GEORGIA. STATE GAME AND FISH COMMISSION

GEORGIA FISH POND MANAGEMENT

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Georgia Game And Fish Commission

TO THE PEOPLE OF GEORGIA:

I have reviewed the contents of this book, and your Game and Fish Commission is offering you information that is necessary in managing your private or farm pond for a higher production of fish.

The fish pond of today is considered almost a necessity to every farmer and landowner, not only for the enjoyment of himself and his family, but as an enterprise by either selling fishing rights or furnishing food. Your pond is important for its scenic beauty, irrigation, watering livestock and serves to provide recreation, which is badly needed in these chaotic times.

Outdoor life plays an ever-increasing role in the health, mental and physical development of our people. Fishing is the most popular of all these activities. People of all ages may participate. Wise pond management is necessary for its full enjoyment and productivity.

Our State has more than 27,000 fish ponds ranging in size from one to more than 200 acres. The investment in these fish ponds amounts to more than thirty million dollars.

Each pond owner should study the information contained here and put into practice these helpful rules. You and your friends will be rewarded through the enjoyment provided by a better fish pond.

Herman E. Talmadge

HERMAN E. TALMADGE, Governor.

TO THE PEOPLE OF GEORGIA:

You will find in this booklet much helpful information for every pond owner and every fisherman of our State.

This information has been compiled by experienced fish management men. They present for your use the results of their work with managing fish ponds in Georgia.

If these instructions are followed, you will be able to enjoy good fishing for yourself and your friends. You may realize an income from your investment, but certainly you will profit in the pleasures of good fishing.

Fulton Lovell

FULTON LOVELL, Director
State Game & Fish Commission.

HERMAN E. TALMADGE, GOVERNOR

GEORGIA GAME AND FISH COMMISSION

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PREFACE

Methods of management of ponds and lakes for successful fishing year after year were developed for the Southeastern States by Dr. Homer S. Swingle, Fish Culturist, Alabama Polytechnic Institute, Auburn, Alabama. Dr. Swingle directs the largest fisheries research station in the world for warm water species of fish. There were found methods which produce in regulated ponds the largest poundage of fish of edible size.

The U. S. Fish and Wildlife Service, the Soil Conservation Service, the County Agents, and others like Dr. R. W. Eschmeyer, Executive Vice-President, Sport Fishing Institute, are following Dr. Swingle's methods with marked success.

I had the opportunity to earn a Master's Degree in Fish Management under Dr. Swingle. This course naturally entailed work in class, but a great deal of time was spent in selecting a pond site, constructing a pond step by step, properly stocking, and fertilizing the pond, and then actually fishing the pond. The courses in management of fisheries were of inestimable value. Also, I enjoyed and profited by the research that had been and was being carried on upon 154 other ponds at the fishing school. During that time, Dr. R. W. Eschmeyer was working upon the TVA lakes, where I had the opportunity to study and observe his methods.

I acknowledge with sincere appreciation my indebtedness to Professor H. S. Swingle, Mr. John Lawrence, Mr. Ellis Prather, and Dr. J. S. Dendy of the Fishery School at Alabama Polytechnic Institute; Dr. R. W. Eschmeyer, Executive Vice-President, Sport Fishing Institute; and the thousands of pond owners in the State of Georgia. For their patient assistance in preparing this manuscript, my appreciation goes to Professor H. S. Swingle, Professor Edwin H. Folk of Georgia Tech, and my wife Bettie.

I have borrowed freely from the writings of many biologists trained in fisheries, but lack of space prevents me from acknowledging all sources of information used in this study. I trust my readers will understand I recognize the value of these contributions even if I fail to give due credit to these authors.

Figures number 1 - 18, 19 through 23, 25, 27, 44 through 49, are used through courtesy of the Agricultural Experiment Station of the Alabama Polytechnic Institute. Figures number 28-B and 30 are used through courtesy of Mr. George Smith, College Park, Georgia. Figures 31 through 35 and figures 52 through 55 are used through courtesy of the Texas Game and Fish Commission. Figures number 36 and 37 are used through courtesy of the Virginia Agricultural Experiment Station. Figures 50 and 57 through number 101 are used through courtesy of James Heddon's Sons.

Fred J Dickson

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CHAPTER 1

INTRODUCTION

Fishing for sport is now big business in the United States. During the year 1953, there were over 25 million persons who spent over 9 billions of dollars on fishing equipment and related expenses. More money is spent on fishing than all the other sports combined. With our evergrowing population, the fishing pressure on the waters of Georgia is increasing steadily. During the year 1934, there were 210 persons that fished the mountain trout streams in the managed area, and last year there were over 6,000 persons that fished the same streams. This means there were 29 times more people fishing last year in the managed area than there were 18 years ago. There is reason to believe the increase of fishermen on the warm water streams in Georgia is at least as high and maybe higher than on the trout streams.

The State of Georgia has more than 27,000 ponds that range in size from one to 200 acres. The cost of construction was between 30 and 35 millions of dollars. New ponds are being constructed at the rate of 2,000 each year, even though many have been constructed poorly and in unmanageable locations.

For years fish conservation and production in this country have been largely a matter of passing laws and planting fish. In the past, people became accustomed to take their medical problems to a doctor, their legal problems to a lawyer, and their farm problems to the agricultural expert; but they didn't feel the need to take their fish problems to a fisheries manager or biologist. As a result, they frequently got wrong answers. Some laws, passed without factual foundation, failed to serve their intended purpose and oftentimes proved harmful.

Management of a pond site is the skillful treatment at the proper times in order to harvest the largest poundage of edible size fish and to catch a nice string of fish each fishing trip year after year. Facing realities with sound principles and correct facts is the foundation of good planning and management.

Scientists have found that most ponds in Georgia are too large and have too much water leaving the pond for best results. Most people will tell you they want plenty of fish and good fishing, and that is the reason they build large ponds. Ponds must be managed correctly to produce the best fishing. Certain steps must be taken to produce good fishing, just as certain steps must be taken to produce a high yield of corn, or a good crop of flowers. In order to get a high production of corn, one must take several steps as follows: prepare the soil during the proper season; apply the necessary formula of fertilizer; select, disinfect, and plant at the right depth the type seed inducive for high production; work the crop regularly to keep out weeds and other undesirable plant life; and finally the most important step

is to do a good job of harvesting to realize the benefits. If any step is done poorly or omitted, a high yield or profit cannot be expected.

Farm ponds are helping to raise the standard of living in Georgia. Pond owners sell fishing rights, thereby making the fish pond a source of cash; ponds provide meat for the table; recreation—fishing, boating and swimming; water for livestock and for irrigation, and for scenic beauty. There is no wonder the modern Georgia Gentleman values his fish pond above a country estate with sweeping lawns and a pillared mansion. The owners of ponds that produce successful fishing always find themselves popular members of the community by offering sport for their friends.

The Georgia Game and Fish Commission looks with favor on fish ponds because these ponds contribute greatly to the overall recreational picture, and by the same token, lessen fishing pressure on public streams. The Game and Fish Commission contribute to the program by assisting in stocking the new ponds, by offering data for their management, and by analyzing ponds that are not producing good fishing and by suggesting methods to correct unfavorable conditions.

This book deals mainly with the steps that are necessary for successful fishing year after year. It offers suggestions on: selection of pond site, construction, stocking, fertilization, and fishing of ponds. It revolves primarily around the largemouth bass and the bluegill bream, warm water species best suited to Georgia ponds. I hope that it may help toward wider enjoyment and further acquaintance in the field of fish pond management that offers abundant opportunity to all explorers, both beginners and seasoned investigators.

STATE FISH HATCHERIES

There are 5 State fish hatcheries. Lake Burton Hatchery, located near the upper end of Lake Burton, propagates rainbow, brown, and brook trout, also largemouth and smallmouth bass, bluegill and shellcracker bream. Summerville Fish Hatchery, located near Summerville, propagates rainbow, brown, and brook trout, largemouth bass, bluegill and shellcracker bream. Walton Hatcher, located near Rutledge, propagates largemouth bass and bluegill bream. Bowen Mill Hatchery, located near Fitzgerald, propagates largemouth bass and bluegill bream. Richmond Hill Hatchery, located near Richmond Hill, propagates largemouth bass and bluegill bream.

HOW TO PROCURE HATCHERY FISH

After finding the exact surface acreage of your pond to the nearest one-tenth of an acre, send a card or letter addressed to the State Game and Fish Commission, 412 State Capitol, Atlanta, Georgia, requesting an application blank for fish. Upon receiving the application, fill it out and return it as soon as possible. The fish are given free of charge as a State service. In the fall, the bluegill bream are harvested in the hatcheries and are given to the pond owners as fry[1] or fingerlings[2]. In the following spring, the

[1]Fry are newly hatched fish.

[2]Fingerlings are young fish more than one inch in length.

bass are harvested and distributed as fry or fingerlings. Bass must be stocked in the pond *after* the bluegill bream, but before the latter spawn the first time.

Another source of fish is the U. S. Fish and Wildlife Service, Peachtree-Seventh Building, Atlanta, Georgia. Apply for fish to only one source because overstocking is undesirable and usually you will receive your fish from a nearby hatchery.

CHAPTER 2

MANAGEMENT PRINCIPLES[1]

Many ponds produce good fishing only during the first two years because the owners do not know or do not practice proven management principles. Everyone following these principles of management reports success.

1. **The weight of fish an unfertilized pond can support is dependent upon the fertility of the watershed.** This weight ranges from 35 pounds to 200 pounds per acre, according to poorness or richness of the watershed or lands that drain into the pond.

2. **The number of pounds of fish that a pond can produce can be increased by the use of fertilizers.** Fertilizer produces a plankton that is food for microscopic animal life, water insects and small fish. The diet of a bluegill throughout the year consists approximately 84 percent of the midge larvae (blood red-worm). If a pond is fertilized properly it will support from 400 to 600 pounds of fish per acre.

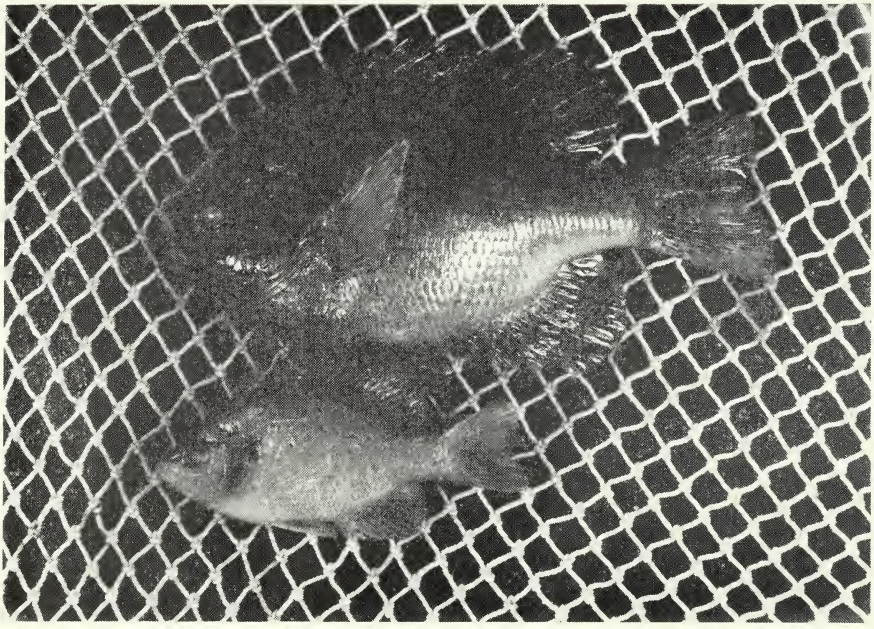


FIGURE 1.—Effect of fertilization on the size of fish. **Above:** Average size (4.0 ounces in a fertilized pond. **Below:** Average size (1.1 ounces) in unfertilized pond. Both ponds were stock with 1,500 bluegill fingerlings per acre.

[1]The following section is taken in part from Bulletin 254 of the Alabama Polytechnic Institute Agricultural Experiment Station Fisheries School.

FIGURE 2.—Rate of growth in a pond stocked with 6,500 bluegill bream per acre. **Above:** Average size (0.8 ounce) 6 months after stocking. **Below:** Average size (0.9 ounce) 2 years later.

3. **Fish grow rapidly if they have plenty of food, but very slowly if food is scarce.** If the bluegills get plenty of food and are properly stocked they will average about 4 ounces within one year after stocking. The bass, if properly stocked, will average about one pound in one year.

4. **Too many fish in a pond cause small undersized fish and poor fishing.** A pond can support only the weight of fish for which food is available. It can support several thousands of small fish or a much smaller number of large fish. The faster a fish grows the easier it is to catch; the slower it grows the more difficult it is to catch.

5. **Within one year after stocking, a pond is usually supporting close to the maximum weight of fish for which food is available.** After the stocked fish have spawned once, there are more fish in the pond than can be adequately supported by the food that the pond is producing. Therefore, the fish must be reduced by the bass and by heavy fishing. A pond properly fertilized reaches a maximum of fish food production in the same manner as a pasture properly fertilized reaches a maximum of hay production.

6. **If the number of fish in a pond is reduced, the average size of those remaining increases.** The remaining fish get more food. If a man has a

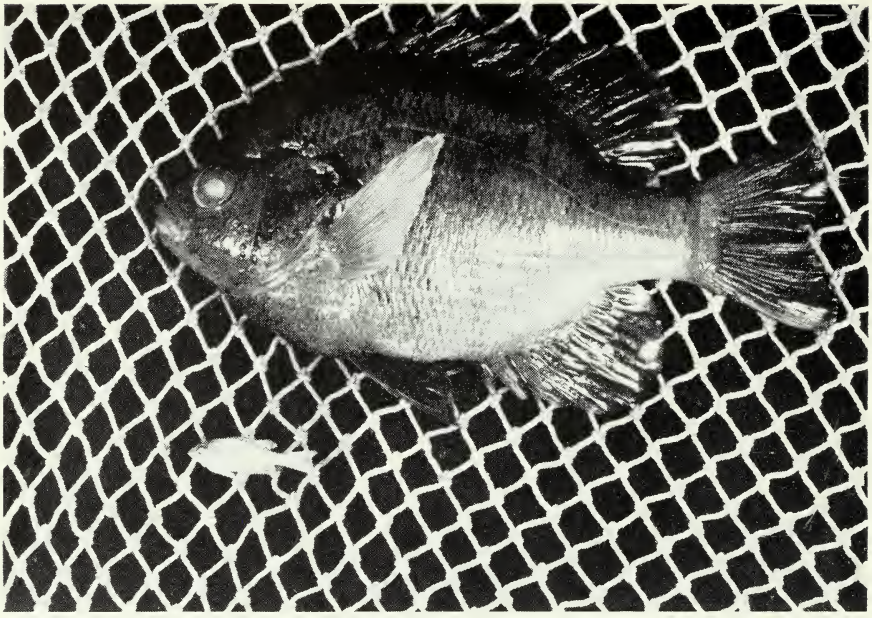


FIGURE 3.—Effect of rates of stocking on the size of bluegill bream. **Above:** Average size (4.0 ounces) 1 year after stocking with 1,500 bluegills per acre. **Below:** Average size (0.02 ounce) 1 year after stocking with 180,000 bluegills per acre.

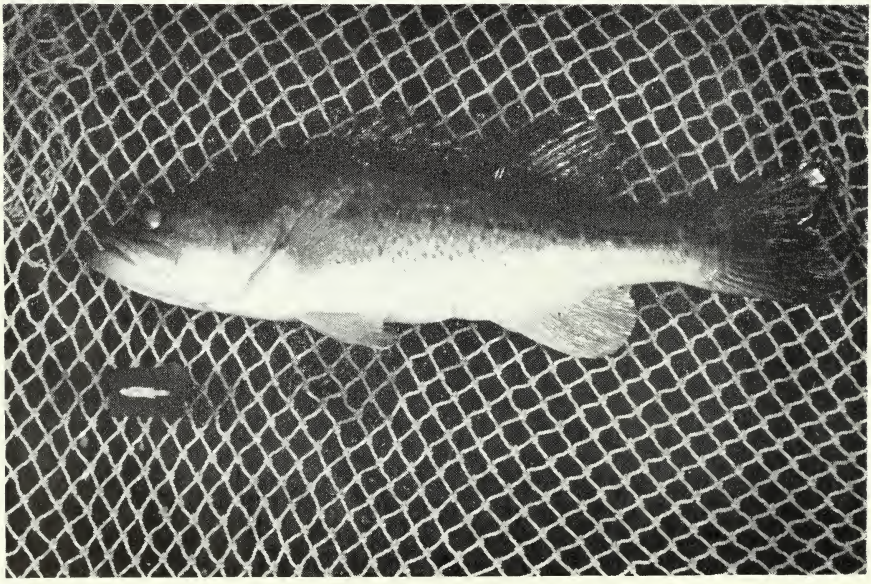


FIGURE 4.—Growth of largemouth bass (**Huro salmoides** Lac.) in a fertilized pond. **Below:** Size (0.0008 pound) of a week-old bass hatched May 1941. **Above:** Size (1 pound) reached when 6 months old, October 1941.

good pasture that will support 100 cows without over-grazing and the cows are left on the pasture until they have calves, he knows he must reduce the number to prevent over-grazing. Fish are thousands of times more prolific than cows; therefore, fish must be drastically reduced in numbers—so enjoy catching and eating them.

7. **Bluegill bream cannot reach a large size generation after generation in ponds containing only bluegills.** Each pair may produce 5,000 or more young fish the first year. This increase causes the weight of fish that the pond can support to consist of very small bream.

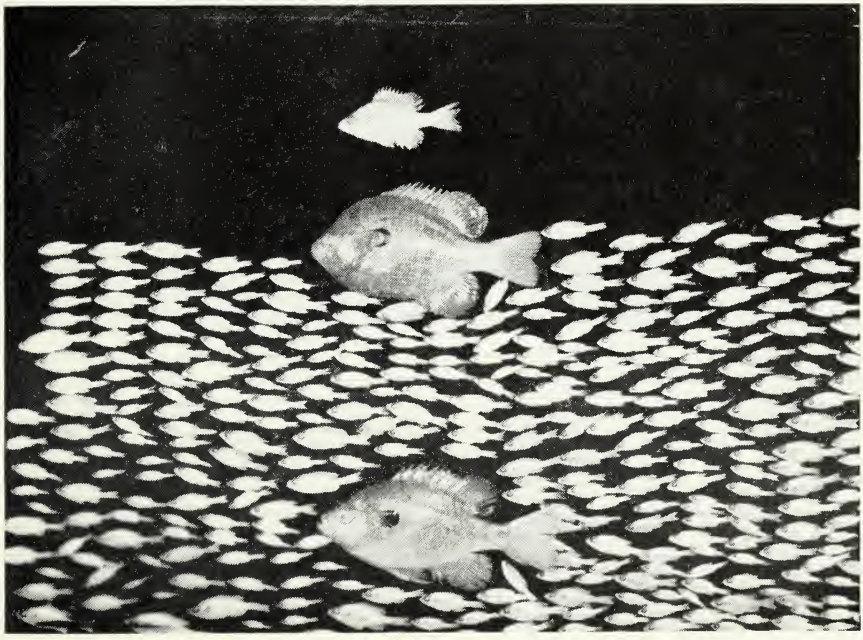


FIGURE 5.—Result of stocking with bluegills only. **Above:** Average size (0.2 ounce) stocked March 1938. **Center:** Average size (2.7 ounces) reached by June 1938, when spawning occurred. Each pair of bream produced an average of 4,000 young. **Below:** When the pond was drained November 1938, the large bream weighed two-thirds as much (1.9 ounces) as in June, because the pond was overcrowded with their own young.

8. **Largemouth bass should be used in ponds with bluegill bream.** The main purpose of adding the bass is to reduce the offspring of the bream. The largemouth bass is the sole carnivorous fish satisfactory for use in ponds. If the pond is stocked properly with bass and bluegills, and there is no very shallow water or weeds, the bass usually eat most of the young bream. But you should help reduce the total population by taking out every fish you can by fishing. The bass and intensive fishing will help prevent a pond getting out of balance.

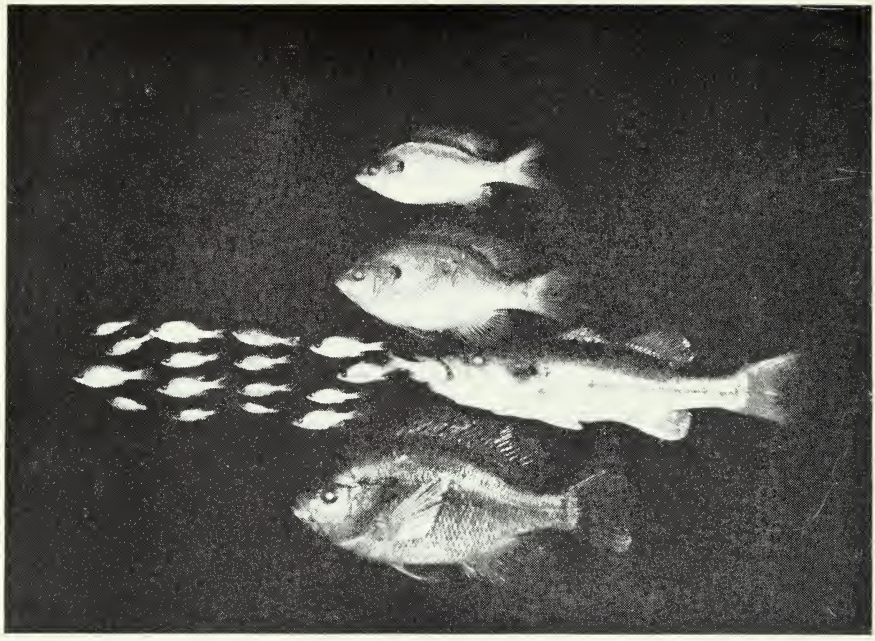


FIGURE 6.—Results of stocking with bluegill and largemouth black bass. **Above:** Average size (0.5 ounce) of bream used in stocking February 1939. **Center:** Average size of bream (1.8 ounces) in June 1939, when spawning occurred. Most of the young fish produced were consumed by the bass. **Below:** Average size of bream (4.2 ounces) in November 1939. Since the bass had reduced the number of young fish, the bream more than doubled in weight after spawning.

9. **Ponds in Georgia fertilized properly should be stocked with 1,000 bluegill fry or fingerlings and 100 bass fry or fingerlings per acre.** Experiments in Alabama over thousands of ponds over 20 years have proven this ratio to be the most successful in size of fish and in fishing success when the ponds were properly fertilized.

10. **Unfertilized ponds should be stocked with only 400 bluegill fingerlings or fry and 30 bass fry or fingerlings per acre.** When unfertilized ponds are stocked in this ratio, bream will average about 4 ounces while bass will average about one pound in one year.

11. When shellcracker bream are used, they should not constitute over 20 percent of the total number of bream. Shellcrackers do not sustain themselves as well as bluegills and sometimes disappear after 3 or 4 years.

12. Other species of bream as the redbreast, warmouth, green sunfish, stumpknocker, pumpkinseed, longear sunfish may be classified as scrub types. In ponds they will not put on as much weight as the bluegill and shellcracker bream per ounce of food consumed. Only a very small percentage of such fish attain an edible size in ponds.

13. Too much water passing through the pond takes out the fertilizer and

causes a reduction in the amount of food produced. Also too much water encourages the entrance of suckers, shad and other undesirable species.

14. Catfishes and crappie are not recommended because they usually overpopulate the pond. By adding extra species, one reduces the number of fish caught per hour of fishing effort.

FALSE BELIEFS OR IDEAS

LOTS OF WATER

One false idea held by many people is that the more water entering and leaving the pond, the better the conditions will be for the fish. An ideal fish pond receives sufficient water to prevent fluctuation of water level without overflow. Water will not become stagnant if fertilized because fertilizer produces microscopic plant life which gives off oxygen during all daylight hours.

DEEP POND

Others mistakingly believe the deeper the pond the better. In North Georgia a pond should have some of its area 8 feet in depth, while in South Georgia none of the pond area needs to be over 5 or 6 feet in depth. Most of the fish food is produced in water less than 4 feet in depth.

SHADE

Fish do not need shade as much as they need food. Sunlight is as necessary for the growth of the microscopic plant life as are the nutrients. Fish do not require or need shade.

CLOSED SEASON DURING SPAWNING TIME

The old erroneous belief about not fishing while the warm water fish are spawning prevented a great deal of recreation and joy and contributed to an overpopulated fish condition. One catches more fish while fish are spawning than at any other time. Since 50 percent of the total weight of fish cannot be caught by hook and line fishing and since the crop of fish needs to be harvested, people should catch all the fish they can at any time of the year.

WEEDS IN THE POND

Some pond owners place water lillies, cattails and other types of weeds in ponds, thinking the little fish need some place to hide from bass or other big fish. The weeds induce overpopulation of bream—smaller fish and poorer fishing. We want large fish and good fishing, so predators are necessary.

THROW THE LITTLE ONES BACK

If each pair of bream produced only one pair of offspring each year, it

would probably be wise to throw the little ones back, but their offspring mount into the thousands during each spawning and depending on food supply bluegills spawn 2 or 3 times each year. Therefore don't throw back the little ones if you want to improve fishing conditions. There should never be a size limit on bass, bluegills, catfish, crappie, and other warm water fish.

FISH SPAWNING DURING THE FULL MOON

The bluegills start fanning out nests when the temperature of the water is around 73° F. and when the temperature of the water rises to 80° F. and remains there 2 or 3 days, the bluegills will spawn whether the moon is half, one-quarter, dark, or full. Spawning by the different bluegills will occur every month throughout the summer and until the temperature of the water falls below 80° F. Bluegills may spawn when they are one-half ounce in weight. If they are getting plenty of food they may spawn, form new eggs and spawn again within a period of six weeks. The largemouth bass start fanning out their nests at 65° F., and when the water temperature rises to 70° F. and remains there for 2 or 3 days, they will spawn. It is very seldom that bass spawn over once a year. Bass usually form their eggs in the late fall.

FISH PONDS MOSQUITO BREEDING PLACES

Many people say that fish ponds provide breeding places for mosquitoes. Ponds constructed properly, stocked properly, and managed properly produce practically no mosquitoes. You may be around the pond during the day or night without noticing the mosquitoes any more than you would around your home. The small bream eat the mosquito larvae and prevent their reproduction. Weedy ponds and unfertilized ponds raise many mosquitoes.

FERTILIZING TWO OR THREE TIMES A YEAR

Very often when I ask a man if he fertilized his pond last year, he will tell me yes. I then usually ask him how many applications he made. Often he reports only 2 or 3 applications of fertilizer. This is insufficient for good results. A pond in Georgia requires from 7 to 15 applications of fertilizer each year for it to produce the maximum amount of fish food. Proper fertilization is needed to produce an abundance of microscopic plankton for fish food, which also gives a greenish cast to the water, thereby shading the bottom and preventing the growth of underwater weeds.

PART II[1]

CHAPTER 3

SELECTING A POND SITE

Careful consideration should be given to the selection of a pond site because economy of construction, usefulness, and productivity of the pond depend upon its location.

SIZE OF POND NEEDED

In planning a pond, you should first decide the size of pond you need. You should expect to catch about 45 pounds of bass and 160 pounds of bluegill bream each year from each acre of a well-fertilized and properly managed pond. This means approximately 40 bass and from 400 to 800 bream per acre. If you do not plan to commercialize your pond by selling fishing rights, or to furnish fishing for a large number of people, you need to construct a pond no larger than two or three surface acres of water.

To obtain the most benefits from the fish pond and to insure continued success, certain points should be emphasized. As the pond is a permanent structure, costing from $300.00 up to $25,000.00 to build, it is important that it be constructed properly. The best advice on location and construction should be obtained and followed. The selection of the site and manner of construction will govern the efficiency of management.

Ponds should not be located on areas subject to flood nor should they be built by damming large streams. Precautions should be taken in selection of the site to prevent seepage through the dam or through the subsoil.

A SUITABLE POND SITE SHOULD POSSESS THREE CHARACTERISTICS

1. A SUITABLE TOPOGRAPHY

Topography determines the economy of pond construction. Most ponds are built in natural hollows or draws. These hollows are usually swampy and wet, and usually are covered with hardwoods. Some of these hollows can be turned into productive use if they meet requirements of good ponds. The hollow should have a gentle slope. The highest fish production is in ponds where approximately five-sixths of the area is from 2 feet to 6 feet in depth, and where approximately one-sixth of the pond area is approximately 8 feet or more in depth. Try to find a site as near as you can to fit these conditions. In the southern part of Georgia, where the winters

[1]The information in Part II was taken largely from Circular 95 Construction of Farm Fish Ponds, and Bulletin 254 Management of Farm Fish Ponds, Alabama Polytechnic Institute Agricultural Experiment Station Fisheries School. Also some information was taken from Georgia Agricultural Handbook, Georgia Agricultural Extension Service, University System of Georgia.

are much milder than in the middle portion of the State and northward, none of the area of the pond needs be greater than 6 feet in depth unless a great deal of the water is used in irrigation or watering livestock, or if the water level fluctuates one foot or more due to seepage or evaporation. Ponds with a large part of the area 7 to 20 feet deep do not produce a high yield of fish.

