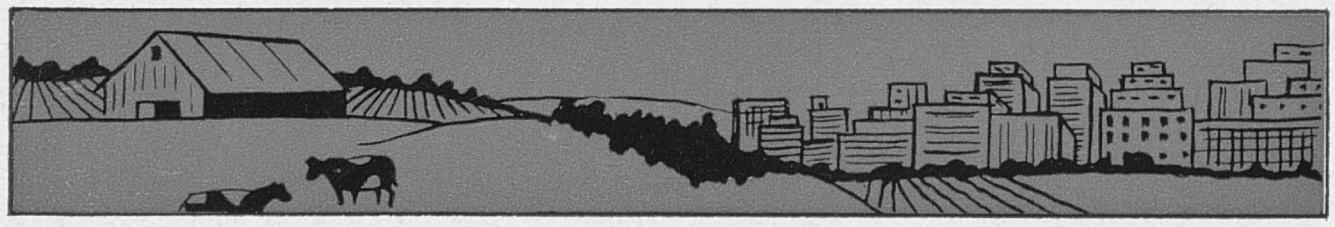
Ready to serve YOU...

are your COUNTY EXTENSION AGENTS. They represent both the U. S. Department of Agriculture and Texas A&M University in your county. These agents have ideas and materials that are helpful to everyone, regardless of whether you live on the farm or ranch or in a town or city.

Extension agents have information on a wide variety of subjects. For example, you can learn from them how to farm and ranch more efficiently . . . . achieve more satisfying family living . . . . discover how much we *all* depend on agriculture.

This publication is one of many prepared by the Texas Agricultural Extension Service of Texas A&M University to present up-to-date, authoritative information, based on the results of research. Such publications are available from your local agents whose offices usually are in the county courthouse or agricultural building.

Give your agents a try. They welcome your visits, calls or letters.



Cooperative Extension Work in Agriculture and Home Economics, Texas A&M University and the United States Department of Agriculture cooperating. Distributed in furtherance of the Acts of Congress of May 8, 1914, as amended, and June 30, 1914.
25M—8-64, Revised