2. WATER SUPPLY

A water supply, adequate but not excessive, is desired. All water flowing from a pond is waste, carrying away fertilizer that has been applied to make food for growing fish. An ideal water supply keeps the pond water from fluctuating with no water leaving the pond.

Too much water entering the pond is bad for several reasons: (A) Mature fish are carried over the spillway. (B) Fertilization and high yields of fish are made impossible. (C) The owner is forced to build an expensive dam and spillway. (D) The life of the pond is shortened too rapidly by siltation. (E) Many times, undesirable species of fish such as suckers, carp, catfishes, etc., will enter the pond. All sites on streams that carry much flood-water should be avoided.

Some ponds can be protected by turning the excess water around the pond through a diversion ditch. An ideal location is on bottom land that is not subject to flooding, and where there is a sufficient water supply that can be directed into the pond in the amount required. Ponds formed by damming a large stream are ordinarily not successful because it is almost impossible to prevent the escape of large numbers of adult fish and the introduction of undesirable species. Ponds constructed on small spring-runs not subject to severe floods, or where storm water can be by-passed or diverted from the pond, develop high fish productivity.

Flowing water is not essential for pond fishes. As has been previously stated, fertilizer produces microscopic algae that give off oxygen during all the daylight hours. This new supply of oxygen prevents the pond from becoming stagnant.

A pond fed by small springs, which will fill it in 2 to 6 months, is ideal for good management and utilization of the fertilizer. If the water comes only from the watershed, there should be sufficient acreage but not too large an acreage. The ratio of the watershed area to the size of the pond should be from 10 to 20 acres of pasture land **or** 20 to 35 acres of woodland per acre of impounded water. The entire drainage area should be well vegetated to prevent erosion. If the pond water often becomes muddy, poor fishing will result regardless of the amount of fertilizer applied to the pond.

Streams bold enough to fill the pond in one month or less supply too much water for proper utilization of the fertilizer, which governs production in pounds of fish. Therefore a diversion ditch is required in such cases to reduce the flow to permit high production. If artesian wells are used,

the water should flow over a bed of gravel to aerate it before it enters the pond.

3. SOIL AND AREA SURVEY

When selecting a pond site, sometimes one may depend upon the eye but it is much better and safer to check the area with a surveying level. Make certain that the soil will hold water before you start building the pond, because a successful pond cannot be built on the wrong kind of land. The subsoil should be checked by taking soil samples with a soil auger or a post hole digger. Enough samples should be taken to make certain there is three-to-four-foot layer of clay under the dam site. The way to test the clay to see if it is suitable is to take a handful of the moist soil from the hole and compress it into a firm ball. If, after a little handling, the ball does not crumble, the soil contains sufficient clay for building the dam. Avoid sites with rock out-croppings along the bank or with rock or shale ledges near the surface. Also avoid sites having sand, gravel, peat, limestone, or marl through which the water might seep.

From your findings on the topography, water supply, subsoil, and pond area, it is easy to determine the suitability of the proposed site.

CHAPTER 4

POND CONSTRUCTION

A pond should be completed only a short period of time before the fish are available from the hatcheries. Late summer or early fall is the best time of the year to construct a pond. At that time of the year, there is usually the least amount of rainfall; therefore heavy equipment can work economically without bogging down or being stopped by bad weather. A pond completed during the early fall has time to fill sufficiently to allow bluegills to be stocked in the late fall or early winter.

PROPER TIME FOR IMPOUNDMENT

The time of the year the pond is filled with water is an important factor in pond management. If a pond is constructed and filled with water in the spring, fish will not be available until late fall or winter. The pond owner is unwilling to fertilize the pond that has no fish in it. Consequently, underwater weeds—needle rush, coon-tail moss, parrot feather, or other undesirable plants—are likely to grow from the pond bottom everywhere sunlight penetrates to the bottom.

If the pond is constructed during the winter, spring, or summer, and is not allowed to fill with water, weeds, bushes, and brush will cover the bottom before fall; thus, the bottom must be cleared again before the pond is filled by late fall and winter rains. But this clearing is cheaper than getting rid of underwater weeds after the pond has been filled.

The importance of completing the entire job of pond construction before water is impounded cannot be over-emphasized. A pond must be constructed properly to produce a high yield of large fish. And it is cheaper to have the pond construction complete before the water is impounded.

CLEARING THE SITE OR POND AREA

Trees, brush, and other litter within the **dam site area** must be removed in their entirety—roots, trunk and limbs. No woody material that will rot should be left in the dam area to later cause a leak. All trees and brush should be removed from the pond site.

The balance of **the pond site** should have the trees and brush removed. These may be piled and burned. Two areas, approximately 50 to 75 feet wide and 100 feet long in water less than 5 feet in depth, should have all stumps removed and the bottom fairly smooth (no abrupt holes) in order that a pond analysis may easily be made in the future. If these cleared areas are not provided, an analysis by seining is impossible. These test areas should be clearly marked with posts or signs. Every pond should be analyzed by the end of the second year by a Fishery Biologist.

FIGURE 7. In the layout of proposed base of dam shown here, the two straight lines of stakes across the hollow outline the width of top of the dam when it is completed. The outside rows of stakes (toe-stakes) outline the area that the base of the dam will cover.

All trees and brush on the bank above the water level should be cut at least 20 feet from the water line to comply with public health regulations. Clearing the banks of trees, brush, high grass, and weeds reduces the number of snakes and holds down the breeding of mosquitoes. And finally, every foot of the edge of the pond becomes usable for fishing.

CONSTRUCTION OF THE DAM (STEP BY STEP)

REMOVAL OF TOPSOIL FROM BASE AREA OF THE DAM

FIGURE 8. Tractor with bulldozer attachment pushes topsoil from base of the dam to the down stream toe. This operation is done prior to cutting the core trench.

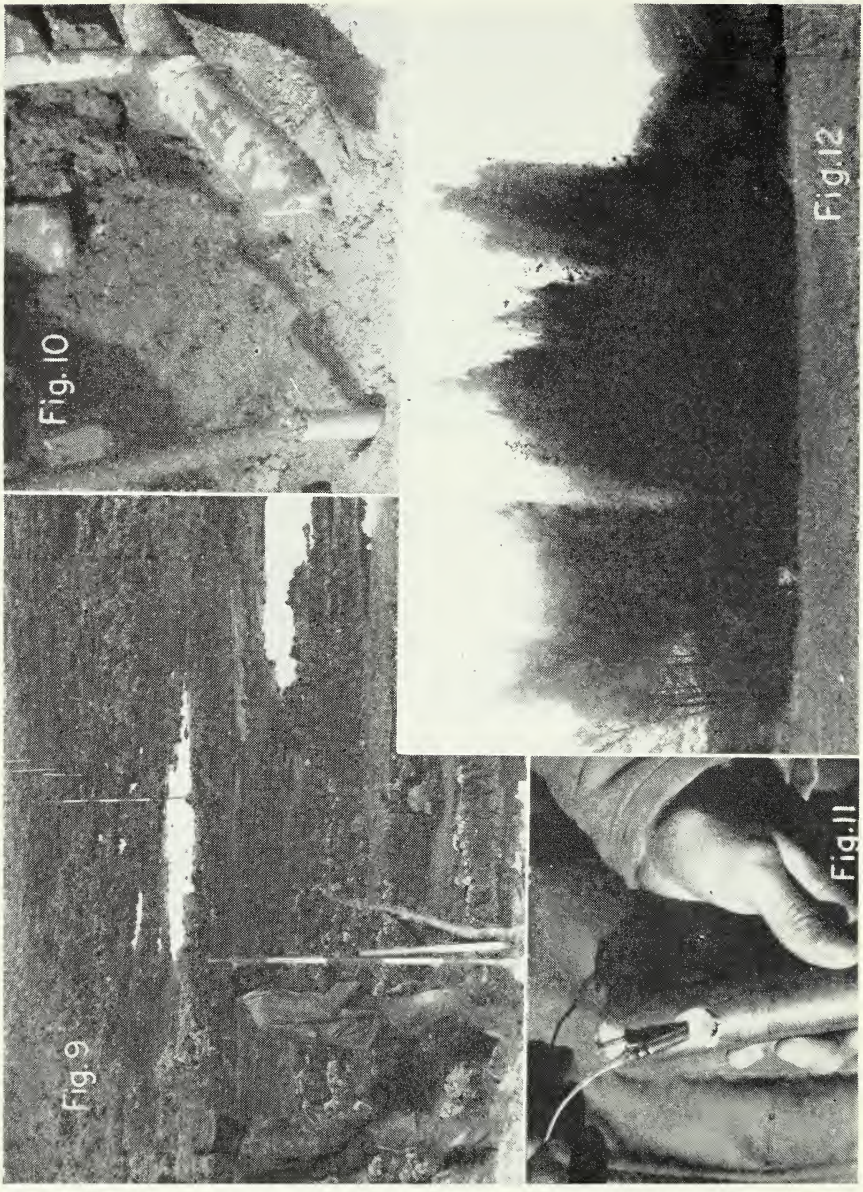


FIGURE 9. Guide stakes are set along center of core preparatory to setting dynamite. FIGURE 10. Close-up of method of punching holes and inserting sticks of ditching dynamite. FIGURE 11. Electric cap is inserted in hole punched in side of dynamite stick. This hole should be about 3 inches deep and one-half inches in diameter. FIGURE 12. Cap is ignited and entire line of dynamite is exploded. Note the height to which mud and dirt are thrown. Since most of this material falls outside of trench, no one should be nearer than 500 feet.

Topsoil must be removed to a depth of one foot or more below the surface to dispose of roots and other organic matter that destroy the bond between the soil of the pond bottom and the base of the dam. Bonding is necessary to prevent seepage.

DIGGING THE CORE TRENCH

After the removal of the topsoil within the base-area, the core trench is cut. Good clay must extend the full length of the dam and be used from the subsoil of the pond bottom to a point slightly above the highest of the water level of the dam. The trench should be dug approximately 10 feet wide if it is in impervious clay. If the base material is slightly porous, the width of the core trench must be increased to twice the proposed water depth at that point. The depth of the core trench should be dug at least 3 feet or more into the subsoil. An old stream bed may be too boggy for heavy equipment to work. Then, it is cheaper, quicker, and better to blast that portion of the core trench with ditching dynamite (used by an experienced worker), rather than to dig it by hand or with a drag line. After blasting, be certain to check to see that the clay subsoil has been fully exposed across the bottom and that the trench is wide enough. If the clay subsoil has not been fully exposed, additional blasting should be done until the clay subsoil has been fully exposed.

When ditching dynamite explodes, it exerts a downward and sidewise pressure that breaks up and packs the soil in the bottom and sides. This packing of the soil collapses and closes small water channels in the subsoil and reduces seepage of water beneath the core.

TYING THE DAM INTO THE SUBSOIL

After the core trench across the wet area has been cleared out, it is refilled with good clay. Usually this good clay can be obtained from the

FIGURE 13. All undesirable materials have been blasted from trench in the boggy area. The tractor is now starting to cut the trench on the hillside. This good clay is used to fill the trench across the bottom.

ends of the hillside core trench. The hillside trenches need to be cut from 4 to 6 feet in depth into the clay to break up underground seepage channels. The depth of the cut can be determined only by examination of the sides of the cut while it is being made.

When the core trench of the dam is cut from the water level on one side to the water level on the other side, the portion that is still open should be refilled with good clay, and then one-half of the length of the dam may be filled in to a depth of approximately 3 feet.

INSTALLATION OF DRAIN

A drain pipe is installed to permit lowering the water level when repairs are necessary, and to provide facilities for piping water to stock-watering tanks or troughs, and to empty the pond completely for removing undesirable species of fish.

FIGURE 14. Joints of cast iron soil pipe are laid in the ditch. Here the line is being straightened and held in place with dirt preparatory to caulking and concreting the joints. The flat valve at the right will be placed later in the bell joint of the drain pipe in foreground.

POSITION OF DRAIN PIPE

Water may be diverted around the other side while the drain pipe is installed. The drain pipe should be installed at the lowest point in the pond so that all the water may be drained. Before the pond is filled, a check should be made to make certain that no low places remain where fish can gather when the water is drawn off. Low areas filled with water make more difficult the removal of all the fish. Therefore low places should be filled in and sloped toward the drain.

DRAIN PIPE LENGTH REQUIRED FOR DIFFERENT HEIGHT DAMS HAVING A TOP WIDTH OF 12 FEET, ALLOWING 3 FEET OF PIPE EXTENDING UPSLOPE AND 3 FEET DOWNSLOPE FROM THE BASE OF DAM.

PIPE LENGTHS			PIPE LENGTHS		
HEIGHT OF DAM FEET	SLOPE 2-to-1 FEET	SLOPE 3-to-1 FEET	HEIGHT OF DAM FEET	SLOPE 2-to-1 FEET	SLOPE 3-to-1 FEET
5	38	48	13	70	96
6	42	54	14	74	102
7	46	60	15	78	108
8	50	66	16	82	114
9	54	72	17	86	120
10	58	78	18	90	126
11	62	84	19	94	132
12	66	90	20	98	138

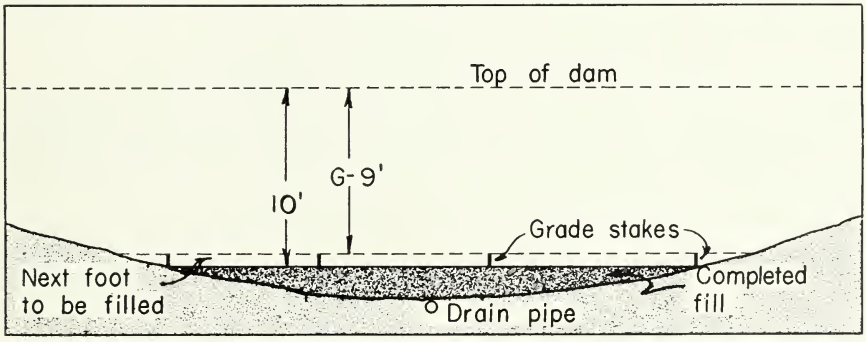


FIGURE 15. Diagram is a side view of incomplete dam, showing grade stakes set for the next foot of fill. "G" is the remaining height of dam to be built above the established 1-foot grade stakes.

The ditch for the drain pipe should be straight and sloped approximately one foot per 100 linear feet.

SIZE OF DRAIN PIPE

The size of the drain pipe depends upon the size of the pond and upon the volume of water coming into the pond. A 4-inch pipe takes approximately 60 hours to drain a one-acre pond that has an average depth of 3 to 4 feet if no water enters the pond during the time of draining. A 6-inch drains the same pond in half that time, while a 12-inch drain requires one-ninth as much time. For ponds with areas up to 3 acres, use a 4-to-6-inch drain. For ponds up to 15 or 20 acres, use a 8-to-12-inch drain.

TYPES OF DRAIN PIPE

After the drainage ditch is dug and given the proper slope, the drain

pipe is laid. There are several different types of pipes adapted to use as drains. Asbestos-cement pipe, commonly called transite, is probably the best type to use because it is very durable, comes in long lengths, and may be obtained in various diameters. Cast iron pipe, with the joints sealed with oakum and lead, makes a very good drain. Galvanized pipe may be used in small ponds and minnow hatcheries.

Terra cotta pipe and concrete tile should never be used as a pond drain pipe because they will crack under slight pressure or movement.

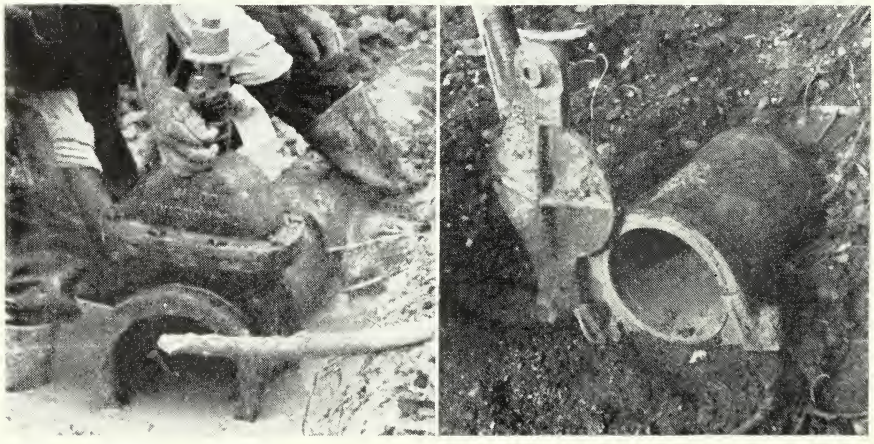
PREVENT SEEPAGE ALONG DRAIN PIPE

Several ponds have had serious trouble from seepage along the drain pipe that slowly and gradually became larger until the ponds had to be drained and the drain pipes fixed properly. Therefore, all asbestos-cement pipe drains and cast-iron pipe, assembled with mechanical or prepared joints, should be anchored in the sides and the bottom by concrete cut-off collars, spaced at 15-foot or less intervals along the pipe to prevent seepage. Clay should be packed around the pipe.

THE TIME AND PLACE TO INSTALL VALVE

The valve may be placed on the drain pipe when it is laid, or it may be installed after the dam is completed. The location of the valve, whether inside or outside the pond, depends upon the type of valve and the type of connections of the drain pipe. If the joints are sealed with concrete collars, the valve needs to be located on the upstream end of the pipe because water pressure may be great enough to start a leak and seepage if the valve is on the downstream end. If the joints of the pipe are leaded or mechanical,

CONNECTING THE VALVE TO DRAIN PIPE



FIGURES 16 AND 17. The brass-fitted gate valve at left is being set into place over the pond end of an asbestos-cement drain pipe. Shown at the right is a brass-fitted shear gate valve. The wedges hold the flap tightly closed.

it is safe to locate the valve on the downstream end, provided, a gate valve is used. The shear gate valve, the flap valve, and the ell with a stand pipe must be placed inside the pond on the upstream end of the drain pipe.

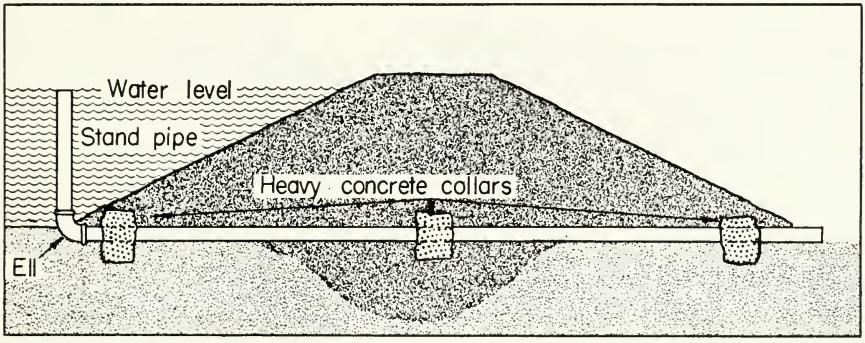


FIGURE 18. Cross-sectional diagram shows how threaded pipe with an ell may be used for a pond drain, eliminating the use of a valve. Heavy concrete collars must be placed at about 15-foot intervals to prevent the pipe from turning and prevent water from seeping along side of the pipe.

After the valve is connected, whether by collar and bolts or by oakum and lead, a heavy concrete footing must be poured around the collar to withstand the pressure that will be exerted when the valve is opened.

WATER SUPPLY FOR LIVESTOCK

Cattle, hogs, and horses should never be allowed to wade in the pond; they trample the pond edges, roil the water, and cause the water to become muddy. The pond should be fenced off to make it inaccessible to livestock.

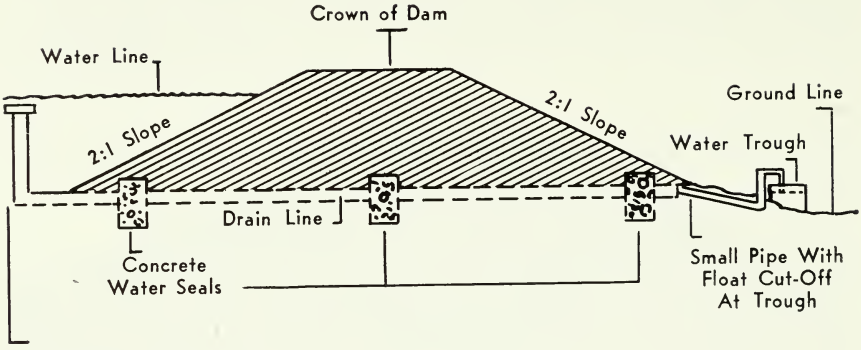
The stock water tank should be located on the downstream side of the dam. The tank or watering trough may be made of concrete, metal, or wood, depending on the desires of the owner. It should be equipped with a float valve to control the flow of water into the tank. Provision should be made for draining the tank during the winter months to protect it adequately from freezing and to facilitate cleaning.

The water line should be laid at the same time the drain pipe is laid. A 1½-to-2-inch galvanized pipe will usually be large enough to carry an ample supply of water for livestock. Protection against seepage should be taken by installing concrete collars spaced at 15-foot intervals.

Outlets for irrigation, fire protection and other farmstead purposes may be installed in a similar manner.

FILLING THE DAM

A good type clay is needed to build the above ground portion of the dam. Best results are obtained when the clay is applied in thin layers and well packed. The clay should be free of leaves, roots and trash.



CROSS SECTION OF DAM
Showing
Water Line And Water Trough For Watering Livestock

FIGURE 18A.

PROPER SLOPE OF DAM

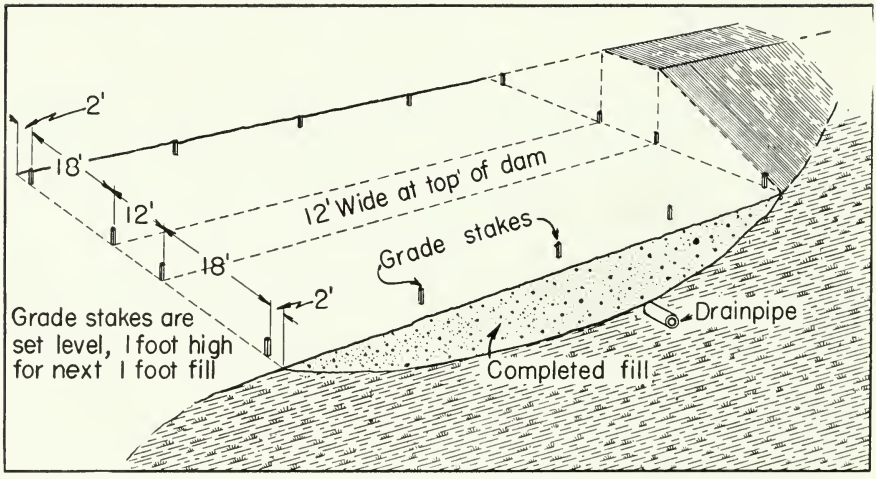


FIGURE 19. Perspective view of Figure 15 shows position of stakes on fill.

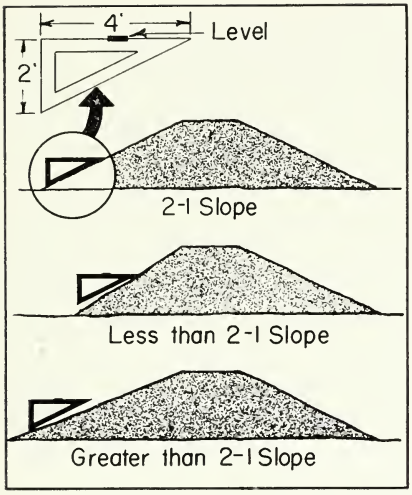


FIG. 20. Diagram shows use of home-built triangle-level that may be used in maintaining the 2-to-1 slope.

Dams up to 20 feet in height need a 2-to-1 slope on both the upstream and downstream side to hold dirt in place and prevent slides when wet. One of the common faults in constructing earth dams is failing to make the base wide enough to allow for adequate slopes and top width. All dams constructed above 20 feet in height must have a 3-to-1 slope. The top width of a dam should be 12 feet if the dam is to be built with large and heavy equipment. If teams and slip-scrapes are used to build the dam, the top width should not be less than 6 feet. When the dam is completed the top width should not be less than 6 feet. When the dam is completed the top should be level from one end to the other. Be sure to pack firmly the topmost 3 or 4 feet of filling to prevent settling of the dam. If heavy equipment isn't used, one can expect a 10 percent shrinkage in new dams.

FREE BOARD

The height of a dam above the water level is known as free board. Ponds that have from one to 3 acres of water should have 2 feet of free board. The ponds that are larger than 3 acres in size should have at least a 3-foot free board because of wind-wave action.

DEEPENING THE POND EDGE

A most serious mistake pond owners made in the past was failing to deepen the edge all around the pond, especially in the upper end. Where water runs out to a feather-edge in depth, weeds are always going to grow. As stated before, underwater weeds in a pond cause an overcrowded fish population and make for poor fishing. Therefore, steps should be taken while constructing the pond to deepen the edges all the way to the upper end. This is done by staking the water line and then cutting the dirt away from inside the stakes until at least 18 inches and preferably 2 feet in depth is reached. If the pond is to be used for irrigation or watering stock, deepen the edges to 3 feet to take care of fluctuation. This excess dirt may be used either to fill other areas where it is too boggy for the tractors to work or to spread above the water line to give a higher bank. In small ponds, a goodly portion of the pond edge may be deepened and the dirt used in the dam. The deepening of the edges slightly increases the area of the pond and volume of water.

THE SPILLWAY

The main cause of dams being washed away after big rains is that the spillways are not wide enough. Since the spillway is the main insurance of the dam, it should be wide enough to take care of the maximum amount of flood water than can be expected. The water should never pass over the spillway at a greater depth than 3 to 6 inches.

Another important and interesting thing to know is that a large percentage of the fish population leave a pond where the spillway is so narrow that the water goes out at great depths. As an example, over 95 percent of the fish left a half-acre experimental pond of the Alabama Agricultural Experiment Station Fishery School during one heavy rain when the water flowed out of the spillway to a depth of 2 feet. Practically no loss of large fish occurred in a nearby pond where the spillway capacity was large enough for the water to pass out at a depth no greater than a few inches.

DANGER OF SCREENS

The danger of putting screens in the spillway is that they invariably become clogged with leaves and trash during heavy downpours. The final result is a washed out screen or flood water over-tops and washes out the dam. Providing adequate width in the spillway offers a much safer and more satisfactory solution. Be certain to construct a spillway wide enough so that the heaviest floods will not pass over the spillway to more than 3 to 6 inches in depth. Screens are needed only during the first year to keep small bream and bass from escaping during heavy rains.

ESTIMATING SPILLWAY WIDTH

A good method of estimating the necessary width of a spillway is to observe the driftwood and trash on the banks of the stream for indications of the highest flood in the area. Measure the width and get the average depth of water that produced this drift. From these measurements, the width of the spillway necessary to handle this volume of water in a thin sheet may be estimated. Suppose, for example, after an extremely heavy rain a stream flooded and left deposits of driftwood on the banks that were 12 feet apart. The average depth of water across this area during the crest of the flood was one foot. This one-foot depth is divided by 3 inches (desired depth of flow in spillway) to give a workable factor of 4. The 12-foot width is then multiplied by 4 to give a spillway width of 48 feet.

Another method to determine the width of a spillway if the drainage area is less than 50 acres is to take the total number of acres and divide it by 2 and add 10 more feet as a safety margin. As an example, suppose that the drainage area is 40 acres. Dividing 40 by 2 gives 20 and adding 10 feet of safety margin gives a spillway of 30 feet in width.

LOCATION OF SPILLWAYS

The hillsides at ends of the dam are natural places to locate spillways. Sometimes a great deal of grading has to be done to get the necessary

width to handle the flood water in a thin sheet. However, this grading is well worth its cost in providing protection to the fish and to the dam. The spillway may be located at one end or both ends of the dam or at a convenient point along the side or sides of the pond.

CONSTRUCTION OF SPILLWAY

The spillway should be paved with rock, concrete, or covered with a good sod. Whatever method is used, the entire width should be level so water will not go out at different depths. All of a concrete spillway should be poured at one time. The sod spillway should have a grade of 0.2-foot fall for each 100 feet to prevent too much erosion. The floor and slopes should be seeded or sprigged to a good permanent grass to reduce erosion. Centipede grass is recommended for Georgia. The Soil Conservationist or County Agent can well advise as to the type that will do best on a particular soil. The edge of the water at the spillway should be riprapped with stone or rocks.

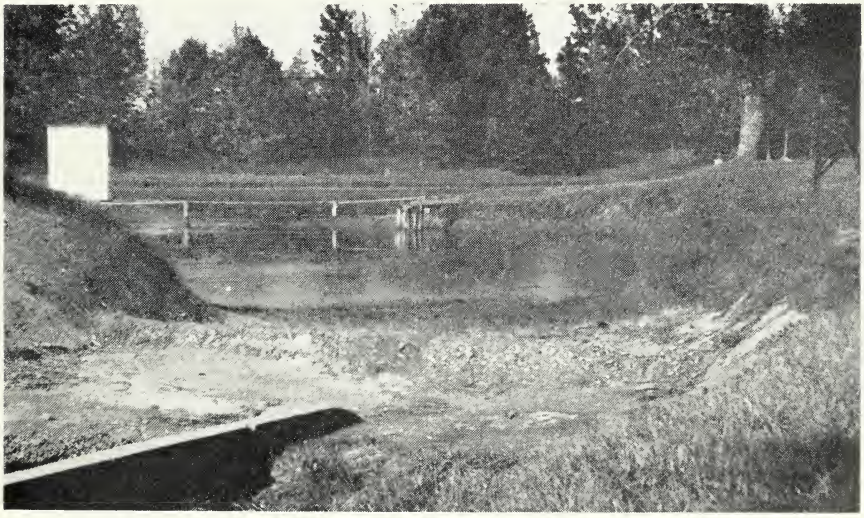


FIGURE 21. This concrete spillway for a 1.3-acre pond has a low wall across it to obtain desired water level in the pond. The entire floor is paved to prevent erosion and end of dam is faced with concrete to prevent flood water damage.

DIVERSION DITCH

It is impractical to fertilize and manage ponds for high fish production where there are excessive amounts of water entering and leaving the pond. Ponds built on sites with too large a drainage area become flooded after heavy rains and often stay muddy most of the year. If the topography of the land is such that a diversion ditch may be constructed around one or both sides of the pond, the water may be controlled for complete utilization of the fertilizer and complete control of the fish population.

FIGURE 22. A diversion ditch is built on hillside to by-pass excess water around the pond. This ditch is sodded to prevent erosion.

DIVERSION DITCH AND DAM

FIG. 23. A pipe with a valve is used for controlling the water entering the pond through the diversion dam.

Plan the diversion ditch and dam prior to constructing the dam, since some of the clay from the ditch may be used in building the dam. In planning a diversion ditch for a pond, the first thing necessary is to locate the site for the diversion dam for collecting the water in the channel before it enters the pond. The diversion dam must be located at a height above the water level along the old water channel to allow 0.2-foot or more of fall per 100 linear feet of ditch around the side of the pond. The diversion ditch is then laid out from the diversion dam around one side of the pond to a safe distance below the main dam to prevent damage.

PREVENTING EROSION OF DAM

Wind-waves are often large enough on big ponds to cause severe erosion above and below the water line. Large rocks or stones laid along the dam approximately a foot above and below the water lines will prevent erosion of the dam. If rocks are not easily obtainable from a nearby source, a concrete apron from 4 to 6 inches thick extending above and below the water line the length of the dam will serve the purpose.

A log wall along the edge of the water of the dam will break the waves and prevent erosion. If logs are used they should be at least 10 inches in

FIGURE 24. Water line riprapped with rocks 1 ft. above and 1 foot below water line.

diameter and as long as you can get them. The logs are held in place by driving stakes on each side, or by driving stakes and tying the logs by means of wire or cable to the stakes.

SODDING DAM AND EDGES

It is wise to spread a thin layer of top soil over the dam, with the exception of the portion that will be covered with water, and plant grass upon it by seeding or sprigging.

In Georgia, centipede grass has been found to be the best grass to sod the dam and the pond edges. The upkeep of this grass is approximately one-half that of other grasses. Centipede grass is thick sod grass that spreads by runners and does well on moist to dry soils. It seldom grows to a height of 6 inches and requires very little mowing. It is especially good for erosion control. For best results, fertilize it well but do not use heavy applications of nitrogen. Where ponds are located in pastures centipede grass should not be used as it will replace more desirable pasture plants.

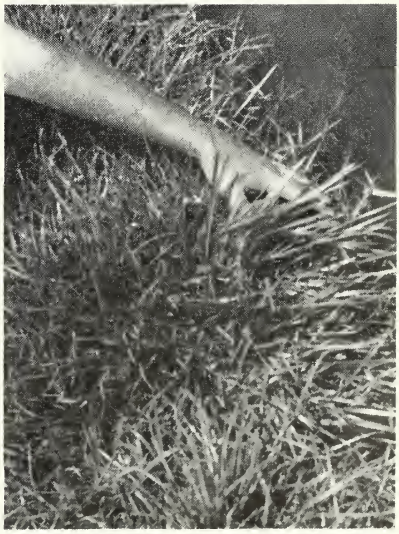


FIG. 25. Shown here is a pond edge sodded with centipede grass.

Second to centipede grass for sodding dams is bermuda grass. The main objection to bermuda is that it sends runners into the water sometimes for a distance of 3 feet, forming a thick sheath or mass of grass where small bream hide.

KILLING ALL ROUGH FISH

Before the drain valve is closed and the pond begins to collect water, the

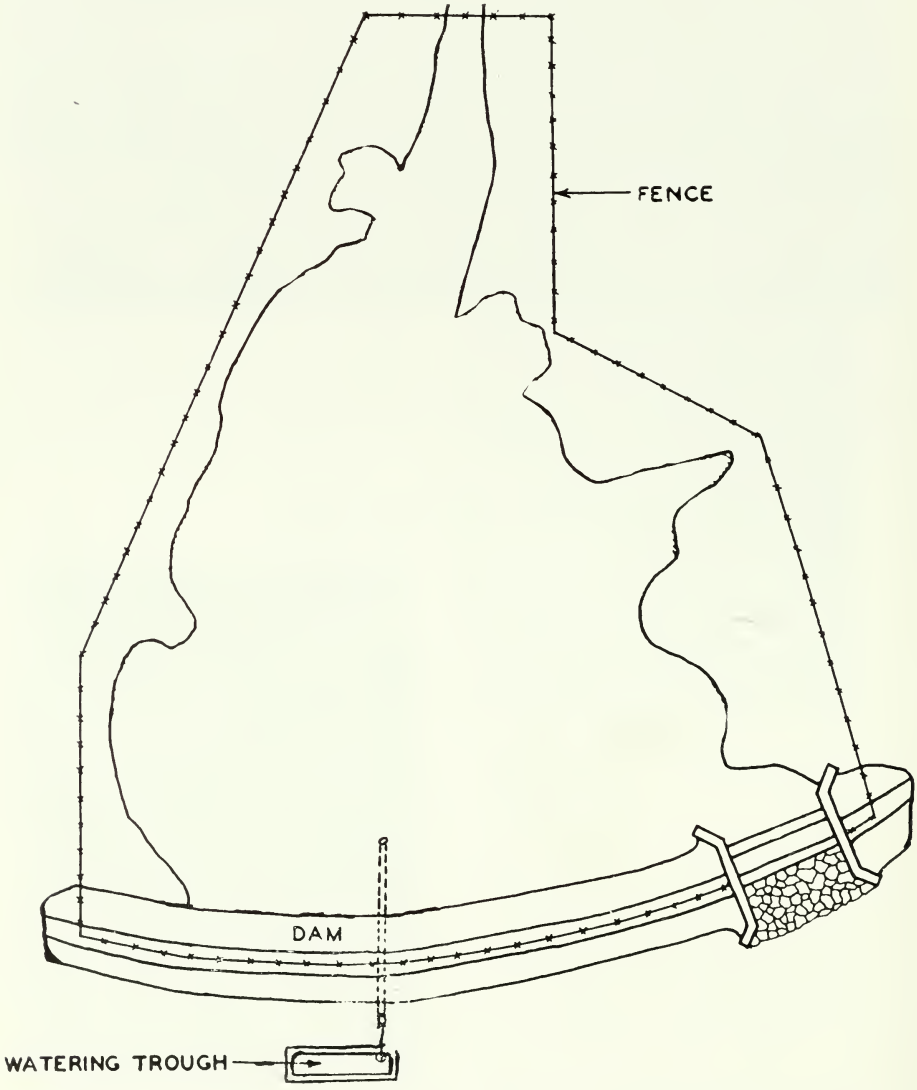


FIGURE 26. Drawing of assumed lake showing how pond should be fenced. Notice spillway is placed to side to release water sufficiently downstream to prevent water current from back washing levee.

little branch or spring stream should be poisoned to kill all undesirable fish such as suckers, carp, catfishes, perch, and shad. In very small streams, as small as one foot in width and only a few inches in depth, there are nearly always found a few suckers and catfish. The pond should contain only those species secured from the hatcheries.

FILLING THE POND

Because filling the pond is the main thing, I repeat these precautions: The pond should be constructed during late summer or fall, so the pond will be ready for fish during the fall and to prevent bushes and weeds from covering the pond area again. If the pond is constructed at any other time of the year, the pond should not collect water until early fall because with no fish the owner will not want to fertilize the pond. Therefore, underwater weeds will occur if the pond is full of water and not fertilized. With no water in a pond that was constructed in the early spring, bushes will grow and will have to be removed before the pond is filled; however, the removal of bushes is cheaper and easier than ridding a pond of underwater weeds.

GAMBUSIA MINNOWS (MOSQUITO FISH)

Gambusia minnows help to control mosquitoes the first year. After the first year they are not needed. They can usually be obtained from old ponds that have shallow edges and weeds. Try to secure 100 gambusia minnows for each acre of the new pond. Do not add golden shiners (roaches) or the gizzard shad as they will become too large to be eaten by the bass and are of no value for human consumption.

FLOATING TRASH

A few days after the pond has been filled, the floating trash will be blown to the banks. This trash should be removed with forks or rakes to make mosquito control by the fish more effective.

CHAPTER 5

STOCKING

IMPORTANT THINGS TO KNOW BEFORE STOCKING

Of first importance before stocking a pond is knowing the size of the pond to the nearest one-tenth of an acre. Every pond should be surveyed for two reasons: (1) To stock the proper number of fish so they will grow to a large size in a comparatively short time. (2) To know how much fertilizer should be applied each time so you will not supply too much nor too little with each application.

COUNT THE FISH THAT ARE TO BE STOCKED

The number of fish added to a pond should actually be counted to get neither too many nor too few. This can be done without injury to the fish, by using a dipper and counting the fish as they are poured into the pond. It is just as important to get the proper number of fish to reach a high production as it is to plant corn properly to produce corn of a high yield.

USE ONLY HATCHERY REARED FISH

All your stock fish should be hatchery reared fish that are free from diseases. Wild fish secured from a stream, frequently are infected with one or more kinds of diseases. As an example, fish captured from the Chattahoochee River during the year 1951 by several fishermen were stocked in a one acre pond. Within 3 months, most of the fish died from tail-fin rot, eye-fluke, fungus, and anchor parasites.

The fish used to stock a pond should all be fry or fingerlings size.

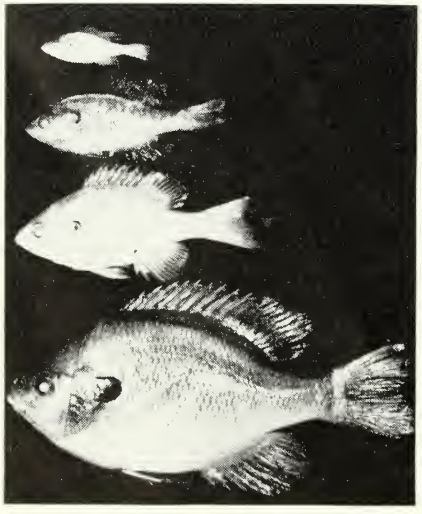


FIGURE 27.—Stocking with adult fish vs. stocking with fingerlings. The three bluegills at the top represent the relative average sizes after 1 year (0.06 ounce) 2 years (0.4 ounce) and 3 years (0.8 ounce) in a pond stocked with adult bluegills, crappie, and bass. The fourth bluegill shows average size (4 ounces) reached in 8 months when the pond was stocked with the correct number of fingerling bluegills and bass.

ADULT FISH STOCKING

The stocking of adult fish in ponds is not satisfactory because certain species usually become over-crowded, while other species may fail to reproduce.

MIDSUMMER STOCKING OF BLUEGILLS IN FISH PONDS NOT DESIRED

In seventeen experiences, ponds stocked with bluegills during midsummer and with bass the following spring were found to be over-crowded with bream to such an extent that both bream and bass had stopped reproducing. These ponds furnished practically no fishing.

The main problems in raising fish in ponds are as follows:

(a) Production of fish food.

(b) Management of the fish population so that the correct number are present to efficiently utilize the food produced. In a well managed pond 70 percent by weight, or higher, of the fish population will consist of edible size fish.

RESULTS OF OVERSTOCKING

One of the most popular misconceptions is the belief that placing vast numbers of fish in a pond will increase fishing. Some people, it seems, desire 50% fish and 50% water. In some respects as to food supply, fish are no different from livestock, and a pond (an aquatic pasture) is just like a terrestial pasture, capable of producing so much food for so many livestock. If we had 2 ponds just alike and stocked one with 1,000 fish and the other with 10,000 fish, and drained them after a year, we would find that the total pounds of fish recovered from both ponds would be about the same. Except that the pond having 1,000 fish would have catchable and edible size fish, while the over-crowded pond would have stunted or runted fish.

RESULTS OF UNDERSTOCKING

An understocking of bass cannot prevent an overpopulation of bluegills. When bass are too few, the early-hatched bluegills grow rapidly until they reach the capacity of the pond and stop growing. These halfgrown bluegills, or intermediates, are large enough to multiply. Yet they are not big enough for the frying pan, and they are too big for the bass to eat; therefore, neither bass nor fishermen reduce the bluegills to a reasonable number. The bass will lay eggs, but fail to reproduce because the thousands of half starved bluegills eat the eggs of the bass. Consequently, fishing is poor because the few bass have more than they need to eat and the bluegills are too small for the table.

An understocking of bluegills is also a mistake. A few adults placed in the pond cause an overpopulated condition of bluegills. A single pair may

raise 5,000 to 20,000 fingerlings or 3-inch fish. Since a pond can create only so much food, even though it is fertilized, the pond cannot have enough food to grow such large numbers to large size bream. It is well to remember that no more than 1,500 bluegills can reach usable size in a properly fertilized one-acre pond.

MANAGE YOUR POND AS YOU WOULD A CORN CROP

The primary purpose of managing a pond is to produce good fishing. To provide good fishing, the pond must be stocked and managed in such a manner that the maximum number of fish will be large enough to catch and large enough to eat. The small fish should be 30 percent or less of the total weight of fish to take the place of those caught. If one allows most of the weight of fish in the pond to be tied up in small undersized fish, one might as well stay at home or at work, as very small fish will be one's catch. One can produce poor fishing in several ways: (1) By stocking too many fish; (2) stocking too few fish; (3) leaving bass out of the stocking combination; (4) not stocking the bluegill bream; (5) improper construction resulting in many underwater weeds; (6) not removing enough fish annually from the pond; (7) stocking with adult fish; (8) improper or no fertilizing if stocked for a fertilized pond; (9) putting in fish that are not known to be suitable, and (10) allowing too much water to pass through the pond; (11) failing to poison out the wild stream fish before stocking with hatchery fish.

Quite a few people seem to think pond waters can be stocked in any way, and nature will overcome all obstacles. It does not work out. Incorrect stocking is the chief cause of poor fishing in most ponds and lakes. There are a hundred ways to stock fish ponds to assure failure, but only a few ways to assure successful fishing.

PROPER SPECIES FOR NEW PONDS

In order to produce good fishing, the pond must be stocked with the proper kinds and numbers of fish. There are several species of bream, as there are several species of cattle. There are only a few species of cattle that are considered good beef types, while there are several species that are considered scrub types. The scrub type will eat as much food as the good beef type, but the scrub type will not put on as much weight per ounce of food consumed as will the good beef type. After careful study of all the bream, biologists consider the bluegill "the beef type". It is able to sustain itself better year after year than other species of bream. By the end of the first year, if properly stocked, bluegills average one-quarter of a pound in weight.

Largemouth bass should also be raised in all ponds in Georgia, since their presence has been found necessary to prevent a pond from becoming overcrowded with small bream. By the end of the first year, if properly stocked, the bass average one pound.

FOR BEST RESULTS IN CATCH, STOCK WITH ONLY BLUEGILL AND BASS

One of the main purposes of a pond is to enable the fisherman to catch as many fish as possible during each hour of fishing effort. Another popular and erroneous idea is to stock the pond with every possible kind of fish. Such persons assume if they cannot catch bass, they should be able to catch bream; if not bream, then crappie; if not crappie, then they feel they should be able to catch catfish or some other species. They are wrong. Ponds stocked only with bass and bluegills give better catches than those stocked with three or more varieties. This means that every time an additional species of fish is added to the bass-bream ratio, one reduces the number of fish that can be caught per hour of effort. This has been proven every time over a period of several years.

Ponds stocked with species other than largemouth bass and bluegill bream very seldom produce continuous fishing. No other combination is as simple to manage as bass and bluegills, and experimental results at the Alabama Agricultural Experiment Station Fisheries School in over 100 ponds over a period of 20 years have proven no combination of fish as successful.

Ponds that are improperly constructed, incorrectly and insufficiently fertilized, will get out of balance. If not enough fish are removed yearly, ponds may become overpopulated by bream or by bass. Either upsets the balance of the pond and causes poor fishing success.

Every new pond before the end of its second year of life should be checked by a Fisheries Biologist to see if the fish ratio is or is not in balance. There are certain steps to take to adjust the ratio of one species to the other if the ratio is out of balance. The sooner the condition is known the easier and quicker it is to correct.

STOCKING RATIO

The correct stocking ratio per acre of water is given below for both fertilized and unfertilized ponds. Small unfertilized ponds have proven unsatisfactory in Georgia because they support a relatively small number of edible size fish, and usually become filled with weeds if the pond doesn't remain muddy most of the time.

COMBINATION A. Bluegill Bream and Largemouth Bass

Fertilized Pond: 1,000 Bream fingerlings added during fall or winter. 100 Bass fingerlings added same fall or winter, or 100 fry the following spring.

Unfertilized Pond: 400 Bream fingerlings added as above. 30 Bass fingerlings or fry added as above.

COMBINATION B. Bluegills, Shellcrackers, and Largemouth Bass

Fertilized Pond: 850 Bluegills added as in previous section. 150 Shell-

cracker fingerlings added the same time as bluegills. 100 Bass fingerlings or fry added as in the previous section.

Unfertilized Pond: 340 Bluegills added during fall or winter. 60 Shellcrackers added the same time as bluegills. 30 Bass fingerlings added during same fall, or 30 Bass fry added the following spring.

WHY BREAM AND BASS MUST BE STOCKED

In order to get a yearly high crop of desirable size fish, the pond must be stocked with a type of fish that feeds on insects, microscopic plants and microscopic animals. The bluegill is the sole forage fish. Also, the pond must be stocked with fish that feed on small fish. The largemouth bass is the sole carnivorous fish.

If a pond is stocked with only shellcracker bream and bass, the bass will eat practically all the shellcrackers within 3 years, but if the shellcrackers have the bluegill bream added as a buffer to help supply bass food, then the shellcrackers will be able to reproduce. It is not advisable to have the number of shellcracker consisting of more than one-fifth of the total bream population.

Golden shiners, carp, or gizzard shad **should not be placed** in ponds intended for the propagation of game fishes. They will overpopulate the pond and use the food the game fish should get. Also, the two latter species become too large for the bass to eat.

CHAPTER 6

FERTILIZATION[1]

IMPORTANCE OF FERTILIZING PONDS

One of the most important factors in fish management is that of providing enough food.

Fertilization of pond waters is the only practical method known by which the weight of fish that the pond can support may be **increased.** Properly fertilized ponds in Georgia support 4 to 20 times as great a weight of fish as unfertilized ponds; consequently, fertilized ponds give much better fishing.

Three things are accomplished when a pond is fertilized. First, it increases the production of food for fish; second, it controls submerged weeds; and third, it makes fishing more successful.

There are two types of ponds that cannot be fertilized economically—those that stay muddy and those through which excessive amounts of water flow during the growing season. Ponds of the latter type can often be fertilized after the spring rains are over or during dry periods. For best results, there should be little or no overflow from the pond.

HOW FERTILIZING A POND INCREASES FISH PRODUCTION[2]

The fish do not eat the fertilizer; the fertilizer is rapidly dissolved by the water. These nutrients added to the water cause a growth of microscopic plants called algae. The microscopic algae provide food for insect larvae and water animals that are in turn eaten by the forage fish, such as bluegills, catfish, and small crappie.

Nearly everyone is aware that fish eat fish, crayfish, worms, bugs and other animals large enough to be seen and known, but they do not know of the hundreds of species of plants and animals, microscopic or slightly larger in size, that are just as essential to the daily diets of fish as the larger items. They constitute the food eaten by the young fry of all types of fish and by some fish throughout their lives. These small plants and animals are called **plankton** by biologists. In order to distinguish between the plants and animals, scientists have designated the plants as **phytoplankton** and the animals as **zooplankton.** The phytoplankton consist of algae and bacteria. The zooplankton consist most frequently of protozoans (one-celled animals), rotifers (wheel animalcules), and crustaceans (water fleas, copepods, ostracods, etc.). Next in size, we find the benthos organisms that are also known as bottom fauna. This group consists of midge larvae and pupae, also called blood-red worms; large crustaceans such as scuds, the nymphs of

[1]Fertilization of ponds is taken mainly from Bulletin 254 of the Alabama Polytechnic Institute Agricultural Experiment Station Fisheries School.

[2]The information was taken largely from Bulletin No. 24 Utilizing Stock Tanks and Farm Ponds for Fish—Texas Game and Fish Commission.

dragon flies, damsel flies, may flies, etc. The bottom fauna feeds upon the phytoplankton and zooplankton, and is in turn eaten by the forage fish, which are in turn eaten by the bass and other carnivorous species. The life cycle within a pond runs in a definite order from smaller to larger organisms, and each succeeding group depends upon the preceding for the synthesis of its food supply. The abundance of these organisms is dependent upon the amount of available inorganic matter, as nitrogen, phosphorous, and potash in the water.

COMMERCIAL FERTILIZER PREFERRED

Better results are obtained in fish production from the use of inorganic or commercial fertilizer than from the use of organic types as manures, cottonseed meal, and hay. Great care must be exercised in the use of organic fertilizers as a serious depletion of the oxygen content of the water is likely to result in death of the fish. Using proper formula and amount of commercial fertilizer produces a quicker effect, is more dependable in shading the bottom, thereby preventing growth of undesirable underwater weeds (pond moss), and is more productive than the organic types. The organic types have a tendency to support the undesirable pond scums, which may have a disagreeable odor.

Feeding fish with stale bread, grain, or other foods is a great deal less efficient than fertilizer and is really not worth the effort or expense. Practically the only benefits that might be derived is the pleasure of watching the fish eat.

THE KINDS AND AMOUNTS OF FERTILIZER TO USE PER ACRE

The pond (an aquatic pasture) needs certain amounts of nutrients to give the best results. The fertilizer formula found to give the best results is an 8-8-2; that is, a formula that contains 8 percent of nitrogen, 8 percent of phosphate, and 2 percent of potash. Each surface acre needs 100 pounds of fertilizer at each application. This formula is sometimes difficult to find ready mixed and is usually very expensive. It is usually necessary to buy another formula and adjust it. By adding sodium nitrate or ammonium sulphate, most commercial fertilizer can be made the equivalent of an 8-8-2. Sometimes it will have a little more potash than is necessary, but that will not matter.

To 100 pounds 6-8-4 mixture, add 10 pounds of sodium nitrate or 5 pounds ammonium nitrate.

To 100 pounds 6-8-6 mixture, add 10 pounds of sodium nitrate or 5 pounds of ammonium nitrate.

To 100 pounds of 4-8-4 mixture, add 20 pounds of sodium nitrate or 10 pounds of ammonium nitrate.

When the 6-8-4 fertilizer is not available, or when large amounts of fertilizer are required, the following mixture is recommended per acre of water.

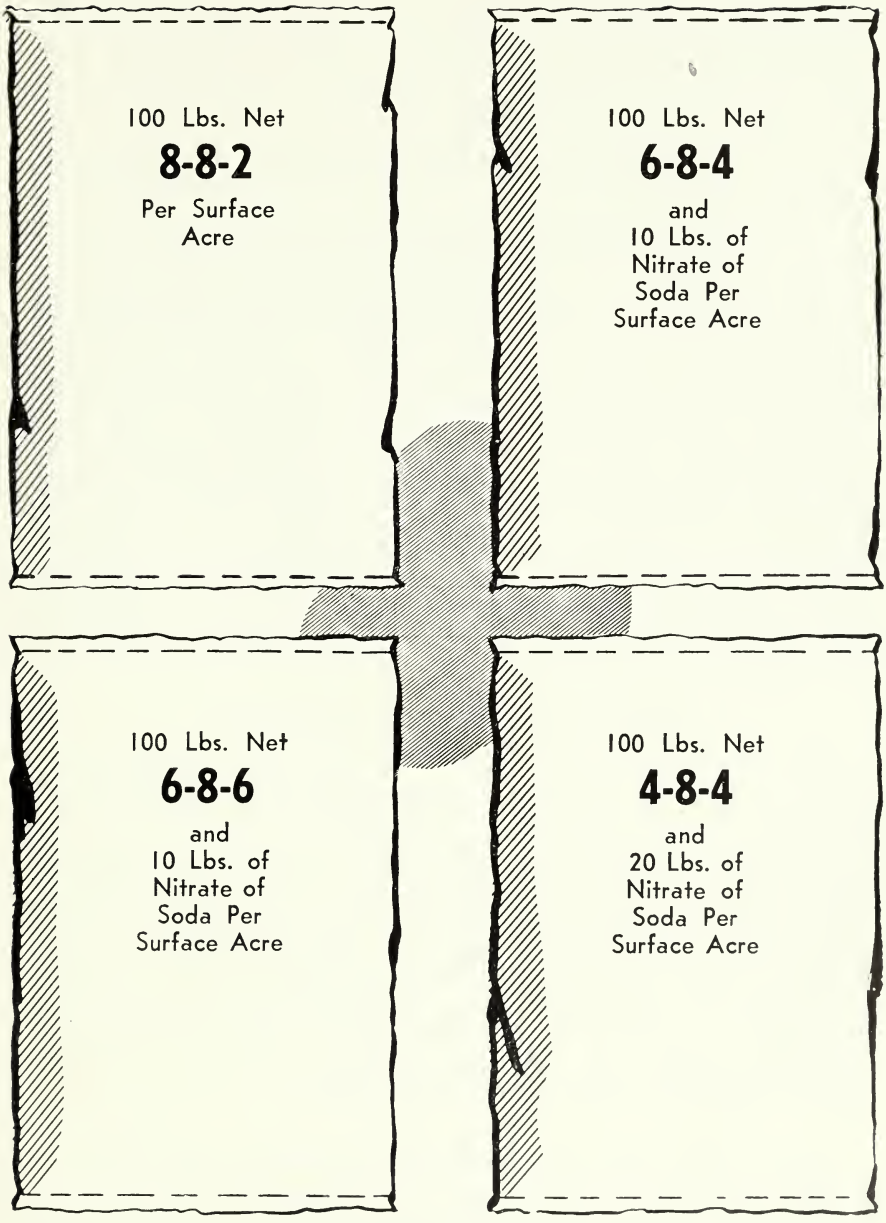


FIGURE 28. Formulas and amounts of fertilizer to use per surface acre during each application.

40 pounds sulphate of ammonia

60 pounds superphosphate (16%)

5 pounds muriate of potash

15 pounds finely ground limestone.

These materials may be mixed before applying, and used immediately or stored several months.

WHEN TO FERTILIZE AND HOW OFTEN

The first application of fertilizer should be made during the first warm weather of spring (usually March in Georgia). Under normal conditions between 24 and 36 hours after fertilizer has been applied, the water develops a good growth of algae. That is, the water will appear green or brown due to the growth of microscopic plants. Sometimes a pond may not turn green or brown after the first application of fertilizer due to the lack of carbon dioxide. Make weekly applications until the greenish or brown cast appears. Subsequent applications should be made whenever the water begins to lose this green or brown color and becomes clear enough for the bottom of the pond or for your hand to be seen at a depth of 12 to 18 inches of water. This usually requires an application every 3 to 5 weeks. The last application should be made when the water begins to turn cold. This is usually in the latter part of September or sometime in October. The pond should receive from 7 to 15 applications of fertilizer each year.

HOW TO APPLY THE FERTILIZER

If the pond is one to 3 acres in size, the fertilizer may be broadcast from the bank into the pond by going all the way around the pond. If the pond is larger than 2 acres, the fertilizer may be applied easily from a boat. Place a few short boards across the front end of the boat and place a sack of fertilizer upon them, and let the fertilizer pour out in a thin stream while the boat is paddled or driven around the edge. As an example, if you have a 5 acre pond, you will need to apply 500 pounds of fertilizer at each application. Let each 100 pounds of fertilizer be applied each one-fifth the distance around the pond. It is best placed in water from 2 to 4 feet in depth. The movement of the water caused by winds will circulate the fertilizer throughout the pond. The winds blow the top water in one direction, causing an undertow in the opposite directions; therefore, there is no need to criss-cross the pond while applying the fertilizer.

COST PER ACRE TO FERTILIZE THE POND EACH YEAR

Costs of fertilizing ponds vary, but the cost is from $15.00 to $25.00 per acre each year on small ponds, and only slightly higher on larger ponds. Ponds that receive nutrients from fertilized pastures certainly will need less fertilizer than a pond that does not receive any nutrients. Where one catches from 150 pounds to 250 pounds of fish from each acre, the cost of fertilizer is more than justified in recreation and food.

DANGER OF NOT FOLLOWING DIRECTIONS IN FERTILIZING

It is undesirable to fertilize irregularly with the intention of reducing the amount recommended. Weeds may get the upper hand and the fish populations thrown out of balance so that it will be necessary to start over again.

Applying several hundreds of pounds of fertilizer per acre at one time has been known to cause many fish to die. Applying more fertilizer than the recommended amount will not greatly increase the poundage of fish produced and **sometimes the poundage produced is lessened.** One should not overfertilize, as the production of too many of certain microscopic organisms will be detrimental to the fish by removing too much oxygen from the water during the night and on cloudy days.

CHAPTER 7

FISHING THE POND

IMPORTANCE OF HARVESTING THE FISH CROP

Removing as many fish as possible by fishing is just as important as selecting a suitable pond site, good construction, correct stocking, and proper fertilization. If the pond produces 500 pounds of fish per acre, it is very necessary to remove (by fishing) all the fish possible in order that those hatched the present year may get enough food to grow to a large size by the next year. Every pound of fish removed leaves more food for the remaining fish. Take notice of the fact that the more fish removed, the easier the fish are to catch; and the smaller the number removed, the more difficult the large ones are to catch. Consequently it is impossible to "fish out" the pond.

WHEN TO BEGIN FISHING

The bream are stocked during the fall and the bass the following spring. Be certain to start fishing one year after the bass have been stocked. The bass will average one pound in that time. Remember not to fish at all until then because while fishing for the bream, which may be large enough, one cannot help catching, even with worms, the little bass. None of the bass should be removed until they reproduce. The removal of bass before they reproduce will throw the pond out of balance. When the water becomes 65° F. the males fan out nests, and when the water becomes 70° F. and remains at or above 70° F. for a couple of days, the bass will spawn.

WHAT IS MEANT BY "BALANCE" IN A POND

A pond is in a balance when it has the proper number of bream (forage fish) for the fertility of the water, and the proper number of bass (carnivorous fish) to grow and control the bream. Balance also means the proper number to produce desirable size bream and bass.

IMPORTANCE OF INTENSIVE FISHING

All ponds should be fished regularly and intensively for each species of fish in the pond each year for recreation, food, and balance, and to obtain full value of the fertilizer expended. If only bass are fished, an overpopulation of bream will result and fishing will decrease. If only the bream are fished, overpopulation of the bass will result and again fishing will decrease. Three to 7 pounds of bream should and can be caught for each pound of bass. Most pond owners need not worry about fishing each species properly as there will be approximately 20 bream fishermen for every bass fisherman.

Failure to keep the pond properly fished may result in a condition similar to that produced by overstocking. This appears to be the common fault in farm pond management that has caused many ponds in Georgia to have

poor fishing. Fish should be harvested as they mature, just as other crops, in order to obtain maximum yields. If the fish are not harvested, the ponds will become overcrowded and the growth rate reduced through lack of food.

It is interesting to know that ponds are never ruined by over-fishing when bass and bream are fished, because there are always many fish of spawning size left. A very strong effort should be made to remove as many bass and bluegill bream of legal size as possible so that the balance between the two species may be maintained.

DON'T THROW BACK THE SMALL FISH

Don't throw back the little fish because by reducing the small ones the remaining little fish will be able to get more food; thereby, they become adults sooner. The faster fish grow, the easier they are to catch. The slower fish grow, the more difficult they are to catch. After a fish starves for a while it gets out of the habit of eating worms and hesitates about taking worms as food.

CATCH ALL THE FISH YOU CAN WHILE THEY ARE ON BEDS

Fish are very prolific. A bluegill bream, one-half pound in weight, will form and lay as high as 51,000 eggs at one time. Then, according to the food supply, it may spawn two more times during the same year. A bass may lay as high as 40,000 eggs at a time, but very seldom spawns more than once a year. Therefore, one can readily see that fish should be caught while they are upon their beds during the spawning season for three reasons: First, they are easiest to catch during the spawning season; Second, the adult fish need to be harvested; Third, if it were possible to capture all adults with the exception of one pair, this one pair of fish would produce enough young fish to replenish the pond.

THE DOUBTERS

There are, of course, doubters particularly among confirmed bass fishermen and confirmed bream fishermen. They hold their opinions because of the long history of restrictive measures and the vigorous educational programs conducted to assure their acceptance. Only time and careful observation will convince the doubters that liberalized fishing can and should be maintained.

SPECIES OF LIVE BAIT TO USE AS FISH BAIT

The goldfish, commonly known as Baltimore Minnow, St. Louis Minnow, or Indiana Minnow, is the hardiest of all minnows and requires the least amount of oxygen for survival. Goldfish will not turn into a carp any more than a cow will turn into a horse. The main reason the goldfish is one of the best to use is that if a pair get off the hook they cannot reproduce in a properly managed pond. The goldfish lay their eggs upon any over-hanging grasses or weeds near the surface of the water. The eggs are not guarded and are in wide open view of all other species of fish which will eat these eggs. Experiments at the Alabama Polytechnic Institute

fishery school in more than 100 ponds over a period of 20 odd years where goldfish have been used as live bait have shown they have never been able to reproduce in ponds containing bluegill and bass. Adults usually have been found, but never have there been found a reproduction of young goldfish.

The minnow called the "Fathead" or "Toughie" is all right to be used as live bait in ponds. Next to goldfish they are the most desirable commercial minnow to use; however, they cannot be easily handled in hot weather and are relatively short-lived.

SPECIES OF LIVE BAIT

The golden shiner (roach) can and will reproduce in great numbers if a pair happen to get off the hook. Several pond owners who allowed the use of golden shiners as live bait in their ponds were dismayed to find, during pond analysis, that approximately 50 percent of the fish population consisted of golden shiners. These fish were consuming food that the bluegill bream should have been getting, thus the fish and the fishing became poor.

The species commonly called "Branch Minnow" will oftentimes consist of small carp, small suckers, and small shad. These species will cause the same harmful effects as the golden shiners.

PART III

CHAPTER 8

HOW TO FISH IN PONDS

It is depressing to admit that only a small number of fishermen catch fish. At least 90 percent of the people that go fishing don't know how to fish. Following a few simple rules will increase your catch many times.

BASS FISHING

Go fishing for bass early each year to enjoy the finest sport to be had. Go as soon as the water warms up to 55° F., when largemouth bass become more active and begin to look for food such as minnows, small bream, frogs, crawfish, and nymphs of aquatic insects. Fish during the warmest part of the day, between 10:00 a. m. and 4:00 p. m., and on the warmest and sunniest days. Look for the bass in shallow to medium depth water, from 2 to 10 feet in depth and on mud bottom near deeper water. Equipped with warm clothing and a thermos jug filled with a favorite beverage, the fisherman is ready. Most of the bass lures will catch fish if used at the right time, in the right place, and if handled or "presented" properly. One bit of advice—however—keep the lure in the water and retrieve it **very slowly.** The bass have been off their feed during the winter and now have ravenous appetites. The water is still cold and the bass are sluggish.

Largemouth bass thrive in ponds, feeding on young fish, crawfish, and aquatic and terrestrial insects. The males begin fanning out nests when the water temperature reaches 65° F. A temperature of 70° F. is required before spawning begins and a temperature of 80° F. before any noticeable growth is produced. During the spawning time and until the water gets up to 90° F., use the medium depth lures in the day and surface lures early in the mornings and late in the evenings.

Fall and early winter fishing for bass is usually as good as it is in the springtime. The metabolism of bass slows down in cold water 55° F. and less, and in hot water 90° F. and above. In the very early spring and late fall and early winter, fish for bass in deep water. From mid-springtime, summer, and early fall, fish in water less than 5 feet deep. The bass feed on the small bream which are near shore.

The world record bass (weight 22 pounds and 4 ounces) was caught in South Georgia, Montgomery Lake, by Mr. George Perry.

A few proven "fish catching lures" will be mentioned. Spoons, such as the Johnson Silver Minnow, Jakes Bait, and Hawaiian Wiggler, and bass plugs as the Heddon River Runt, Heddon Tiny Torpedo and Paul Bunyan's Ole Olson, are among the best and should be used with pork rind or pork chunk. The pork rind gives a spoon or plug "life" and the chunk allows it to travel deeper with a slow retrieve. South Bend's Super Duper, Whopper Stopper, and the Bomber are good Buck's Spoonplugs and the Rooster Plugs are also good.

The "twitch" or "jerk" method of retrieve is probably unexcelled in bait casting with a spoon. After the spoon has been cast to a likely looking spot, it is allowed to settle near the bottom. Then actually bring in the lure with short "twitches" of the rod tip and the reel is used only to take up the slack line. The sequence should go about like this: make cast, allow spoon to settle near or even on the bottom, twitch rod tip, wait several seconds while spoon wobbles toward bottom, then take up slack with reel and repeat until lure has been brought in. Please remember, when fishing in the spring the water is cold, bass are slow, and the retrieve MUST BE SLOW. Never retrieve any lure at a monotonous rate. Try to make the lure imitate a minnow behaving or misbehaving like a crippled fish.

Spinner fishing is more difficult than either spoon or plug casting, but may be more effective under certain conditions. A few good spinners are the Al Foss Frog and Shimmy Wigglers, the Brooks No. 7, the Partington, and the Hugger Natural Bait Spinner. Spinners will catch bass in open water very well. Because spinners will immediately start sinking when they hit the water, it is important to start the retrieve before or as soon as the lure touches the water by pulling back on the rod just before the cast has been completed. When casting always fish into the sun (facing the sun) on clear and calm days. In this way, shadows will not be cast ahead. Remember to wear dark clothes because white clothing and objects are more easily noticed by the fish. Also, sudden movements will frighten bass.

SELECTING THE LURE

This is a problem for the experienced fisherman, as it is for the novice. Sometimes it pays not to use the lure very much that gave the most success the preceding year, as bass seem to learn to leave it alone. If no fish are caught after fishing for an hour or so, change lures; however, don't spend too much time changing lures—give each one a good work out. Fish in shallow water, medium depth and deep water, with a change of pace in retrieving. In likely places, try several times before passing on.

FISHING ACCORDING TO BAROMETRIC PRESSURE

In all water temperature, game fish go deeper with a falling or low barometer or in stormy weather conditions and to shallower water with a high or rising barometer. Game fish seem to feed and strike better on a rising or high barometer.

TEMPERATURE OF WATER AT WHICH BASS DIGEST FOOD THE FASTEST

Fish are cold blooded animals and their bodies take the same temperatures as the water in which they swim. Water temperatures determine the body functions such as activity, digestion, spawning, and feeding habits.

Largemouth bass spawn when the water temperature is 70° F. They will consume more food and be able to digest it faster when the water temperature is between 75° F. and 80° F.; therefore, their meals are closer to-

gether and one's chances of catching bass are better, unless there are large numbers of small fish available for food in the pond.

DO NOT MAKE THE "SIDE SWIPE" CAST

The best method of bait casting is the overhead cast. Hold the rod in a straight position on the backward and forward cast. It is very fascinating to see how true to the target the lure will fly. During both forward and backward strokes it keeps the lure on a perpendicular plane with the arm and rod in a sweeping radius. The "side swipe" method of casting is a very dangerous way to manipulate a rod. The "side swipe" makes easy the hooking of a companion.

Write one of the leading bait companies, as Heddon, South Bend, etc., for their catalog in which one will find principles on how to cast and how to handle lures.

SHORT CASTS ARE BETTER

It is much easier to set the hook in short casts. The possibility of the fish snagging the hook and line is much less with short casts. Greater accuracy is achieved in the short casts, and many more fish are captured on short casts than are captured on long casts.

BLUEGILL FISHING

Location in Ponds to Catch Bluegills

The place to fish in a pond according to the season or temperature of the water is important to know to increase the catch. Fishing for bream from mid-fall through early spring when the water is cold, one should fish in the deep water near the dam. After the water gets warm, from mid-spring through early fall, fishing should be in the shallow water in the upper end of the pond that is from one to 6 feet in depths. Try to find the beds.

FLYROD FISHING

Comparing the bluegill with other fish ounce for ounce, the bluegill is the "fightingest" fish of them all. Doubters need only to take a light flyrod, a good line, and a 9-foot leader and "hook" into an 8 ounce bluegill to be convinced. Wet flies, dry flies, small streamers, small bucktails, crickets, worms and nymphs are very good lures.

CANE POLE FISHING

One of the most enjoyable ways of relaxing is to go cane pole fishing for bluegills. Prepare a rig that has proven to catch the most fish. Select a long limber pole, tie on a lightweight line that is 4 or 5 feet shorter than the pole. Tie a leader (cat gut) that is 5 feet in length to the line. Get a hook of size No. 12, No. 10, or No. 8 (being certain to use a hook no larger than a No. 8 because the mouth of the bluegill is very small and cannot easily get larger hooks into it). Secure the hook to the end of the leader

by a figure 8 knot. Attach a split shot (very tiny) on the leader approximately 4 inches from the hook, and select a small float such as a No. 4 cork stopper (which is about the size of the last joint of the little finger.) Using larger hooks, sinkers, floats, and no leader, reduces the number of fish caught per hour of effort.

TYPES OF BAIT

Go to the deep water or to the shallow water, according to the season of the year. Baits to use are red worms (Georgia wigglers), garden worms, crickets, catawba worms, wasp larvae, leaches, meal worms, small crawfish, and small grasshoppers. If one uses fish worms, hook the worm through the band (clitellum), which is about one-fourth the distance from the head, so both ends are left free to wiggle.

A METHOD TO FIND THE FISH, "TEST FISHING"

This method is known as "test fishing", and everyone should know it since the bream migrate around the pond. One may catch the limit standing or sitting in one location today, and return to the same location the next day and fail to get a bite because the fish may be on the other side or in the upper or lower end of the pond, according to the season of the year.

Do some test fishing to find where the fish are in the pond At each location fish in three directions. Walk to the edge of the pond and cast out the bait on a line that is at a right angle to the edge of the pond. Adjust the cork to hold the hook approximately 4 inches off the bottom. One can tell if the bait is on the bottom if the cork lies upon its side or if part of the line that is between the cork and hook floats. After the cork or "float" is adjusted, let the hook remain from 3 to 5 minutes. If a fish hasn't struck within that time, don't leave the bait there. Don't take it out of the water, but slowly pull the pole toward you or move backward from 6 to 10 inches. After the pole and bait has been moved a few inches, leave the bait at this position 3 to 5 minutes. If there are fish in a short radius of the bait, they probably have been watching it and will usually bite when the bait starts moving. A great many fish are captured when the bait is slowly moved after it has been left still for 3 or 4 minutes. If a fish is not captured during the movement of the bait, the fisherman should leave the bait there for 3 to 4 minutes. If no success by then, move backwards or pull the pole toward you again. Fish at this position for approximately 3 minutes. If no fish have been caught, take the bait out of the water and inspect it to see if it is all there or secure upon the hook.

Now fish in another direction from the same standing or sitting location. Cast the bait approximately 45 degrees to the right of the direction first fished. Fish in this second direction the same way as you fished the first direction. If no fish are captured, don't give up. Pull the bait out and check it.

Without moving from the location, try fishing in one more direction. Cast the bait approximately 45 degrees to the left of the first direction. Fish in this direction the same way as you fished the other two directions.

One may fish an area approximately 35 feet wide and 70 feet long from

the same standing or sitting location. If no fish are captured at the first location, don't say "the fish aren't biting today". Move a distance of 75 to 100 feet toward the upper end of the pond and "test fish" that area. Sometimes one may have to test fish several locations before finding the fish and catching a nice string.

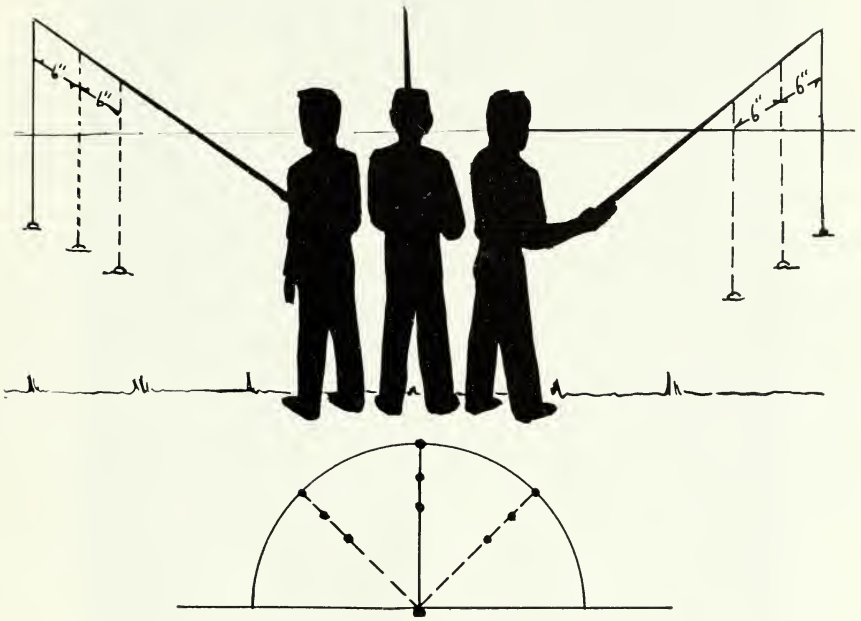


FIGURE 28-A. Test Fishing.

NOISES, VIBRATIONS, AND COLORS

Talking, laughing, bragging or complaining do not bother fish, but fast movements and vibrations, sliding a tackle box or bait can around in the boat, frighten the fish and cause them to stop biting. As you move around the pond in a boat, don't throw the anchor overboard, but gently slide it into the water so as not to frighten the fish away.

Wear dark clothes instead of white clothes because the fish don't seem to notice dark clothes as easily. Move slowly for two reasons: first, not to frighten away the fish, and second, to get maximum relaxation which is more beneficial to you than catching fish.

AN OFTEN ASKED QUESTION

One of the most common questions asked by fishermen is: "Why can't I catch fish when you fellows say there are plenty of fish in here?" Well, this type of angler does not pursue the fish, he expects the fish to hunt down his bait. Try new locations and new successful ways, and learn them well. Know fish and pursue one species at a time. Learn their haunts and feeding habits. The time required to develop skill as an angler can be reduced by learning from other fishermen and by reading fishing literature.

FIGURE 28B.

PART IV

CHAPTER 9

FISH BAIT

EARTHWORMS[1]

Earthworms are the most generally available and effective bait known to anglers. There are more than 90 different kinds of earthworms in North America. Of these at least 18 species and probably more are found in Georgia. The most familiar is the "Red Wiggler," a good fishing bait.

Worms prefer to live in soils that contain an abundant supply of moisture and organic matter. Excessive amounts of water cause the death of worms while a lack of moisture causes them to move deep into the ground in search of it. Their food consists principally of decaying organic matter such as pieces of leaves and other vegetation, pieces of animal matter in the soil. Earthworms do not eat plants. They feed mainly at night. Food particles are sucked into the digestive tract by the muscles of the pharynx.

Most worms live in the upper 2 feet of the soil. They swallow the soil and pass it through their bodies, absorbing the plant and animal matter; thus, benefiting the soil. Charles Darwin found the eating habits and casts on the surface of the ground by a good population of worms, added one inch of soil every 5 years. The soil brought to the surface each year amounts to 7 to 18 tons per acre. They are a benefit to the soil, as their activities make the land more porous and insures better penetration of air and moisture.

The earthworm is an interesting creature. Both male and female sexual organs occur in each individual earthworm. The 14th segment or ring of the body, counting from the head, contains the female organs and the 15th contains the male organs. Self fertilization does not occur, but spermatozoa are transferred from one worm to another. During copulation, two individuals come together and form a cocoon about the region of the clitellum, which is the band approximately a fourth of the way back from the head. The cocoon or capsule containing the eggs is deposited in the ground, where the eggs hatch in one to 3 weeks. The young worms become fully grown in 3 to 5 months. The young worms can be told from adult worms by the lack of the clitellum. They have the power of regeneration; that is if a worm is broken in pieces, each piece will form new segments, but all tail sections behind the clitellum will soon die even though a few new segments are formed. That section containing the head and clitellum will form a new tail and continue to live and reproduce.

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[1]Methods of Culture for English Worm or Red Worm was mainly taken from the Alabama Polytechnic Institute, Agricultural Experiment Station. Progress Report Serial No. 5.

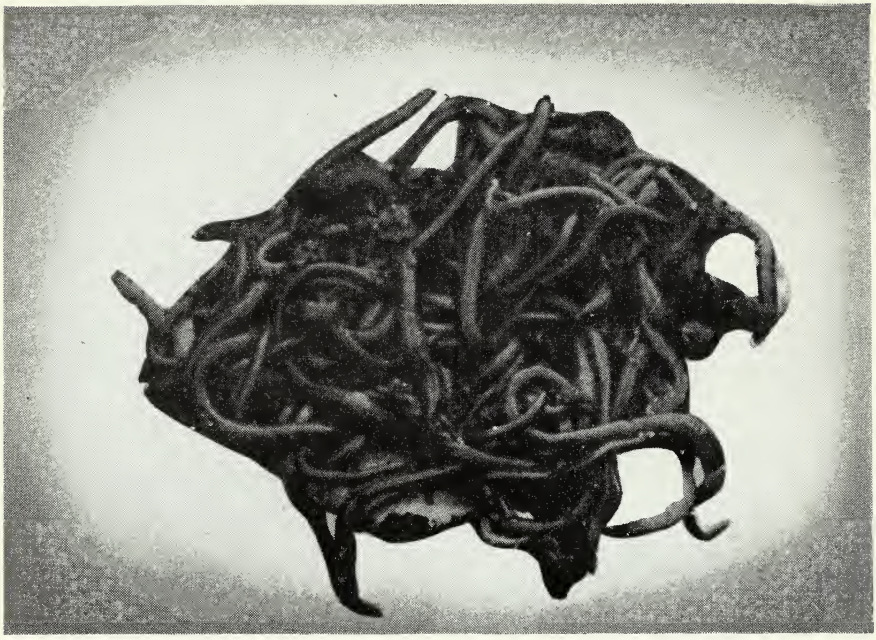

FIGURE 29.—Earthworms.

THE SELECTION OF THE BROOD STOCK IS IMPORTANT

Be certain to select the English worm or red worm (red wigglers) because they reproduce throughout the year under proper conditions. They are very prolific and live under a wider variation of conditions than most other species.

Earthworms may be raised in the garage, basement, vacant room, or any well shaded place. If protected, the containers may be metal drums cut in halves lengthwise, wash tubs, or old bathtubs. Any exposed metal should be painted on the inside with hot asphalt, acid proof paint, or good house paint, to prevent rust which injures the worms. If the place is in a well shaded place on the outside, bury the box in the soil, leaving a few inches protruding above the surface. A well drained, shady spot should be chosen.

A clay loam or a porous clay is very satisfactory. Do not use sandy clay. If the soil does not contain considerable organic matter, one-fourth of its volume of dead leaves or well rotted manure is mixed with the soil. If the organic matter is not well decayed or decomposed, heat will generate and cause the death of the worms.

One can produce 3,000 to 5,000 worms of fishing size per year in a tub 2 feet in diameter and 10 inches deep. A minimum of 2 tubs should be kept, using the worms from one for several months and then using from the other. In this way a better reproduction can be maintained.

EARTHWORMS NEED TO BE FED APPROXIMATELY EVERY TWO WEEKS

Each tub of worms requires one-half pound of vegetable shortening or lard and one pound of cornmeal every two weeks. Mix these ingredients into the soil. The addition of coffee grounds is no help, contrary to popular belief.

The soil is kept moist throughout, but especial care must be taken not to add more water than the soil can absorb. Add water at the time the food is added.

A very good domestic worm box is one that is approximately 6 feet long, 2 feet wide, and 2 feet deep. Fill the box to a depth of approximately 8 inches with the soil and leaf mixture described above. Add enough water to make the soil moist throughout. Add 6 pounds of cornmeal and 3 pounds of vegetable shortening or lard and mix with the top 2 or 3 inches of soil. Add from 600 to 800 red wigglers. Cover the soil with a damp burlap bag or strips of wood to prevent evaporation. Wait a month and apply another 6 pounds of cornmeal and 3 pounds of lard by mixing the ingredients into the top 2 or 3 inches of soil. When applying the worm food nutrients, add approximately 1½ gallons of water by sprinkling it over the bed. Subsequent feedings and attention should be every 2 weeks Feed sparingly, as uneaten food decays and fouls the entire container.

In harvesting the worms, turn the soil containing the worms by hand or with a 4-pronged fork. Pick up the mature and adult worms quickly and place them in the containers either for use in fishing or for sale, and leave the smaller worms in the bed for use after they have grown up to adult or bait size. If one wants enough worms for a fishing trip, remove soil containing worms and throw loosely into a 10-quart bucket. Allow it to stand approximately 20 minutes to one hour. Remove the top soil from the bucket and place it back into the worm box or bed. Practically every worm will be found in the bottom few inches and can be taken by removing the soil above them. Be sure to return the unused worms from a fishing trip to the worm box.

Worms will be more desirable to be used as fish bait and last longer if they are cleaned or "scoured" before being used. To "scour", place some clean sphagnum moss (from any florist) or an old lace curtain in the bottom of an earthware crock or other container. Dampen the moss or curtain, place the worms into the container and leave for 2 to 4 days in a cool spot. At the end of 3 days, the worms will usually be almost transparent, lively, and tough.

SOMETIMES PESTS NEED TO BE CONTROLLED

Mites, ants, rats, and mice enjoy the cornmeal and lard diet. The mites are small, grayish-white animals about the size of the head of a pin. Mites can be killed by lightly dusting a very thin application of powdered sulfur over the top of the soil. Ants can be kept away by supporting the worm box on legs placed in water or oil. Ants can be kept away by dusting the

floor or ground around the box with pyrethrum dust. To keep out rats and mice, if they become bothersome, the worm box or tub may be covered with screen. Do not exclude the air. Don't let the soil become too moist nor too dry and one will have the least amount of trouble.

If fly larvae are found in the beds during the summer, they can be controlled by spraying the surface very lightly with a commercial fly spray, containing pyrethrum and D.D.T. This material should be used only in small amounts or the worms may be killed. The food piles should not be sprayed, and the bed itself should not be worked or watered for 3 to 4 days after spraying it.

RAISING CRICKETS FOR FISH BAIT[1]

Bream prefer crickets during summer and late fall. Crickets may be raised throughout the year in lard cans, garbage cans, metal drums with the lid cut out, or in boxes lined with tin 2 feet deep and as wide and as long as desired. Four hundred crickets can be raised every 3 months in a can 24 inches in diameter. The rearing cans or boxes may be kept in the garage, basement, or vacant room. The rearing can should have a minimum depth of 18 to 24 inches. The top of the can or box should have a screen lid covered with cardboard, paper or cloth.

FIGURE 30.—Crickets.

The common black field cricket has been raised successfully for fish bait in metal cans. The scientific name is **Gryllus assimilis Burmeister.**

[1]Method for raising crickets was mainly taken from Alabama Polytechnic Institute, Agriculture Experiment Station, Leaflet No. 22 Raising Crickets for Bait.

Place clean white sand in the rearing can to a depth of 4 to 6 inches. Moisten the sand until it feels damp to the touch because crickets will not lay in dry sand. This amount of moisture usually is enough for hatching the first crop of crickets. When they are growing up, the sand should be practically dry, which helps to keep the crickets free of disease. Do not moisten the sand again until the young crickets have matured and are ready to lay eggs.

Place wood excelsior to a depth of 4 or 5 inches over the sand to provide cover and additional surface for the crickets to rest upon.

The inside walls of can or box for a distance of 8 to 10 inches down from the top should be coated with a good grade of floor wax and polished to prevent the crickets from climbing out.

A glass-jar drinking fountain (sold by hardware stores) for watering chickens is very satisfactory. This consists of a one-quart jar inverted in a saucer-like glass dish. The tin dish will cause the water to become discolored and have an irony taste. The saucer is filled with cotton slightly above the water level. This allows the small crickets to obtain water from the moist cotton without danger of drowning. The drinking fountain is placed on the sand in the center of the rearing can. If the rearing can is 6 feet long, place 2 drinking fountains in it on the sand approximately one-third the distance from each end. The water supply will need to be replenished, the saucer cleaned, and the cotton replaced every 4 to 8 weeks.

Take a saucer or small tray, fill it with poultry laying mash, place it on the sand in the rearing can. Pull the excelsior around the food so the crickets can readily eat it. Small crickets will consume a saucerful of mash in 2 or 3 weeks. As they grow larger, they will eat that amount in a week or less time. No other feed is necessary. Approximately 2 pounds of laying mash is required for each 100 crickets.

For every 3 square feet of surface area or to each rearing can 2 feet in diameter, stock with 20 to 30 adult crickets. After stocking they should be examined every third or fourth day for a period of 2 weeks to remove any dead crickets.

The eggs, which are laid in moist soil or sand, hatch in 15 to 25 days. Mature females lay eggs at intervals for a period of 30 to 50 days. The young resemble the adults, but do not have wings.

TEMPERATURE AND GROWTH-RATE

Crickets' rate of growth depends upon the temperatures. Growth practically ceases at temperatures below 70° F., is rapid between 80° F. and 90° F., and is slowed up by temperatures above 95° F. At a temperature of 80° F., the young crickets become large enough for use as bait in one month. It will take them one to 2 more months to reach maturity. During the summer months no additional heat is needed except in basements or places where the temperature remains lower than 80° F. During late fall, winter, and early spring, additional heat is needed and can be supplied

by the use of electric lights. The electric light bulb is suspended in the rearing can or box to within 6 inches of the excelsior. At that height there is no danger of fire, nor can the crickets walk up the light wire and out of the rearing can or box. The size and number of light bulbs to use depends upon the size of the rearing can or box. Each 3 square feet in surface area or each rearing can 2 feet in diameter, which is placed in an unheated room, can be satisfactorily heated by a 100 watt bulb during the winter months. During the cool spring months, a 40 watt bulb will furnish sufficient heat. After the crickets become large enough for bait the heat is removed.

RE-STARTING THE REARING CANS OR BOXES

Larger crops of crickets can be raised by thoroughly cleaning the cans after one or 2 crops than by waiting to clean the cans or boxes after 3 or 4 crops.

SOLDIER FLY LARVAE

A very good bream bait that is very easy to produce is the soldier fly larvae. Any big can or crock will do. Put in growing or laying mash for a depth of 3 to 6 inches. Soak in water and pour off all excess water. Arrange can so that soldier fly may enter by covering the top with the exception of a small opening (a crack one-half inch wide across the top). This will keep the inside of the can or crock dark on the inside. The darkness will discourage the entrance of houseflies. There is no need to stock it. In a few weeks large white soldier fly larvae will be found in the mash. Add more mash as necessary. The larvae hooked through the flat end make excellent bait for bream.

WEED WORM

These worms are found in the joints of the heart weed which grows near dumps and in low waste lands. The heart weed resembles rag weed or pig weed. It is green in color and may grow as high as 6 feet tall. Take a knife and split open the joints for a wonderful bait for bream.

MEALWORMS AS FISH BAIT[1]

Mealworms are larval forms of beetles which are found in flour, meal, and other grains. The larvae can easily be raised in a tight wooden box approximately 2′x1′x1′ in size, or a metal can that has a cover made of fine mesh screen or cheesecloth to prevent the escape of the adults. The inside walls of the container should be smooth and painted with a thin coat of varnish to prevent the escape of the worms, which are about an inch in length.

Chicken laying mash, old flour, or old cornmeal should be spread over the bottom of the box to a depth of one-fourth inch and covered with 4 or 5

[1]Methods of Culture furnished by Professor F. E. Guyton, Alabama Polytechnic Institute in private communication.

layers of burlap. A sprinkling of mash should be placed under each layer of cloth. The culture may be started by using powdered meal from an old box that contains eggs of the beetle. Old grain in feed stores is a good source of supply of mealworms. Place the meal containing the eggs in the bottom layer of the box. Only a small amount of moisture is needed. Enough moisture can be provided by adding pieces of raw potato, ripe apples, or by a damp cloth placed on the surface and slightly dampened every few days. Mold will develop if too much moisture is added.

The box may be stocked with several hundred worms. Within 3 months the box will usually be abundantly populated with mealworms. When adult beetles appear, they can be used in new culture boxes.

HELLGRAMITES AND OTHER AQUATIC FORMS FOR BREAM

Hellgramites are the larvae of the Dobson fly. Hellgramites are found under stones in swift riffles. They are taken easily by turning over rocks and permitting the water to wash the hellgramites into a fine mesh net placed a short distance downstream. To properly care for this bait, carry it in damp moss.

Nymphs of dragonflies, stoneflies and mayflies, and other forms of life as salamanders (spring lizards) are easily taken by the same method as above.

During the summer, try various kinds of bait to catch bream, as small grasshoppers, catawba worms, soldier fly larvae, weed worms, and mealworms. Also try hellgramites and other aquatic forms as bait. A successful fisherman will vary his bait during the different seasons.

Lack of space prevents describing methods for raising minnows and other live bait. If you want information about raising minnows, write for either of the two bulletins as follows:

Propagation of Minnows and Other Bait Species
Circular 12
U. S. Government Printing Office 1948
Superintendent of Documents
Washington, D. C. Price 35 cents

Propagation of Minnows and Other Bait Species
Agricultural Experiment Station of the Alabama Polytechnic Institute
Auburn, Alabama Price 53 cents

PART V

CHAPTER 10

RENOVATION OF OLD PONDS

The RENOVATION OF OLD PONDS requires the making of structural changes necessary to obtain suitable habitat, as well as fish-population changes that affect the balance between predator (carnivorous) and nonpredator (forage) species. We have a tremendous job for future years as the occurrence of ponds with stunted fish population and poor fishing is apparently common throughout the country. Contact the Game and Fish Commission for advice from a Fishery Biologist after he has analyzed the pond.

Many pond owners become disheartened and disappointed after the second or third year of fishing because they do not know how to manage their ponds.

Ponds may be renovated to produce wonderful fishing if they are situated where the owner can gain control of the water that enters the pond. If the topography of the land permits a diversion ditch to by-pass the excess water, the pond can easily be renovated to produce good fishing. The following directions repeat much that has been said about constructing a new pond. For your convenience, however, applicable procedures are restated here.

CAUSES AND METHODS TO CORRECT POOR FISHING

TOO MUCH WATER PASSING THROUGH THE POND

One cannot get much benefit from fertilizer applied to a pond that has too much water passing through it. The fertilizer washes out of the pond and down the stream. This condition may be corrected by diverting the water around one or both sides of the pond. The diversion ditch should be wide enough to handle the water from the watershed after the biggest flash flood. It should have 0.2-0.5 foot of fall per 100 linear feet of ditch. The ditch should start at the diversion dam and extend around the pond to a point below the main dam.

The diversion dam must be placed at a height above the water level along the old water channel to allow the proper fall per 100 linear feet of ditch. The dam is constructed by removing all trees, brush, and other debris from the site. It is not necessary to use a clay core to anchor it to the subsoil. The clay core is purposely avoided to allow a certain amount of water seepage under the dam to help keep the pond filled. While constructing the diversion dam, some type of pipe with a valve should be installed to supply water to the pond. A 3-to 4-inch pipe with valve should be used on ponds less than 5 acres in size; a 4-to 6-inch pipe with valve for 5-to 10-acre ponds, and a 6-to 8-inch with valve for 10

acres or larger. The valve controlling waterflow into the pond is left open when the water is clear and the water level in the pond needs to be raised. It is closed when the water supply becomes muddy or when the pond is full.

When the diversion ditch, the dam, and the disposal area below main dam are completed, they should be sodded immediately with some permanent grass as centipede or bermuda.

IMPROPERLY CONSTRUCTED PONDS

SHALLOW EDGE PONDS always furnish poor fishing after 3 or 4 years. The ponds constructed without deepening the pond edge to a depth of 2 feet usually always have weeds, which are conducive to an overpopulated fish condition. The water level of the pond should be lowered during the latter part of August so that the original shallow-water area can dry out for 6 weeks. Then a bulldozer can deepen the pond edge without bogging down. Another way of getting rid of shallow water that has a depth of less than 2 feet is by using soil that is outside of the pond and pushing it into the pond, filling the area that is less than 2 feet. A dragline can deepen the pond edge at any time of the year. Weeds must be destroyed before you can attain proper balance.

SEEPAGE through main dams is caused by not excavating the core trench and trying the dam to the subsoil with a good type of clay. Seepage oftentimes allows too much water level fluctuation during the summer months. Many times the main seepage is located near the old stream bed. The seepage problem may be corrected by working on the downstream side of the dam. Ditching dynamite, used by an experienced person, will blast out a ditch from 4 to 6 feet deep and 8 to 12 feet wide. After the first charge, if it is found that the clay subsoil has been fully exposed across the bottom, no further blasting is necessary. If the bottom contains sand, silt, and gravel, additional blasting is necessary. If blasting does not remove all the sand and silt from the bottom of the ditch, dig a channel on the downstream side of the core trench to dispose of the muck that is forced through it. The core trench should extend at least 30 feet each side of the visible seepage area with a width of 12 feet.

The tractors should start pushing clay into the ends of the blasted core trench. As the clay is applied and packed it forces the muck into the disposal channel, if the operation is carried on from each end of the dam.

SPILLWAYS that are too narrow are the most frequent cause of dams washing away. Too narrow spillways emit water to a depth greater than 6 inches. Sometimes after flash floods the water will pass out at depths of several feet resulting in a loss of most of the fish in the pond. To correct the spillway, widen it so the water will never go out at a depth greater than 3 to 6 inches. Then contact the Game and Fish Commission requesting that the pond be analyzed for balance between the forage and carnivorous species of fish.

IMPROPERLY STOCKED

The question is often asked "Why are ponds improperly stocked?" Most ponds were improperly stocked through mistake or accident. Many persons believe that the more fish they place in their ponds the better will be the fishing. Therefore, they apply for and receive more fish than their pond can support for good growth. When the bream are over-populated and starved for food, they eat the eggs of the bass and prevent the bass from reproducing. When that condition occurs, which is often, it is only a short time before the pond holds only a few large bass that are very difficult to catch because they have all the small bream they want as food. And a very large percentage of the bream will develop to less than 4 inches in length.

Many ponds are overstock or understocked because the owner guessed at the size of the pond. Each pond should be accurately surveyed to the nearest one-tenth of an acre before the owner applies for fish. Stocking with too many or too few fish will cause a great percentage of the total pounds of fish production to consist of small fish and poor fishing.

Stocking too many bass always causes the bass to be thin and small. Correcting this condition involves very heavy fishing and seining for bass several times at weekly intervals to bring the stock into a balanced condition. Another way is to drain the pond, capture all the fish, and restock with the correct number of bass and bream. Then fertilize properly and fish the pond hard.

Stocking with too few bass will cause the pond to become overpopulated with bream. A large number of the bream will be of a small size, 2 ounces or less, and the bass will be large but very difficult to catch. To correct this condition, contact the Game and Fish Commission for a pond analysis. It might be best to reduce the bream and to follow with corrective restocking with bass.

Many pond owners cannot understand why their ponds are mysteriously full of undesirable fish. This condition usually is the result of their failure to kill all the undesirable fish that existed in the stream that fed the pond.

Certain species of fish stocked in ponds as warmouth, green sunfish, redbreast bream are unsuitable to ponds because only a very small percentage of their number ever attain a large size. If the pond has large numbers of small crappie, small catfish, shad, suckers, or the golden shiner (roaches), the pond must be drained to kill them all and to permit restocking with the correct number and species of fish.

ACCIDENTS AND OTHER FACTORS INFLUENCING MORTALITY

ACCIDENTS may cause the pond to be understocked. For instance, too many of the bream or bass may die in delivery from the hatchery to pond because of delays on the way. The vehicle transporting fish for

stocking must be kept in motion to keep the fish alive. Sometimes too many bass die shortly after they have been added to the pond for various reasons, or they die before they have a chance to reproduce.

If all or more than half of the number of fish die because of an oxygen depletion, diseases, parasites, cotton dusting, or other chemicals, the best thing to do is to start over by draining or poisoning and restocking. As soon as possible after finding dead and dying fish in your pond, call the Game and Fish Commission; a Fisheries Biologist may find the cause and correct it.

There are several other factors that influence the sudden mortality of fish. Sometimes several of these factors work together to produce a condition which kills many or all the fish in a body of water.

Sudden abnormal temperature changes have, in many instances, caused a destruction of fish populations by causing oxygen deficiency—either by ice or snow formations over shallow lakes, or by aiding in the decomposition of an excess of decaying organic matter. Pollution may kill fish directly or by destroying food supplies and spawning areas. Instances are known where fish have been killed by lightning and toxic algae. When fish are transferred from waters of one pH to another water considerably different in pH, they cannot live.

WEED CONTROL

HEAVY WEED GROWTH usually appears within a year or two in improperly fertilized ponds. Large amounts of underwater or above-water weeds inevitably lead to over-population and stunted fish. Weeds in ponds are undesirable for two other reasons: (1) they provide excellent places for mosquito breeding, (2) the collection of masses of weeds upon the hook causes poor and difficult fishing. Certain weeds such as the water hyacinths and duck weed reduce the oxygen content of the water.

There are two things that need to be done before eliminating the weeds. First, if the pond is fed by too much water, the excess water must be diverted. Second, the pond edges should be deepened so that there will be no water less than 2 feet deep. If these two requirements are met, it will be easy to eliminate and prevent the recurrence of underwater weeds.

Pond weeds have the same requirements for growth and livelihood as terrestrial plants; namely, fertility, sunlight, and the proper amount of water. Therefore, if the pond weeds don't receive enough sunlight, they die. It is the same principle used to kill grass and grass roots on a lawn by covering it with a tarpaulin to shut out the sunlight.

An often asked question is, how do weeds get into ponds. Most coarse weeds are flowering plants producing seeds, even though they may be very small and inconspicuous, are dispersed by water currents, wind, animals and birds. Some plants like **Anacharis** and coontail (ceratophyllum) have brittle stems. Terminal buds at the tips of stems break off and form new plants. Another method of propagation is by means of underground

stems which grow out laterally into the pond bottom mud. These stems, also called rhizomes, have joints or nodes from which new shoots arise. This is why draining the pond and the mechanical mowing of weeds give only temporary results. The only pond weed that draining will greatly help is water shield; but usually where one type is present there will be found several types of weeds. Mechanical mowing of weeds usually has to be repeated weekly or bi-monthly and has proved costly and relatively ineffective.

THREE TYPES OF POND WEEDS[1]

Weeds are classified into three types: submerged, emergent, and floating. The methods of eradication and control of each type is different.

Submerged weeds are those that are rooted in the bottom and their stems and leaves may fill the pond to the surface. This type is commonly called seaweed, parrot feather, coon-tail moss, moss, or grass and includes such plants as najas, myrioplyllum, elodea, certain species of potamogeton, needlerush, and chara.

The Emergent type of plant is rooted in the bottom and its leaves either stand above or float on the surface of the water. This type includes spatterdock or yellow water lily, common water lily, lotus or water chinquapin, watershield, cattail, bulrush, and spikerush.

Floating type of weeds are not rooted to the bottom, but float freely upon the water surface. The most common pond weeds of this type are the various species of duck weeds, some species of hyacinth, and bladderwort.

1. ELIMINATION OF SUBMERGED WEEDS

The only certain means of eliminating submerged weeds is by preventing the weeds from getting sunlight and by chemicals. Fertilization has the advantage over chemical weed poisons in that its addition increases productivity of fish, is cheaper, and can be applied by inexperienced personnel.

A. ELIMINATION BY FERTILIZATION

The method by fertilization to destroy submerged weeds cannot be used where the pond receives large amounts of flood water or muddy water during late winter and early spring, nor where the pond has large areas of water that are less than one foot in depth. So during the late summer, lower the water level of the pond and deepen the edges. Also, if there is a large amount of water entering and leaving the pond, divert the water around the pond. The following January begin fertilization while the water is cold. Use for each acre, 100 pounds of 8-8-2 or 100 pounds of 6-8-4 and 10 pounds of nitrate of soda at each application. Broadcast the

[1]Information on pond weed control was taken in part from U. S. Fish & Wildlife Service—Fishery Leaflet 344, The Control of Aquatic Plants in Ponds and Lakes and from Alabama Polytechnic Institute, Agriculture Experiment Station—Bulletin 254, Management of Farm Fish Ponds.

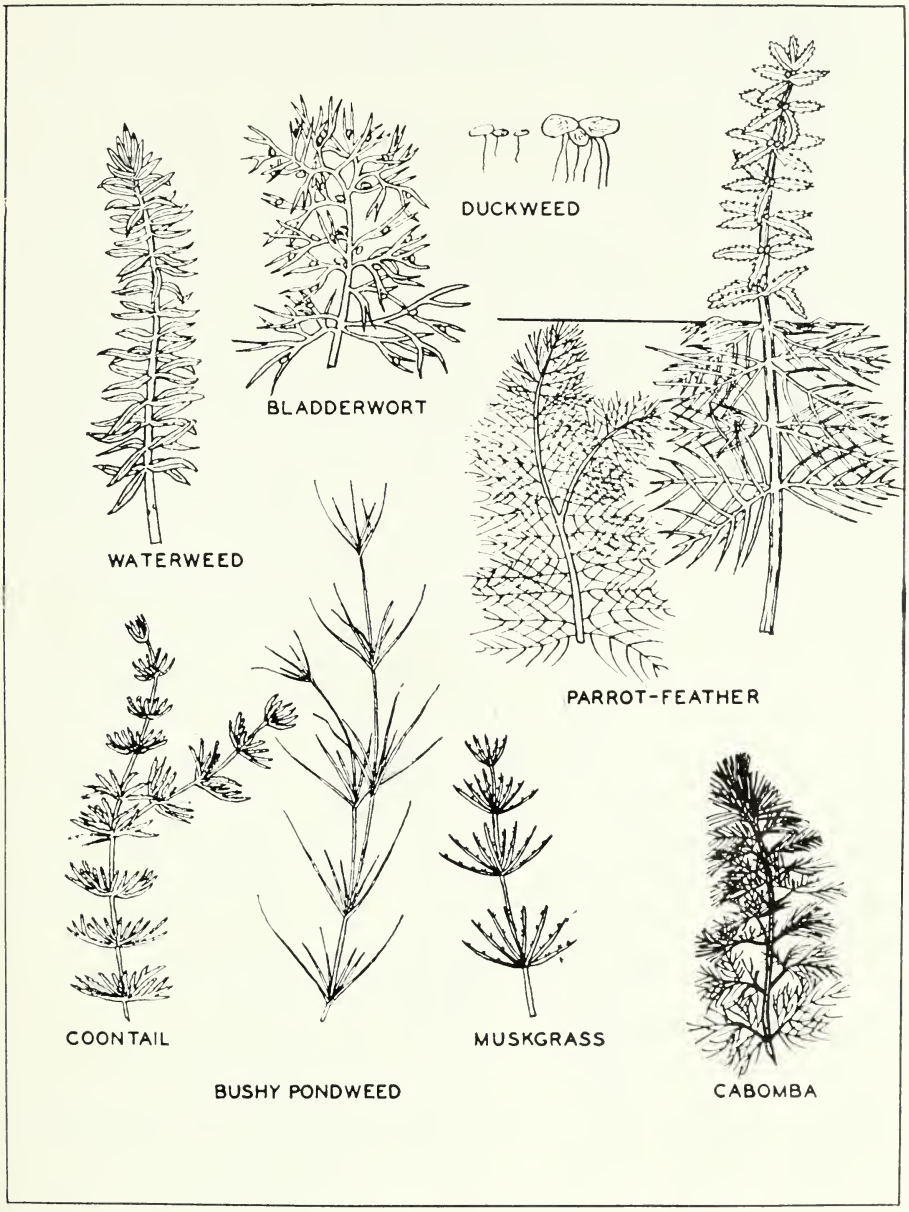

FIGURE 31.—Various Aquatic Plants Found in Georgia. Waterweed, Anacharis canadensis (Elodea); Bladderwort, Utricularia; Duckweed, Lemma; Parrot-feather, Myriophyllum, showing different leaf formations; Coontail, Ceratophyllum; Bushy Pondweed, Najas; Muskgrass, Chara; Cabomba, Fanwort; Cabomba caroliniana.

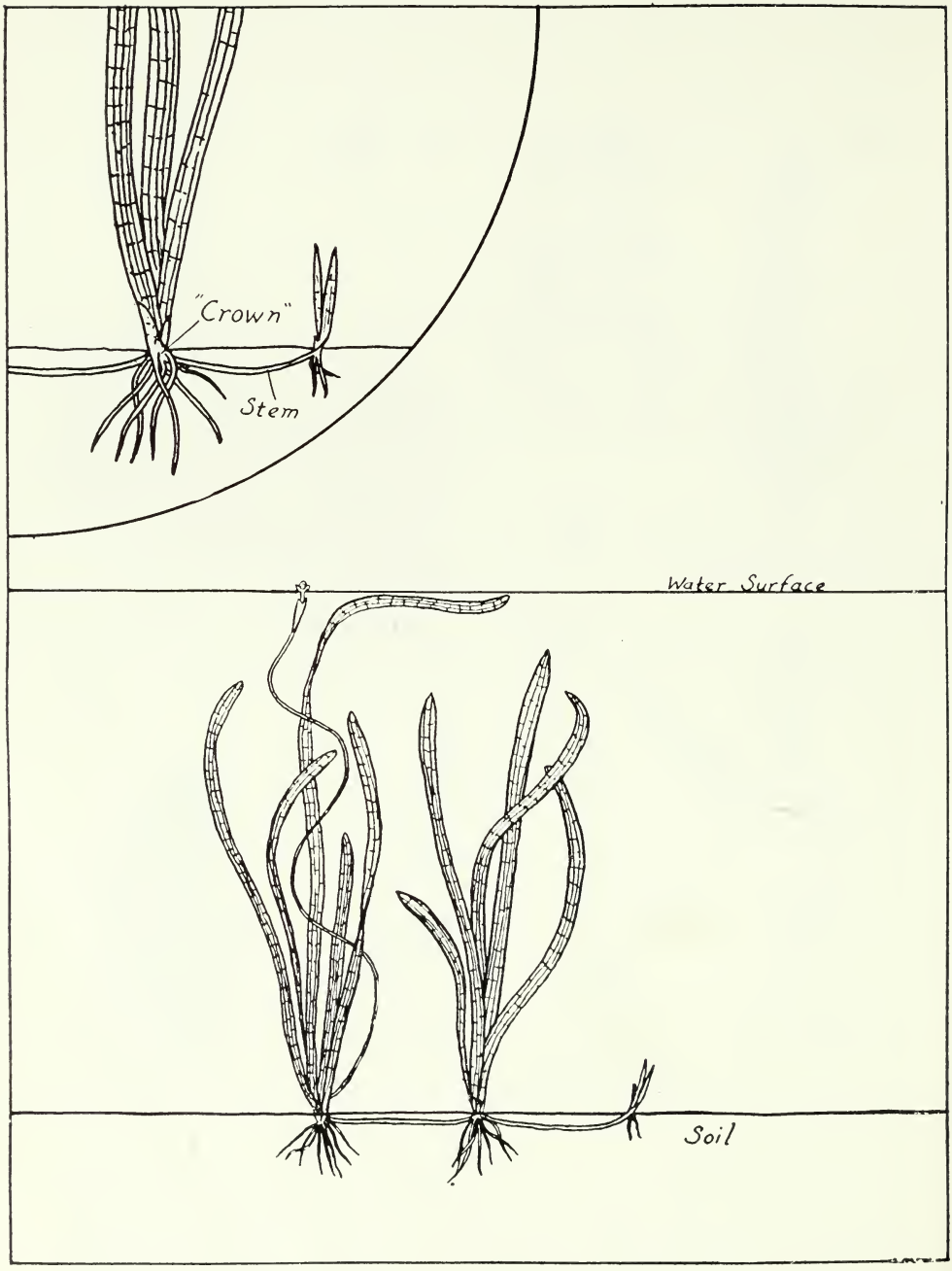

FIGURE 32.—Wild Celery, Tape Grass (Vallisneria spiralis).

fertilizer over the weedbeds. The second application should be made 2 weeks later and the third 2 weeks after the second. Additional applications should be made at 3-weeks intervals, until the weeds become covered with filamentous algae, commonly known as "old slimy green moss found at springs".

The filamentous algae cover the weeds and shade them so that they become weakened. During normal years, around the first of June movement of the water will break the stems near the base and the weeds and filamentous algae will float to the surface. After the weeds float to the surface—PRECAUTION—do not broadcast fertilizer over the floating weeds, nor apply fertilizer while most of the weeds are decaying rapidly. If one applies fertilizer at this time, it may cause such rapid decay of weeds that the available oxygen in the water is depleted and the fish die. Do not rake or pull out the decaying weeds and filamentous algae as they will release nutrients into the water, and the nutrients will cause a heavy growth of microscopic plants, turning the water green or brown. If the water clears enough to see deeper than 12 inches, put in another application of fertilizer, but put it in the pond a few feet away from the weeds. Unless the pond is fertilized each year thereafter from spring until fall, submerged weeds will reappear.

B. ELIMINATION BY SODIUM ARSENITE

The elimination of submerged weeds by sodium arsenite will not be discussed here, simply because sodium arsenite is poisonous to humans, pets, and livestock; inexperienced persons may receive severe burns if the poison comes in contact with the skin or eyes. If too much of the poison is applied to the pond a fish kill may result. Many persons do not want to take the time to figure out approximately the volume and weight of the water, and the concentration of the chemicals needed according to the quantity of weeds and the hardness of the water. It is advisable to contact a fisheries manager of the Game and Fish Commission before using sodium arsenite.

C. COPPER SULPHATE (BLUESTONE)

This poison is the most readily available and easily applied of all aquatic plant poison, but it is effective against only single filament forms of algae and chara, which is known by the common name "Musk Grass". Copper sulphate can be bought at most hardware and farm supply stores in the pure crystalline or powdered form. Use ½ to 1½ p.p.m. and apply as spray or drag the pure crystals in a cloth sack. Copper sulphate is usually not recommended for use to eliminate filamentous algae or "pond scum" because the algae will decompose by midsummer; also the copper sulphate will kill most of the microscopic algae that is food for microscopic animals and insect life, which in turn are food for bream.

D. ELIMINATION OF PITHOPHORA BY THE CHEMICAL KNOWN AS DELRAD

(Summer forms of branched algae)

Pithophora is recognized by its cluster-like form of growth and the coarse texture of the strands when handled. It grows primarily during the warmer months of the year, unlike most of the single-filament forms of algae which grow in cold water. Pithophora usually begins its growth in shallow water then spreads rapidly over the entire bottom and surface of the pond. It interferes with high fish production by competing with the phytoplankton (microscopic plants) for the fertilizer added to grow fish food. Some ponds in Georgia have so much pithophora that the pond owners are never able to get a good green or brown color to the water. Pithophora may be controlled by using a chemical known as DELRAD at a concentration of less than 0.5 p.p.m. Its toxicity to bluegill bream and bass was found to be near 0.7 p.p.m. Use at the rate of 2.5 to 3.0 pounds of active ingredient per surface acre per application. Subsequent applications are made at weekly intervals or whenever sufficient regrowth of pithophora is present to justify another treatment. Delrad is commercially available as a 70 to 50 percent solution, called Delrad 70—a paste containing 70% active ingredient, and Delrad 50S—a liquid. It is manufactured by the Naval Stores Division of the Hercules Powder Company, Rhodes Haverty Building, Atlanta, Georgia. There are two main methods of applying the chemical: dragging and floating. **As soon as further experiments have been made on Delrad to see if it is injurious to livestock etc., we shall know whether or not to recommend it.**

The dragging method is accomplished by the use of a boat powered by an outboard motor to tow some loosely woven burlap bags containing the Delrad. Use 3 to 4 pounds of 70 percent paste per acre, place it in a bag and tow it by the boat over the pond until the paste dissolves from the bag into the water. The chemical should be uniformly distributed over the pond.

The floating method is accomplished by the use of wooden boxes with bottoms covered with a loosely woven burlap bag material instead of wood. The boxes are floated some 10 to 20 feet from the edge of the pond. Put in 3 to 4 pounds of 70 per cent paste per acre. Small ponds consisting of 2 to 3 acres need only two floats to properly treat them. The floats may be moved about the pond from time to time to give better distribution of the chemical.

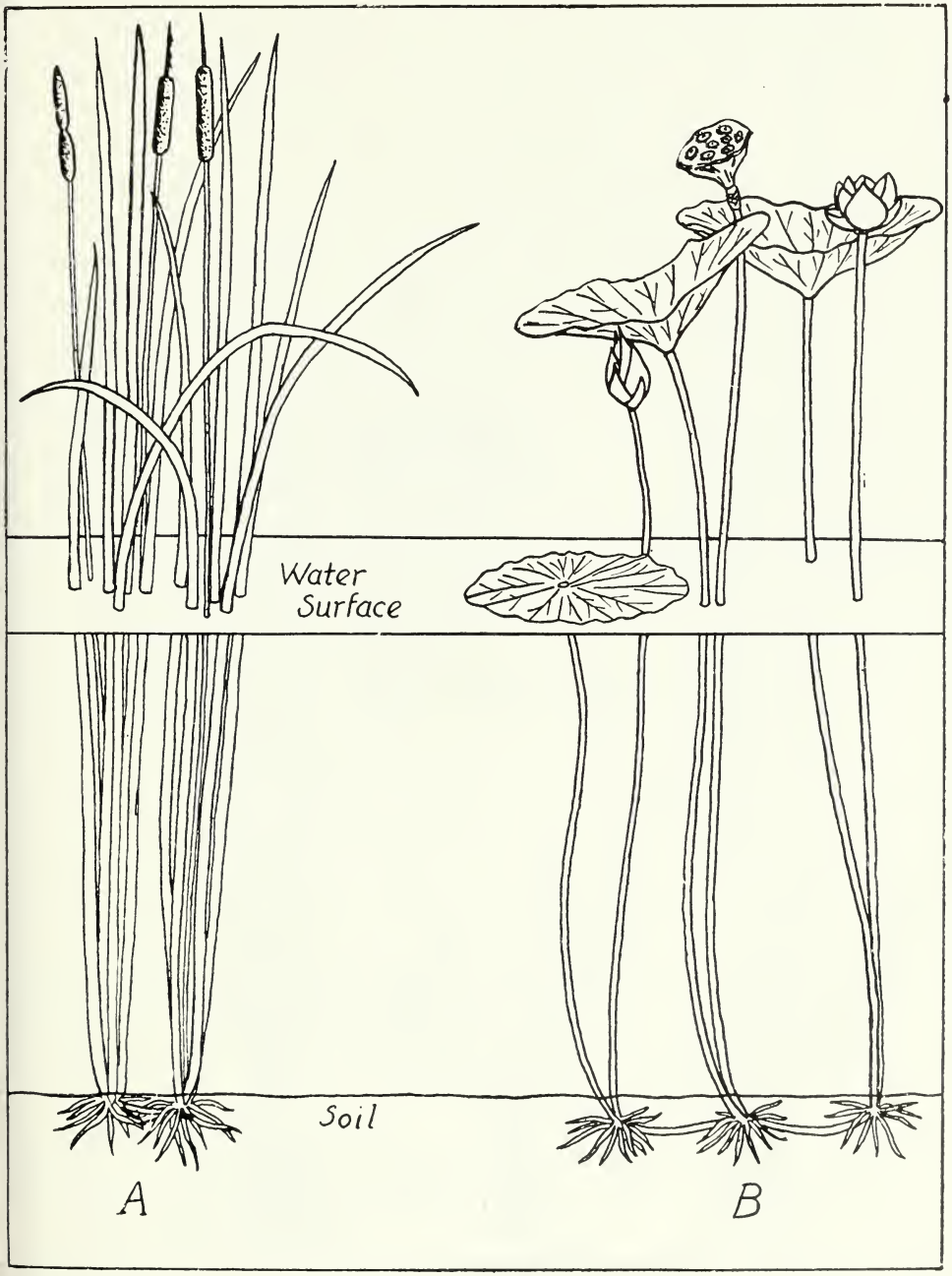

FIGURE 33.—Two types of Undesirable Aquatic Plants. A, Cattail, Typha latifolia; B, American Lotus, Nelumbo lutea.

FIGURE 34.—Duck Potato, Arrowhead, Sagittaria showing different types of leaves; A, arrow shaped, Sagittaria latifolia; B, tongue-like; C, elliptical shaped, Sagittaria platyphylla.

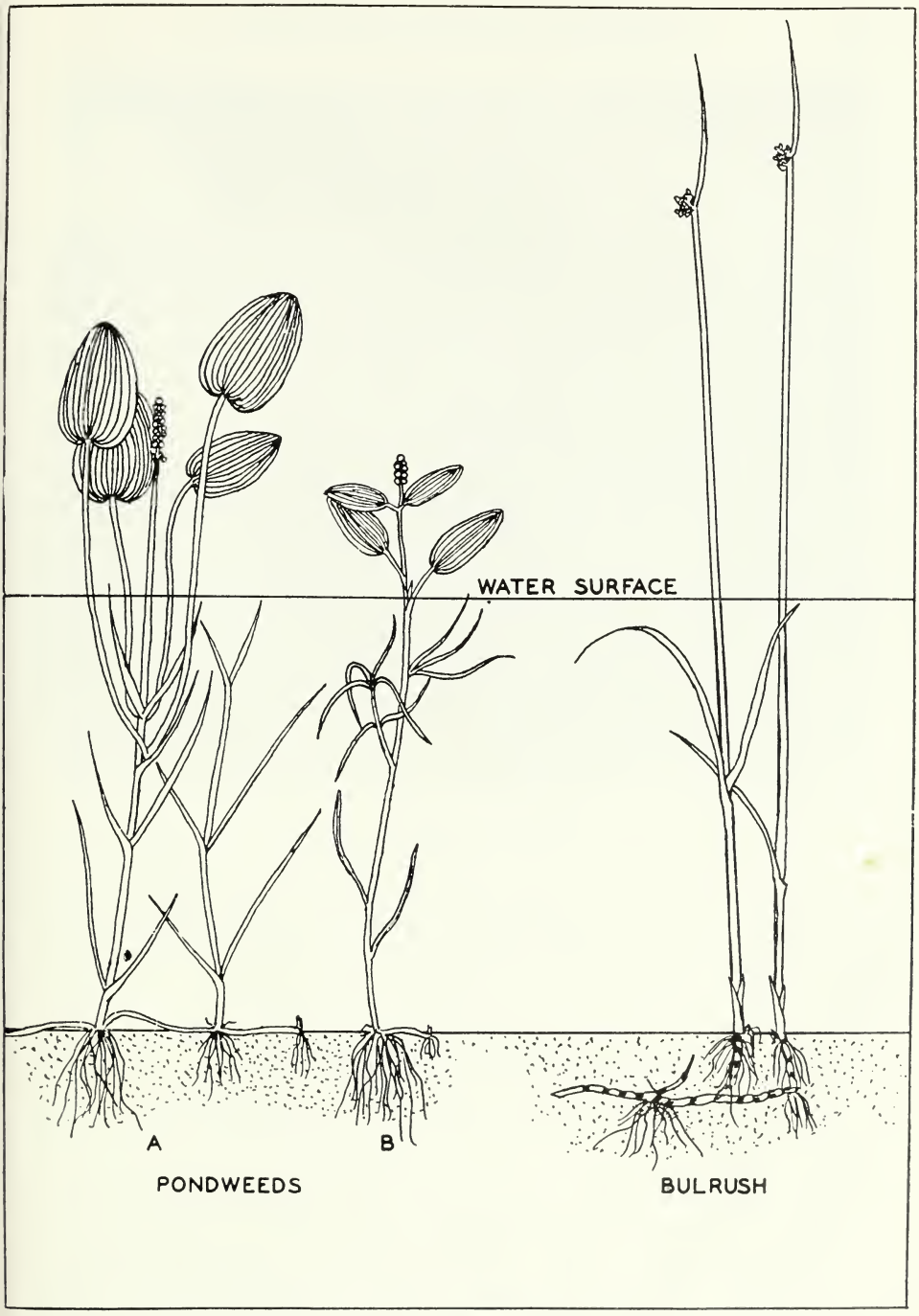

FIGURE 35.—Pondweeds, showing two different types. A, Potamogeton natans, B, Potamogeton spirillus. Pondweed leaves shown above water surface float on surface rather than stand erect as depicted. Bulrush, Scirpus americanus.

FIGURE 36.—Spike Rush (Eleocharis).

2. ELIMINATION OF EMERGENT WEEDS

The emergent weeds are those that grow above the surface of the water as cattails; the various rushes as spikerush, bulrush, and round-stem bulrush; willow; and arrowheads. The growth of cattails and rushes need to be pulled and thrown out of the pond, or sprayed with 2,4-D (2,4-dechlorophenoyacetic). Each time when spraying weeds in a pond, do not cover over one-third of the surface area if an oil base is used. There is no danger to fish from the use of 2,4-D due to the dilution when it is mixed with pond waters. The 2,4-D is more successfully used with diesel fuel or kerosene as an oil base. A rain immediately after spraying with an oil base will not wash the chemical from the weeds. You should purchase the 40 percent 2,4-D ester.

Trade Names of 2,4-D:

Ester forms of 2,4-D are Weed-No-More 40 or Dow Esteron.

Isopropyl ester of 2-4-5T or Esteron 2-4-5 (Dow Chemical Company.)

The proper mixture of the spray should be one cupful (8 fluid ounces) of either of the above materials with 5 gallons of diesel fuel or kerosene. The spray should be applied in a coarse spray to all portions of plants as completely as possible. It will take at least 2 sprayings to kill all the weeds.

The spray may be applied by the use of a power sprayer or a bac-pak type. It normally takes from 36 to 48 hours to kill the plants, while grasses sometimes take longer.

3. ELIMINATION OF FLOATING WEEDS

FIGURE 37. Water Lilies.

Floating weeds are those that float upon the surface of the water—lilies, lotus, and watershield. These weeds may be eliminated by taking a scythe and cutting their leaves or by the use of 2,4-D. It will usually be necessary to clip the leaves from 5 to 6 times the first summer and from one to 2 times the next summer to get rid of the plants. Thereafter, as new plants appear, pull them and throw them out of the pond. The floating weeds may also be eliminated by 3 to 4 sprayings with 2,4-D, using the ester form.

BALANCED AND UNBALANCED POPULATION

Dr. H. S. Swingle states "the interrelationship in fish populations are satisfactory if the populations yield, year after year, crops of harvestable fish that are satisfactory in amount when the basic fertilities of the bodies of water containing these populations are considered. Such populations are considered to be 'balanced populations' and the species within such a population are in balance". A balanced population must have the ability to reproduce, at least annually, in order to replace the harvested individuals. Balance implies a carnivorous species (bass) with the bream. To produce annual harvestable crops of fish, the number of young fish must be reduced by the bass along with the harvesting of the large fish. Balance implies that a great percentage of the total weight of the fish population consist of a desirable size for harvesting.

Unbalanced populations are those unable to produce succeeding yearly crops of fish of an edible size. Unbalanced population is mainly due to overcrowding, but it may be due to the inability of breeders to provide sufficient replacements.

The Fisheries Division analyze ponds by two main methods. One is by the use of seines and the other is by the use of a chemical. The best time of the year for analysis is late spring and summer, after the bass and bream have had time to reproduce. Each new pond should have an analysis made of the fish population before the end of the second year by Fisheries Biologists.

PART VI

CHAPTER 11

PLEASURES AND THRILLS OF FISHING

If we were to ask the twenty-five million American anglers why fishing is their favorite outdoor pastime, we would get a variety of answers. Many would probably say they fish to relax—to "get away from it all". Doctors tell us that mental ailments, heart disease, and gastric troubles are on the increase. We are living under a high nervous tension. Fishing is a tonic for frayed nerves, and is very restful if one will go about it in the right way.

Some of the best examples of fishing success are offered by old men and small boys. One is able to see them happily dangling a hook from a shady bank, a pier, or a country bridge. They have no boats or fine tackle. Fishing does what it is supposed to do for them because of their attitude. They have a great deal of fun; they do not go about fishing in a hard and fast way. At the end of fishing they are rested and relaxed instead of tired and worn out.

It makes no difference what your choice of equipment to catch fish; whenever you hook a bluegill the pole becomes alive, causing a wonderful thrill in your elbows while you watch your bobber have a fit, or you see your favorite popping bug bounced clear out of the water.

Close behind the pleasure of pulling in a record catch is the satisfaction derived from eating a well-cooked bass or bream, fresh from the water.

HINTS ON CLEANING AND PREPARING FOR THE FISH

EASY WAY TO FILLET FISH[1]

(Sauger or Jack Salmon)

Don't scale and gut your fish—fillet them! The method demonstrated in the accompanying photos, worked out by Dr. J. S. Dendy, formerly biologist of the Tennessee Valley Authority, does the business quickly, and it's easy to learn.

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[1]Reprinted from OUTDOOR LIFE, cuts are available through the Courtesy of the Tennessee Department of Conservation.

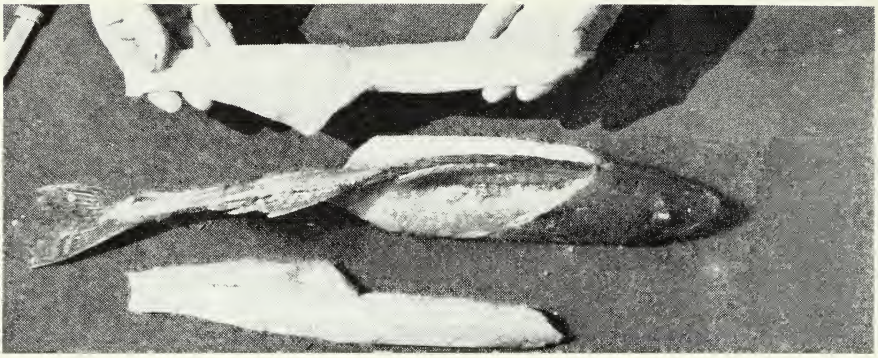

FIGURE 38.—1.—At first glance, filleting may seem wasteful, since everything except the fillets is thrown away. But don't let that worry you. The discarded meat is so full of bones it is usually wasted at the table, anyway. The two big fillets shown at the right are completely boneless and all ready for the frying pan—or your home freezer, if you want to store them.

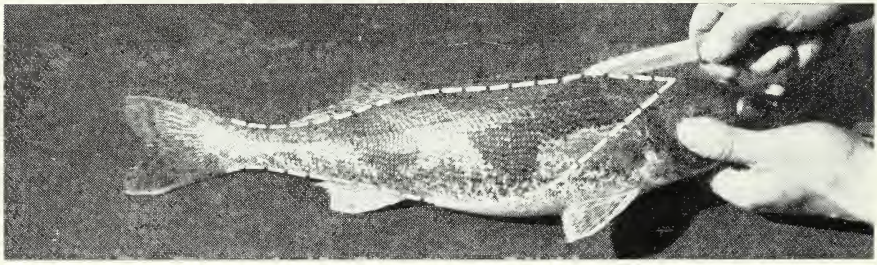

FIGURE 39.—2.—Hold the fish by the head and cut the skin along the backbone all the way to the tail fin. Then cut down the side to the vent and on to the tail, as indicated by the dotted lines in the picture. Keep the cut shallow or some of the flish will stick to skin when it is removed. Always cut toward the tail in order to avoid getting stuck by the fin spines.

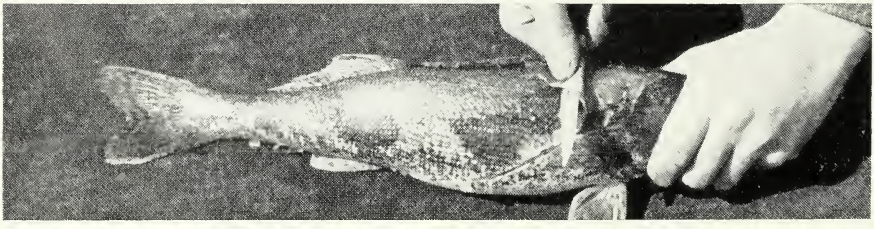

FIGURE 40.—3.—Loosen skin from flesh of starting point of cut and grasp it with thumb and knife, keeping duller end of cutting edge against the scales. Roll blade half a turn toward the tail and pull off the skin. Wall-eyes and sauger skin quite easily, but with bass, crappies, and sunfish it is sometimes necessary to separate skin from the flesh with your thumbnail.

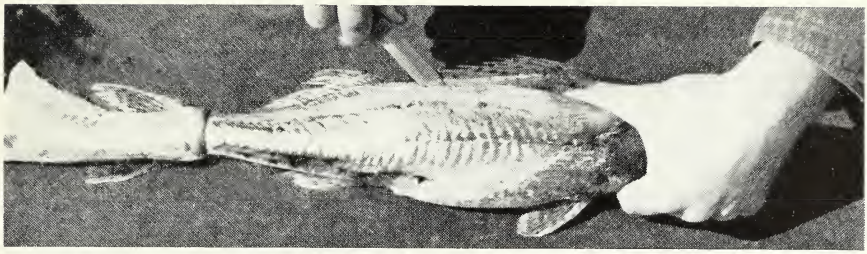

FIGURE 41.—4.—Beginning near the head to free the meat, cut along the backbone down to and then over the ribs. To avoid waste, spread the cut apart with your thumb so you can see that all meat is sliced clear of the bones. Whereas a slightly dull knife is advisable for use in the skinning operation described in preceding step, this one requires a really sharp blade.

FIGURE 42.—5.—As soon as you pass the last rib, push the knife completely through the fish's body and continue the cut by slicing the tail vertically all the way to the fin. Keep blade of the knife close to the backbone and make the slice as clean as possible. In this operation, also, a very sharp cutting edge is required in order to avoid mangling the delicate meat.

FIGURE 43.—6.—Next cut through meat along side, just above faint darkline marking position of small bones. If it's too faint to see, bones may be located with fingertips. Finally, remove the fillet by cutting just behind the last rib to bottom of fish. Repeat entire process on other side, examine fillets for small bones, trim out any you find—and the job is finished.

A FEW TESTED RECIPES FOR COOKING FISH[1]

The most important thing to remember in cooking fish is that it is too often overcooked. Just enough cooking to enable the flesh to be flaked easily from the bones will leave the fish moist and tender and bring out its delicate flavor.

FRIED FISH

2 pounds fillets, steaks or pan-dressed fish
1 teaspoon salt
⅛ teaspoon pepper
1 egg
1 tablespoon milk or water
1 cub bread-crumbs, cracker-crumbs, corn meal or flour

Cut fish into serving-size portions. Sprinkle both sides with salt and pepper. Beat egg slightly and blend in the milk. Dip fish in the egg and roll in crumbs. Fry according to one of the following methods:

PAN FRYING:

Place fish in a heavy frying pan which contains about ⅛ inch of melted fat, hot but not smoking. Fry at moderate heat. When fish is brown on one side, turn carefully and brown on the other side—cooking time about 10 minutes, depending on the thickness of the fish. Drain on absorbent paper. Serve immediately on a hot platter, plain or with a sauce.

DEEP FAT FRYING:

Use a deep kettle with a frying basket and enough fat to cover the fish, but do not have the kettle more than half full of fat. Heat the fat to 375 degrees F. Place a layer of fish in the frying basket and cook to an even golden brown, about 3 to 5 minutes. Raise basket, remove fish and drain on absorbent paper. Serve immediately on a hot platter, plain or with a sauce.

SWEET-SOUR FISH

Everyone should try the recipe SWEET-SOUR FISH. It is the recipe used mainly by Filipinos and Chinese. It improves the flavor of fish.

Fry fish (lightly salted)

Remove fish from fat, pour out most of the fat.

Brown some green and red bell peppers and onions in same fat (salt).

Return the fish to frying pan with peppers and onions.

[1]Recipes for cooking fish were mainly taken from U. S. Fish and Wildlife Service, Fishery Leaflet 106. The recipe of the Sweet-Sour Fish was from Professor H. S. Swingle.

Then pour following mixture over the fish and steam for 10 minutes:

1 cup vinegar
2 cups water
1½ teaspoonful corn starch
Add sugar to sweeten
2 teaspoons ginger
Paprika

BROILED FISH

2 pounds fillets or steaks
1 teaspoon salt
⅛ teaspoon pepper
4 tablespoons butter or other fat, melted

Cut fish into serving size portions. Sprinkle both sides with salt and pepper. Place fish on a preheated greased broiler pan about 2 inches from the heat, skin side up, if skin has not been removed from the fillets. Brush fish with melted fat. Broil for 5 to 8 minutes or until slightly brown, baste with melted fat and turn carefully. Brush other side with melted fat and cook 5 to 8 minutes or until fish flakes easily when tested with a fork. Remove carefully to a hot platter, garnish, and serve immediately plain or with a sauce. Serves 6.

BAKED FISH

3 or 4 pounds fish, dressed
4 tablespoons butter or other fat, melted
1½ teaspoons salt
3 slices bacon (optional)

Clean, wash and dry fish. Rub inside and out with salt. Place fish in a greased baking pan. Brush with melted fat and lay slices of bacon over the top. Bake in a moderate oven 350° F. for 40 to 60 minutes or until fish flakes easily when tested with a fork. If fish seems dry while baking, baste occasionally with drippings or melted fat. Serve immediately on a hot platter, plain or with a sauce. Serves 6.

BOILED FISH

2 pounds fillets
2 quarts water
3 tablespoons salt

Cut fillets into serving size portions. Place fish in a wire basket or on a plate. The plate if used should be tied in a piece of cheesecloth. Lower the fish into the salted, boiling water and simmer, (never boil), about 10 minutes or until fish flakes easily when tested with a fork. Remove fish carefully to a hot platter. Garnish and serve with a rich, bright colored sauce. Serves 6.

TWO RECIPES FOR HUSH PUPPIES

A.

2 cups corn meal
1 tablespoon flour
½ teaspoon soda
1 teaspoon baking powder
1 teaspoon salt
1 whole egg
3 tablespoons finely chopped onions
1 cup buttermilk

Mix all dry ingredients together. Add onion, milk, and last, the beaten egg. Drop by the spoonful into the pan in which the fish was fried. Fry to a golden brown, then drain on paper. If deep fat is being used the hush puppies will float when done.

B.

5 cups cornmeal
2 tablespoons corn starch
1 tablespoon baking powder
1 tablespoon salt
½ tablespoon pepper
2 onions
1 pound cheese
4 eggs
1 can milk
2½ cups water

PART VII

SOME FRESH WATER FISH OF GEORGIA

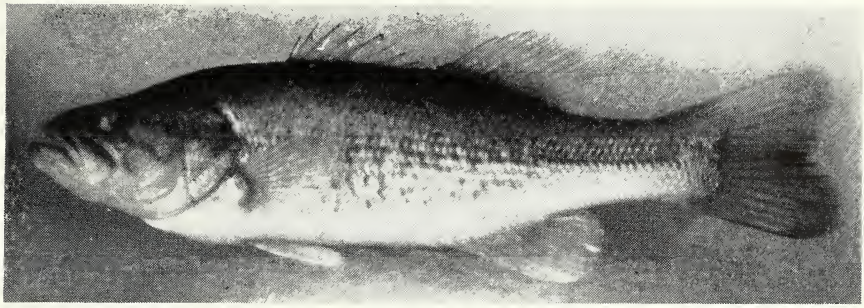

FIGURE 44.—Largemouth bass (*Micropterus salmoides*)

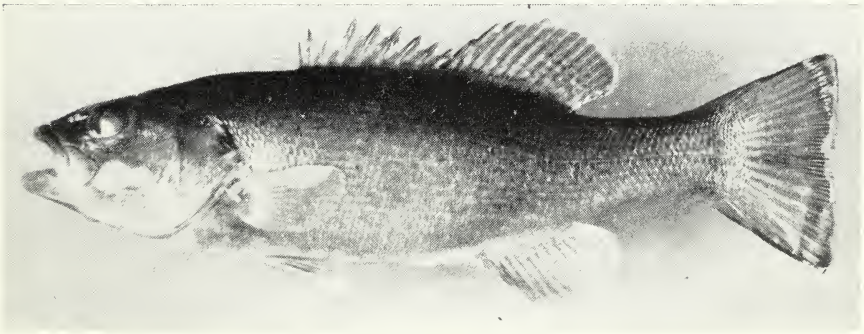

FIGURE 45.—Smallmouth bass (*Micropterus dolomieu*)

FIGURE 46.—Spotted bass.

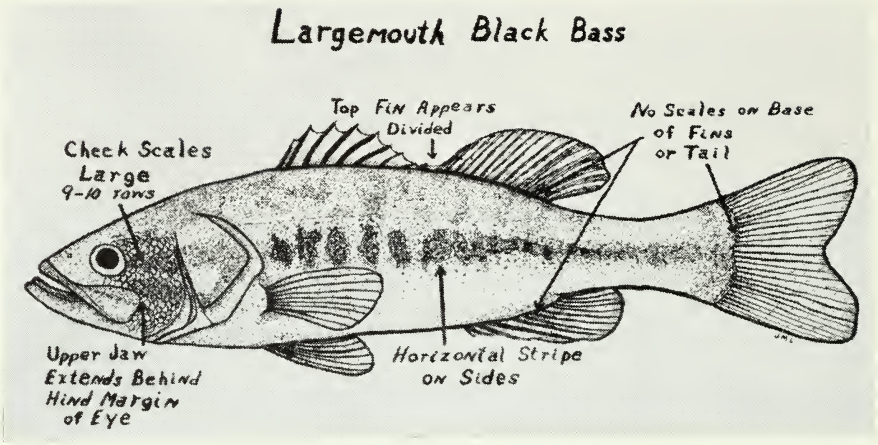

FIGURE 47.—Largemouth black bass.

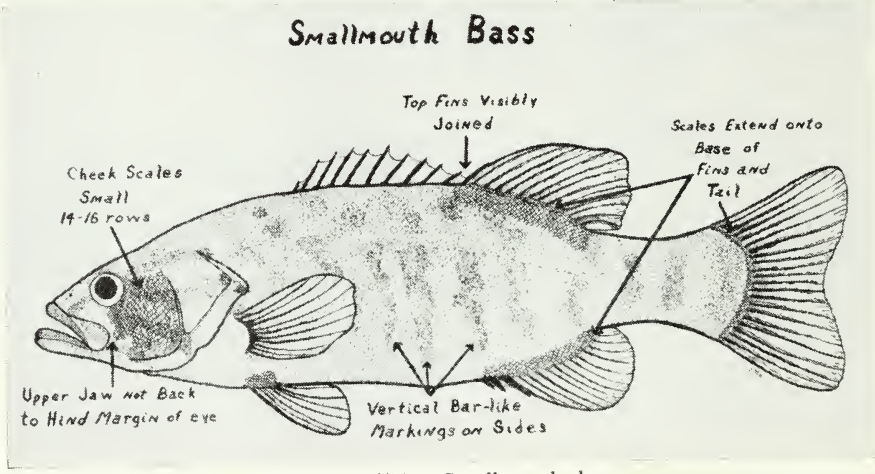

FIGURE 47A.—Smallmouth bass.

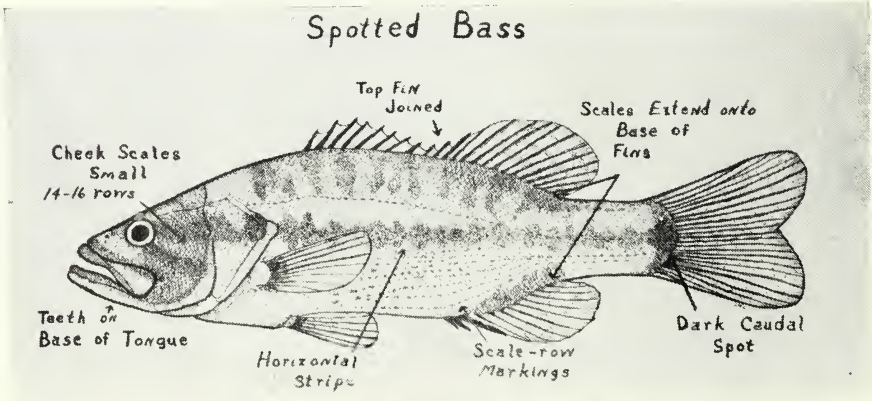

FIGURE 48.—Spotted bass (*Micropterus punctatus*)

FIGURE 48A.—Redeye bass or Coosae bass.

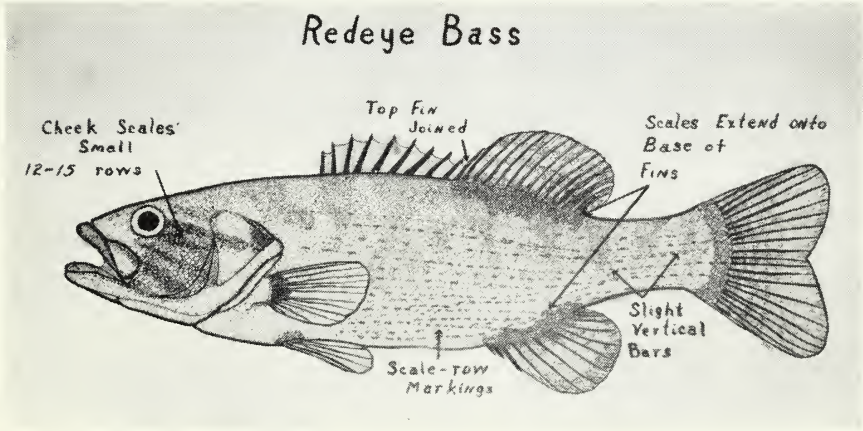

FIGURE 49.—Coosae bass (*Roccus crysops*)

FIGURE 50—White bass *(Lepibema crysops)*

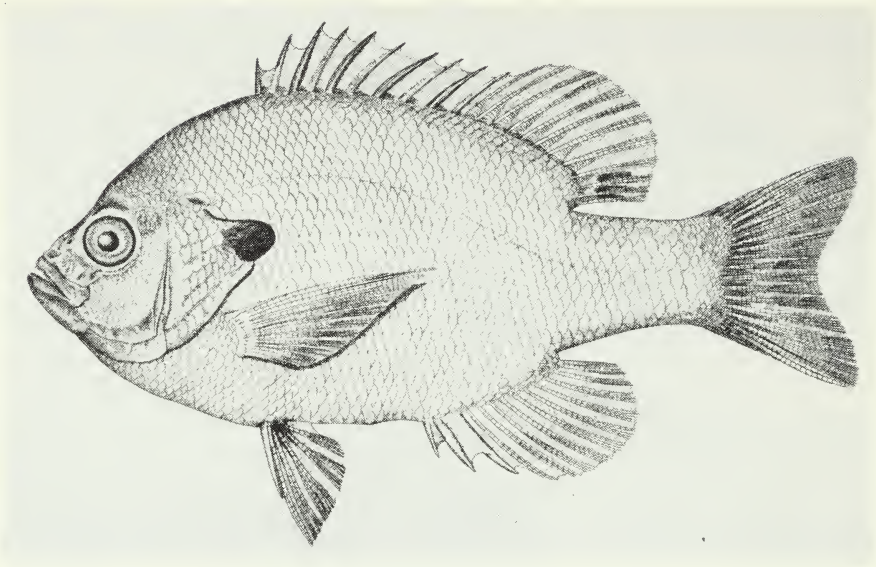

FIGURE 51.—Bluegill.

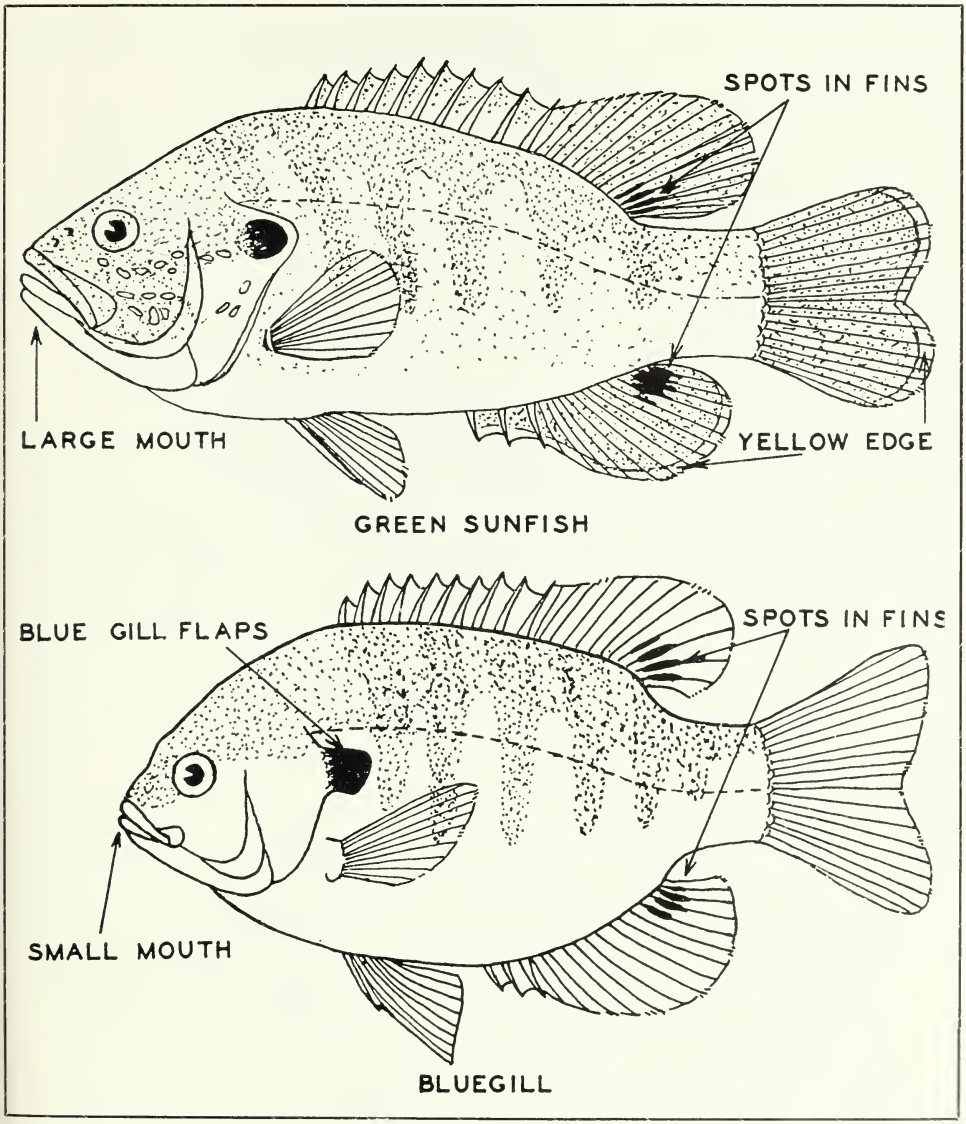

FIGURE 52.—Bluegill (*Lepomis macrochirus*)

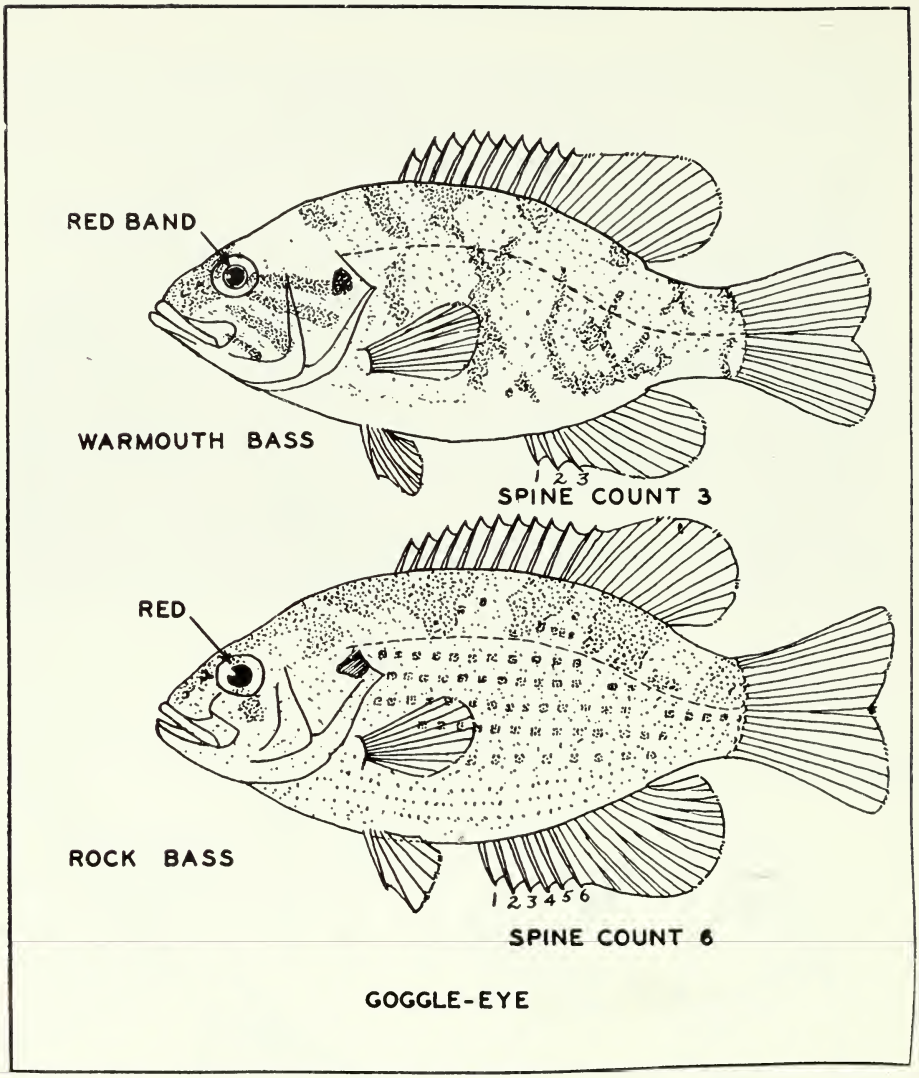

FIGURE 53.—Warmouth bass, Chaenobryttus coronarius, and rock bass, Ambloplites rupestris. Georgia anglers constantly call warmouth bass rock bass. Note the difference in the spine count of the anal fin. Warmouth bass has bars on its cheeks. Rock bass has little square pigments of color on its sides. State hatcheries are now producing rock bass.

Green sunfish, Lepomis cyanellus, and bluegill sunfish, Lepomis macrochirus. These two species have dark spots at the bases of the dorsal and anal fins. Note, however that the green sunfish has a large mouth and yellow-edged fins while the bluegill has a very small mouth.

Longear sunfish, Lepomis megalotis, and red-breasted bream, Lepomis auritus. The longear sunfish is not produced in the state fish hatcheries. It is shown above so that it can be compared with the red-breasted bream. These two species have longer gill flaps than any of the other sunfishes.

Redear bream or sunfish, Lepomis microlophus. Bright red or yellow band on margin of opercular flap. Males have a red band and females yellow band. Pectoral fin long and pointed.

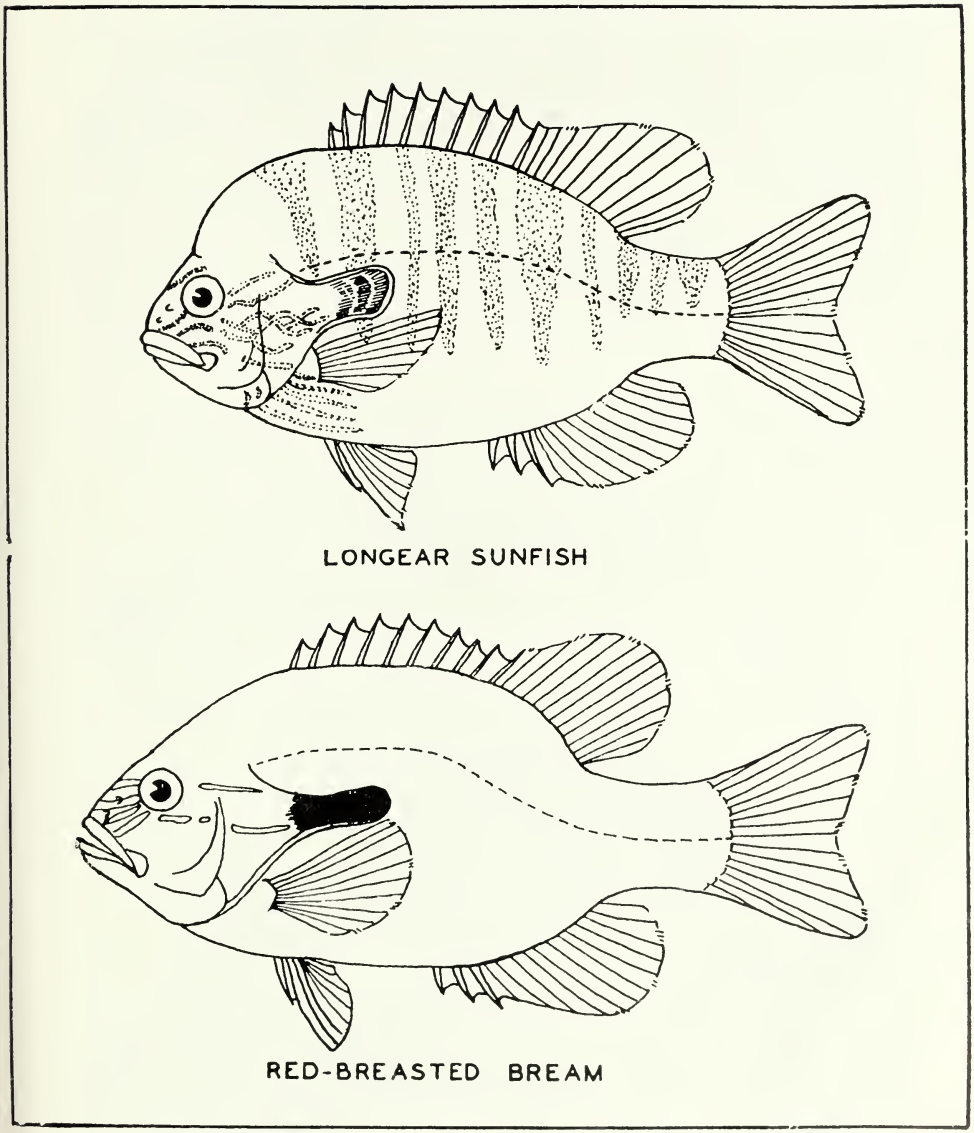

FIGURE 54.—Redbreast (*Lepomis auritus*)

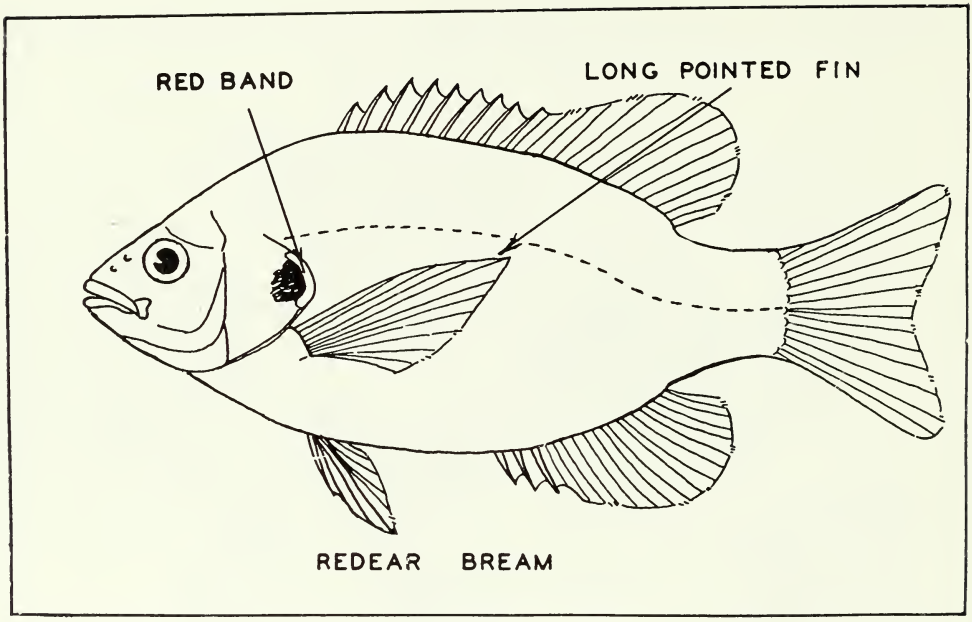

FIGURE 55.—Redear Bream or Shellcracker Bream

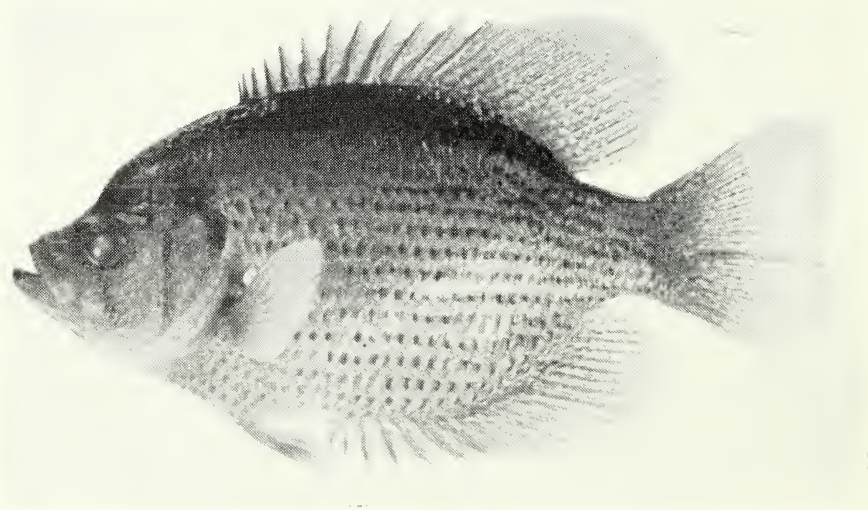

FIGURE 56.—Round flier (*centrarchus macropterus*)

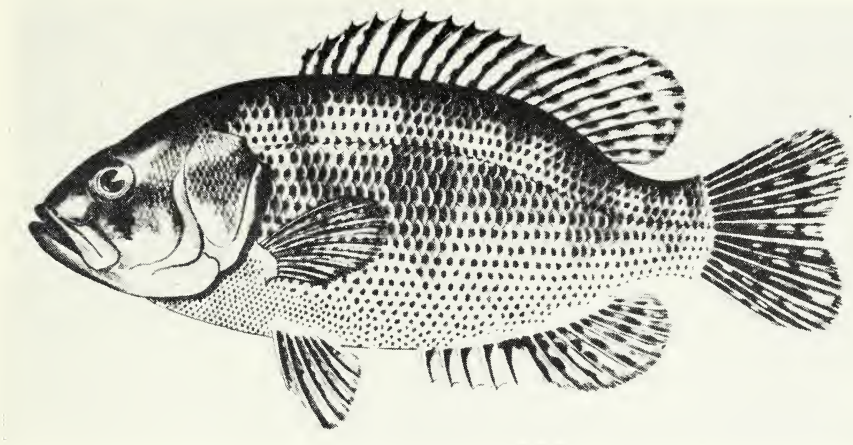

FIGURE 57.—Rock bass (*Ambloplites rupestris*)

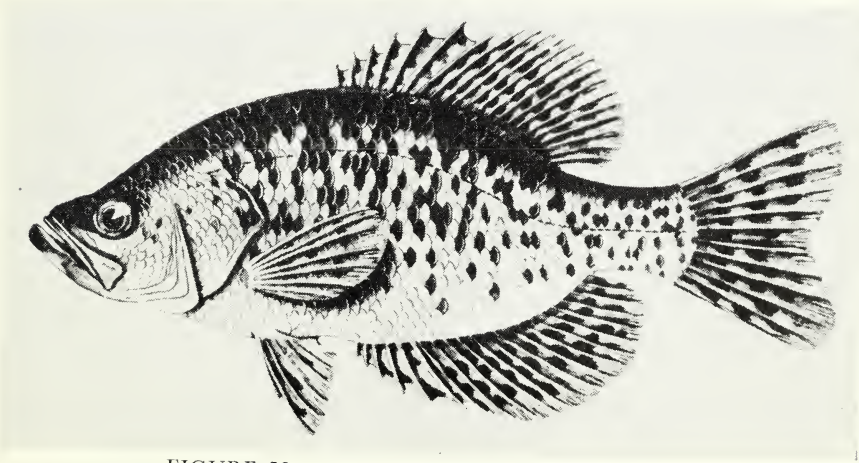

FIGURE 58.—Crappie (*Pomoxis nigro-maculatus*)

FIGURE 59.—Rainbow trout (*Salmo irideus*)

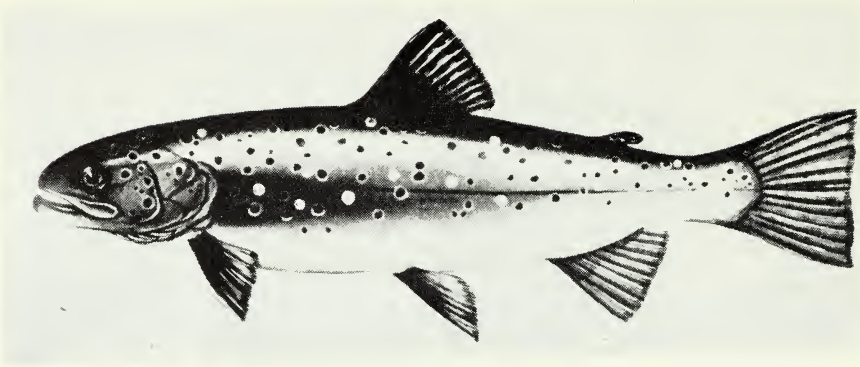

FIGURE 60.—Brown trout (*Salmo fario*)

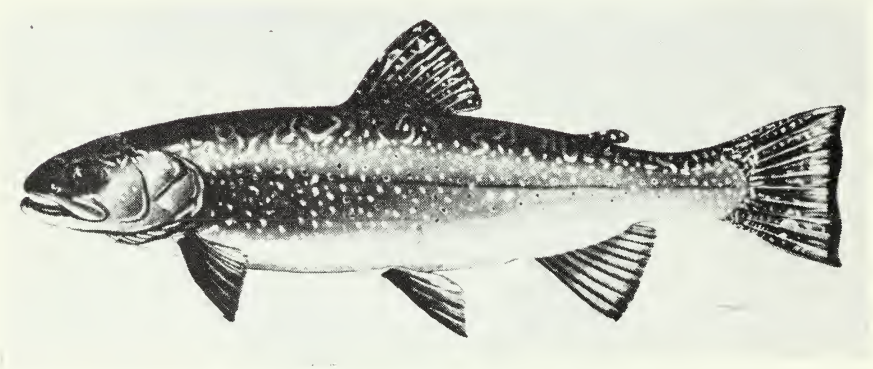

FIGURE 61.—Brook trout (*Salvelinus fontinalis*)

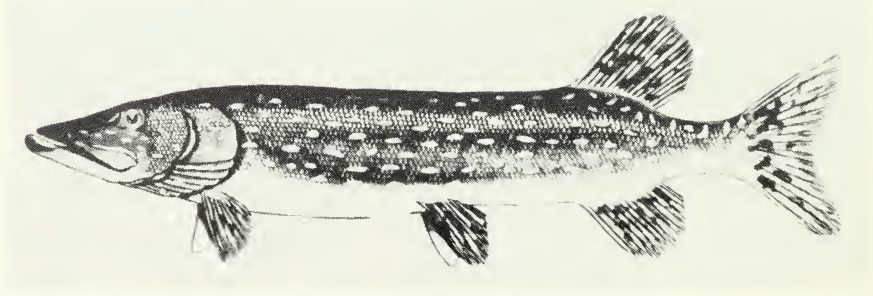

FIGURE 62—Muskellunge (*Esox masquinongy immaculatus*)

FIGURE 63.—Northern pike (*Esox lucius*)

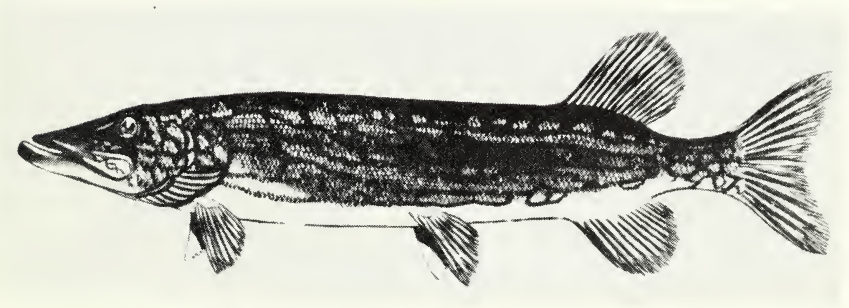

FIGURE 64.—Chain pickerel (*Esox niger*)

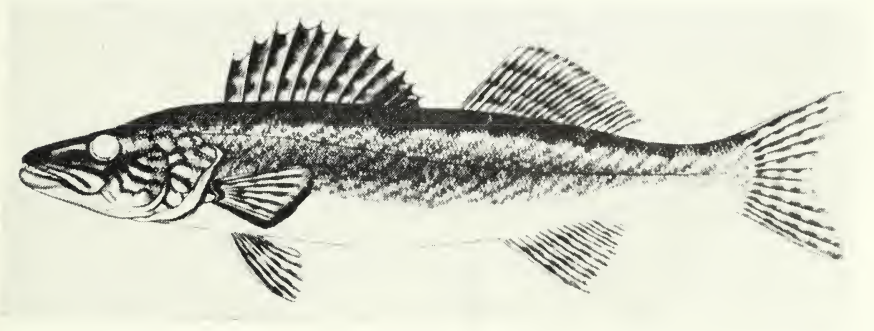

FIGURE 65.—Wall-eyed pike (*Stizostedion vitreum vitreum*)

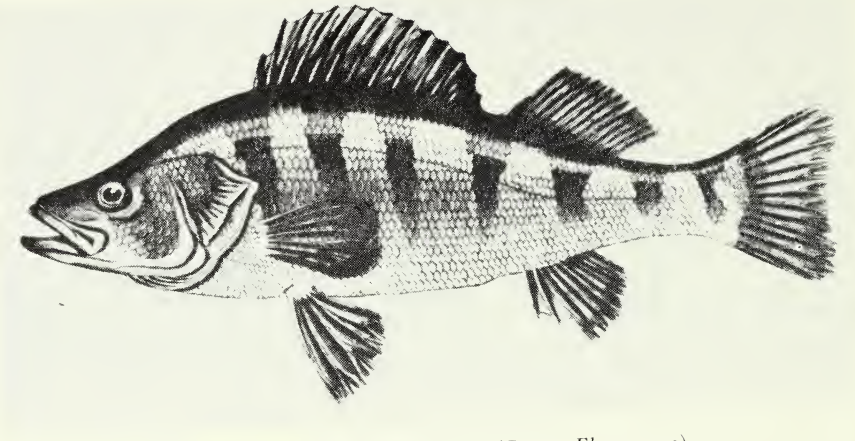

FIGURE 66.—Yellow perch (*Perca Flavescens*)

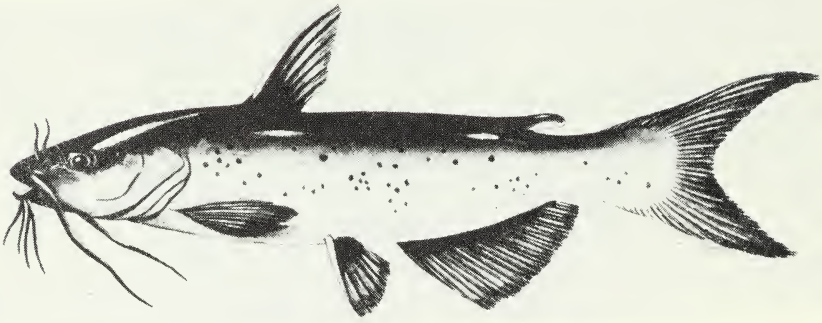

FIGURE 67.—Channel catfish (*Ictaluris lacustris punctatus*)

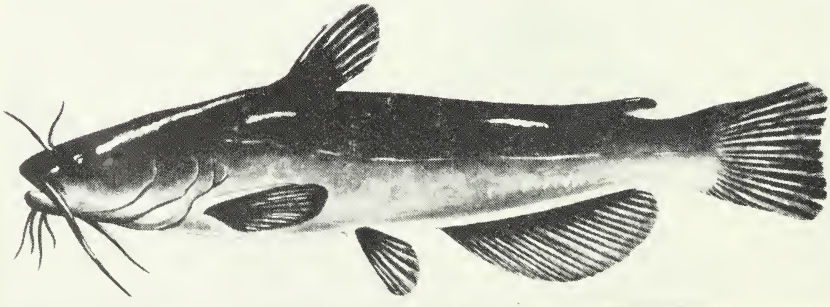

FIGURE 68.—Bullhead catfish (*Ameirus nebulosis*)

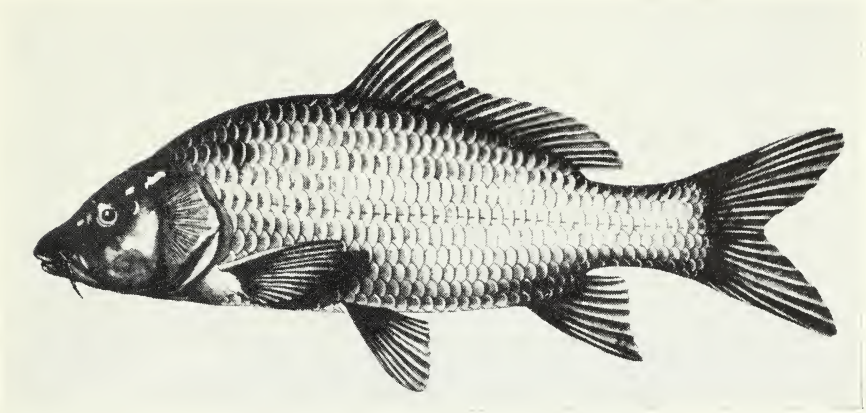

FIGURE 69.—Carp (*Cyprinus carpio*)

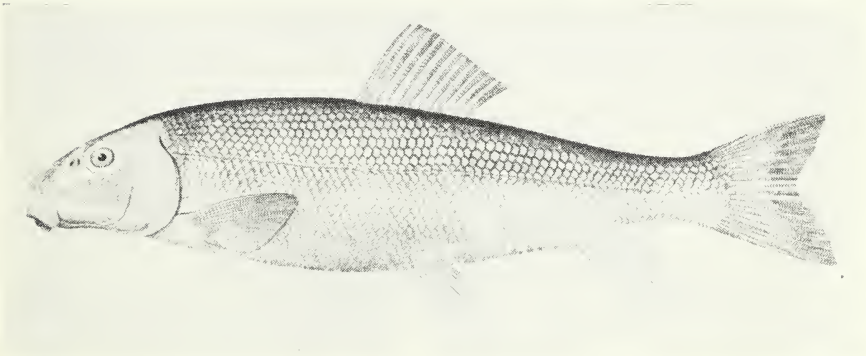

FIGURE 70.—Sucker (*Catostomus commersonii*)

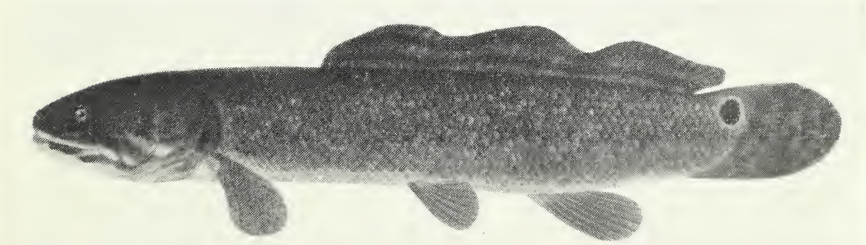

FIGURE 71.—Grinnel (male) Amia Calva Linnaeus (*Mudfish or Blackfish*)

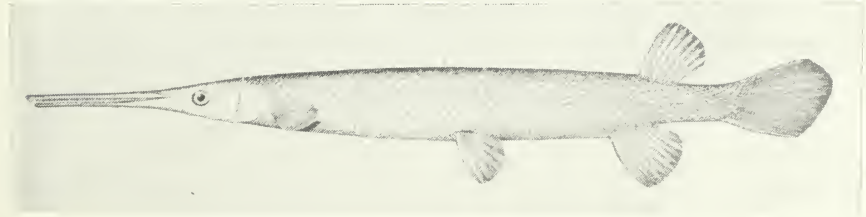

FIGURE 72.—Long nosed gar (*Lepisosteus osseus*)

PART VIII

SOME SALT WATER FISH OF GEORGIA

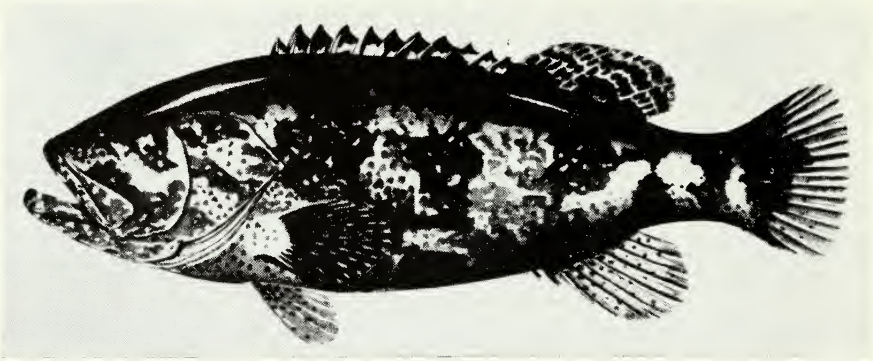

FIGURE 73.—The Spotted Jewfish *(Promicrops itaiara)* is the largest of our sea basses, reaching a length of 8 feet and weight of 693 pounds. The Georgia coast is thought to be the northern margin of its range. Although of great size, the spotted jewfish is not prized as a game fish because of its sluggish habits.

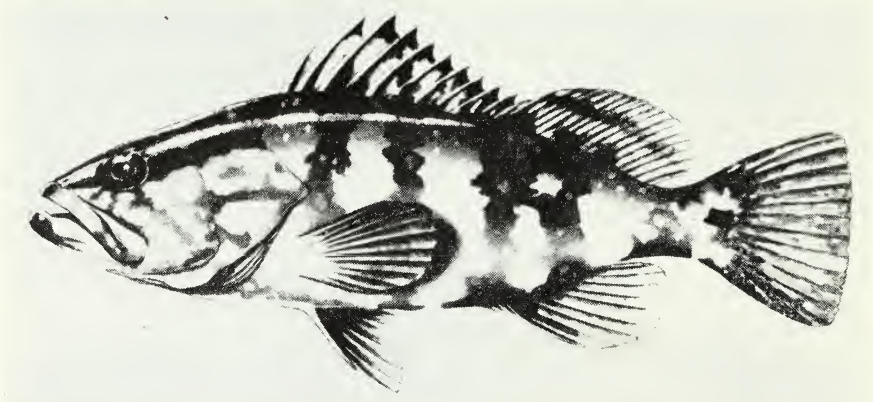

FIGURE 74.—The Nassau Grouper (*Epinephelus striatus*) is easily recognized by the distinctive stripes on its side. The Georgia coast is considered well within the range of this fish, which is highly prized as a food fish. It reaches a length of about 3 feet.

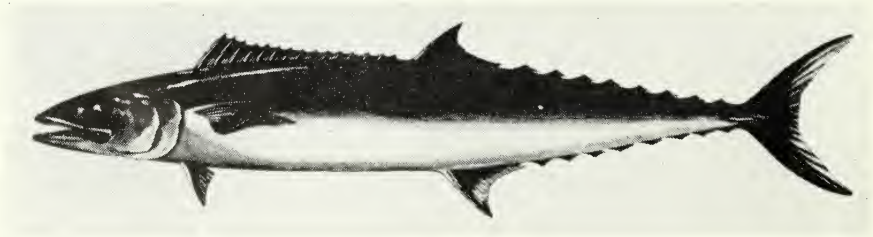

FIGURE 75.—The Cobia (*Rochycentren canadus*) feeds largely on bottom dwelling fish and crabs. The cobia reaches a length of nearly 5 feet and a weight of over 60 pounds. Georgia fishermen catch cobia from April through November.

FIGURE 76.—The Sheephead (*Archasargus probatocephalus*) may spawn in March or April. It is common off the Georgia coast and may reach a length of about 30 inches and weight of 20 pounds. This fish is caught from early spring to late fall.

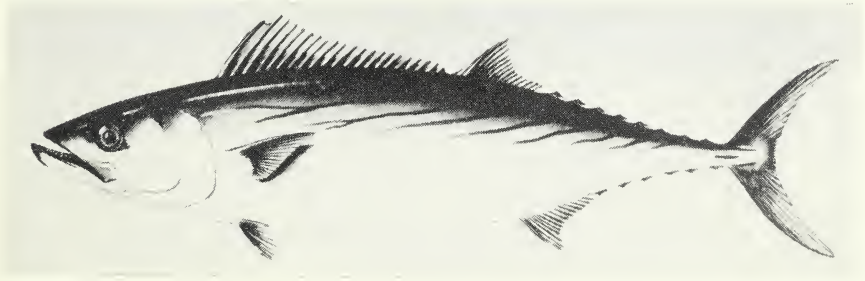

FIGURE 77.—The Bonito (*Sarda sarda*) feeds chiefly on fishes and squid. This fish may reach 12 pounds in weight and spawns in June.

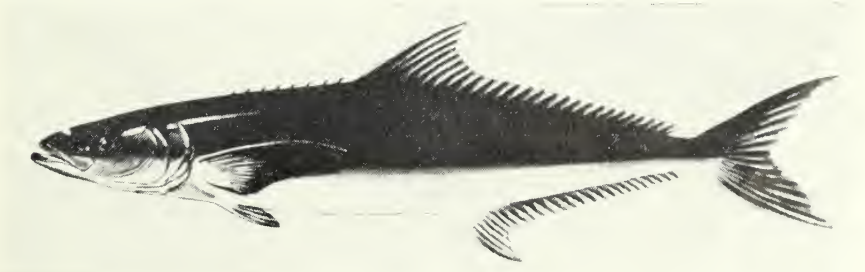

FIGURE 78.—The King Mackerel (*Scomberomarus cavalla*) is one of the larger mackerels reaching a weight of 100 pounds. This fish is caught off the Georgia coast from May through August.

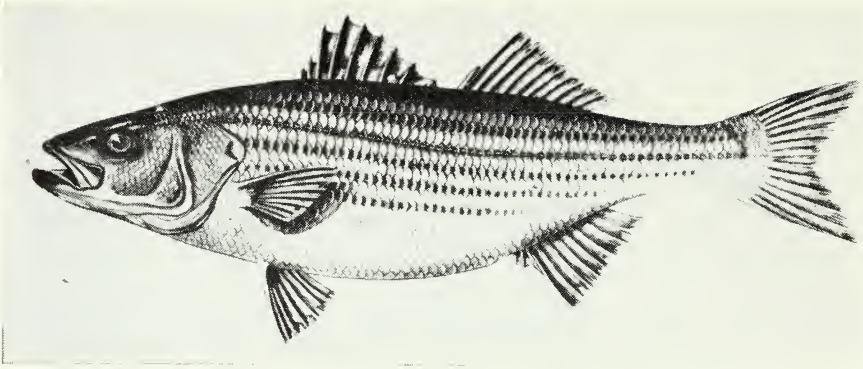

FIGURE 79.—The Striped Bass (*Roccus saxatilis*) is one of our important sport fishes. This fish suffers greatly from fresh water pollution in that many spawning areas are destroyed. A large female may produce over 2,000,000 eggs in one season. The Georgia coast is well within the range of this fish which may reach a weight of 125 pounds.

FIGURE 80.—The Summer Trout (*Cynoscion regalis*) is found along the Georgia coast although the optimum range is more northward. This fish is of great economic importance, both to commercial fishermen and anglers. The spawning season extends from May to September. The greatest size recorded for this species is 30 pounds, however, this is unusual. Summer trout may be caught the year around.

FIGURE 81.—The Spanish Mackerel (*Scomberomarus maculatus*) is quite commonly caught off the Georgia coast. This fish is highly prized by the light-tackle angler. An average female will lay as many as 20,000 eggs as late as September. This fish reaches a weight of around 10 pounds. These fish are usually caught from May through August.

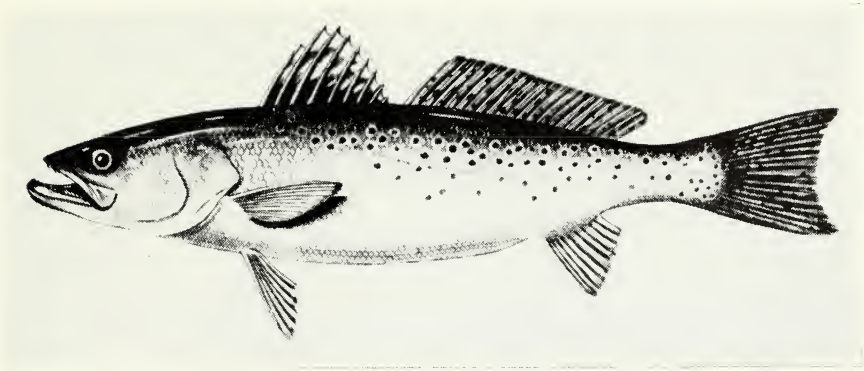

FIGURE 82.—The Winter Trout (*Cynoscion nebulosus*) is the southern counterpart of the weakfish. Little is known concerning this fish, however, its weight apparently does not exceed 15 pounds. The best time to fish for Winter Trout is November through January, however, some may be caught from early October through March.

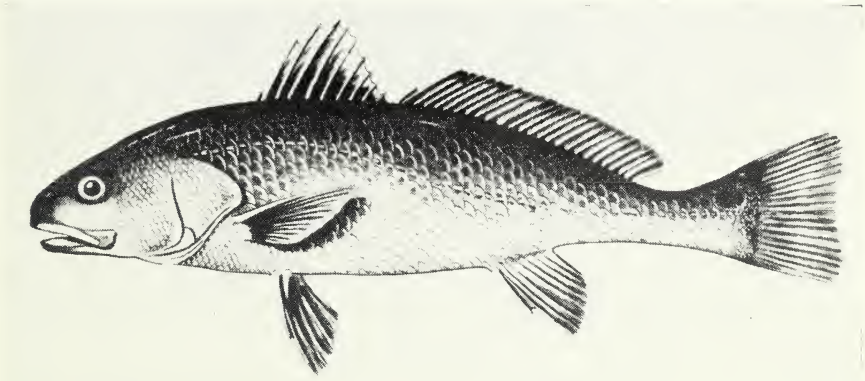

FIGURE 83.—The Channel Bass (*Sciaenops ocellatus*) reaches a length of about 5 feet and weight of 75 pounds. It is very common off the Georgia coast furnishing sport for thousands of fishermen annually. The channel bass spawn in late fall and winter; best time to fish for them is spring and summer.

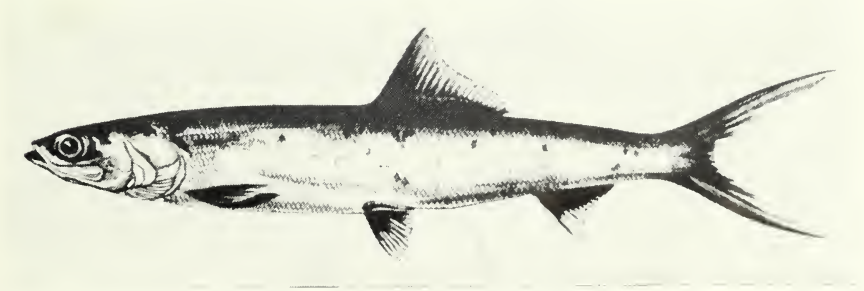

FIGURE 84.—The Ladyfish (*Elops saurus*) is well known as an aerial acrobat when taken on light tackle. Although small, this fish is highly prized by Georgia anglers.

FIGURE 85.—The Sailfish (*Istiophorus americanus*) is commonly caught off the Georgia coast from May through August. This fish may reach a weight of 110 pounds.

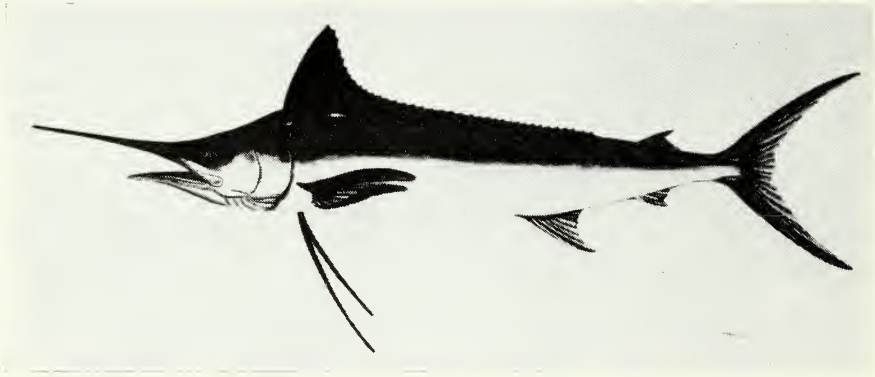

FIGURE 86.—The White Marlin (*Makaira albeda*) is the smallest species of the marlin family, the largest caught on record being only 161 pounds. The Georgia coast is well within the range of this highly prized speedy fighter.

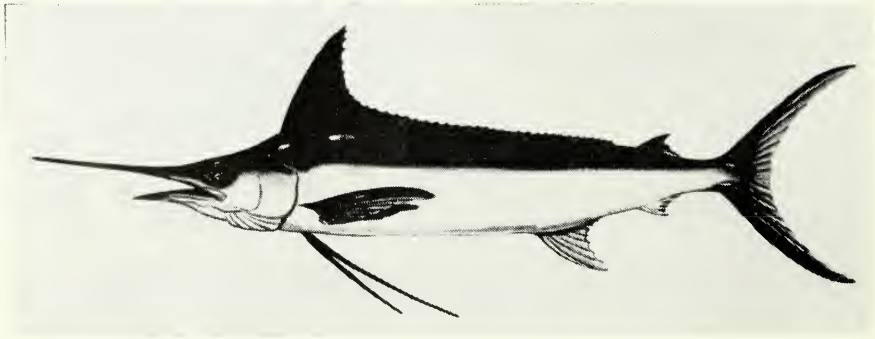

FIGURE 87.—The Blue Marlin (*Makaira nigricans ampla*) is one of the largest and most powerful gamefish found off the Georgia coast. The heaviest of tackle is needed to catch this fish that may reach 750 pounds. The flesh is very tasty though seldom eaten.

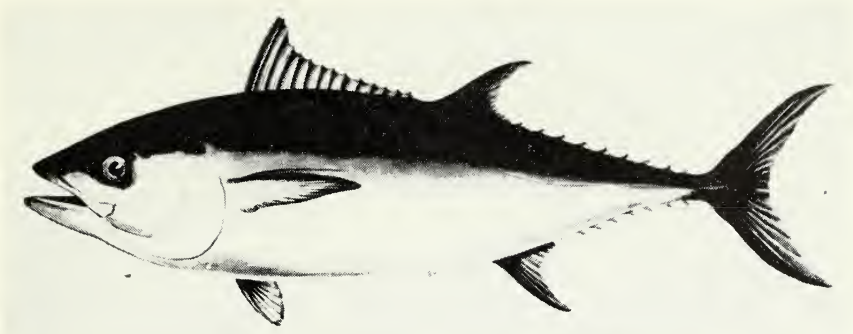

FIGURE 88.—The Bluefin Tuna (*Thunnus thynnus*) is one of the world's most prized sport fish offering the target for international fishing contests. These fish may migrate past the Georgia coast at certain times during the year. The largest bluefin on record weighed 1800 pounds.

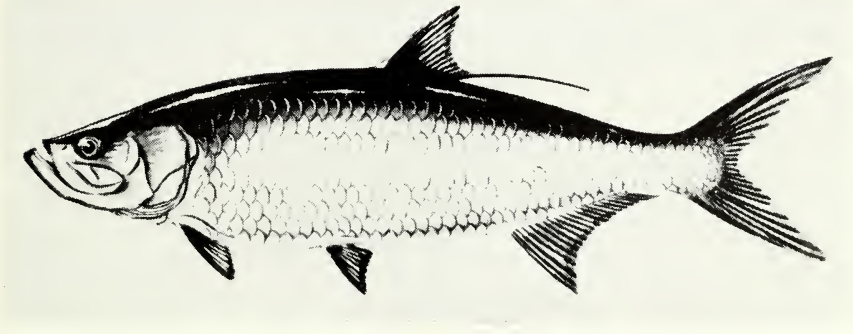

FIGURE 89.—The Tarpon (*Tarpon atlanticus*) is recognized as one of the world's gamest fish and easily lives up to his nickname, the Silver King, by his aerial acrobatics. While most tarpon range farther south, several are caught off the Georgia coast each year, from May to October. This fish may reach 350 pounds. however, those under a foot in length are just as rare.

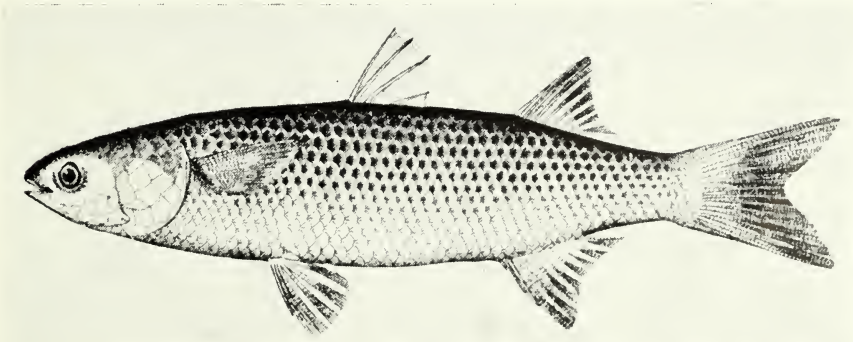

FIGURE 90.—The Mullet (*Mugil cephalus*) is important commercially when found in sufficient numbers. The Georgia coast is well within their range.

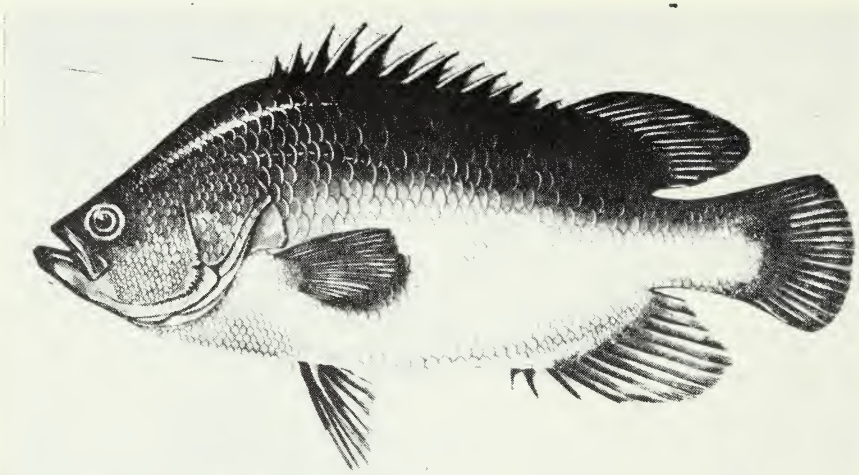

FIGURE 91.—The Tripletail *(Lobotes surinamensis)* is thought of as the sea bream. It is usually found around buoys, old wrecks or moored boats. This fish may reach a weight of 50 pounds and many are caught off the Georgia Coast from April to September.

FIGURE 92.—The Croaker (*Micropagon undulatus*) is found along sandy shores off the Georgia coast. The spawning season is long, extending from August to September. Like other fish of the croaker family, this fish produces noise through a modification of the swim bladder. Early spring to late fall is the time to fish for this fish.

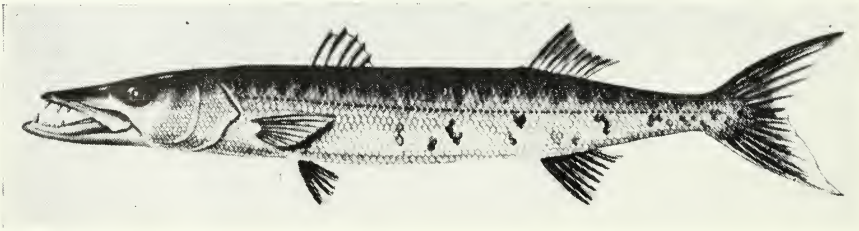

FIGURE 93.—The Barracuda (*Sphyraena barracuda*) is known for his ferociousness, yet is only considered fair as a game fish. He has been known to attack and inflict serious wounds on bathers and should be treated with utmost respect.

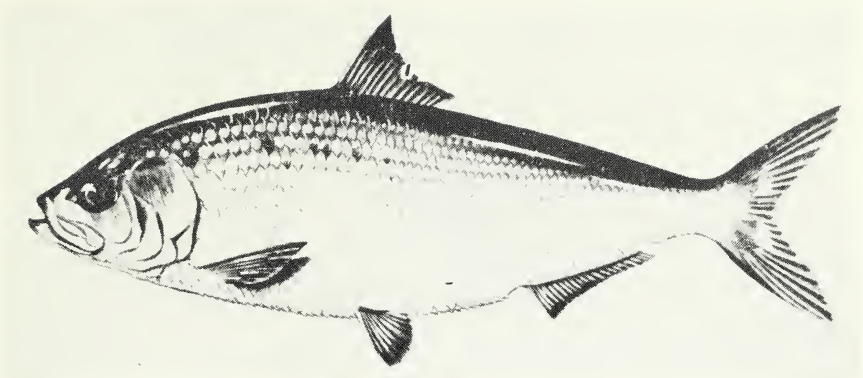

FIGURE 94.—The Shad (*Alosa sopidissima*) is the most sought after of all the herrings for food and is very common off the Georgia coast. The spawning run into fresh water of our Georgia Rivers usually takes places in January, or later, when the water temperatures approach 50° F. The record size taken for this species is 13½ pounds with a length of 2½ feet.

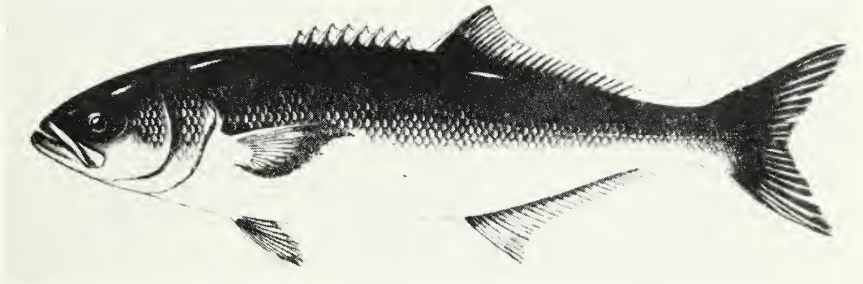

FIGURE 95.—The Bluefish (*Pomatomus saltatrix*) is exceedingly voracious, preying upon other fish and the squid. It is highly prized by anglers and epicures alike. This fish spawn in the spring and early summer and may reach a weight of 50 pounds. An April and May run and an August to October run present the best opportunity to score a catch.

FIGURE 96.—The Amberjack (*Seriola dumerili*) is found well off the Georgia coast. This fish may reach a weight of 150 pounds and should be fished for from May through August.

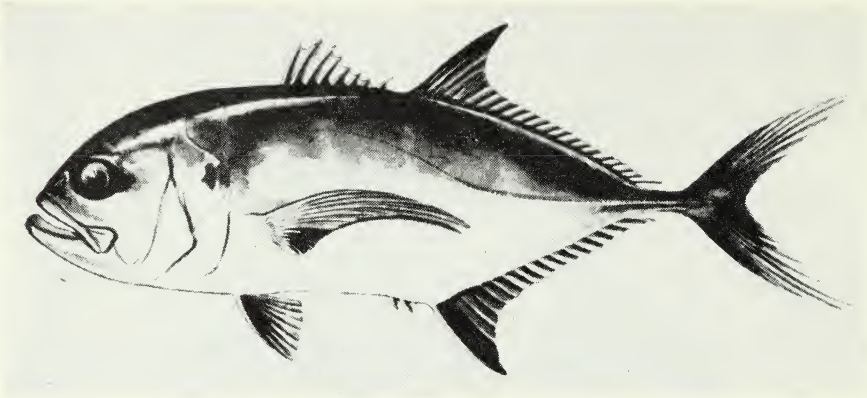

FIGURE 97.—The Jack Crevalle (*Caronx hippos*) is well known for its gameness. These fish feed largely on other fish and may reach a length of 2½ feet and a weight of about 20 pounds. They are caught off the Georgia coast from May through August.

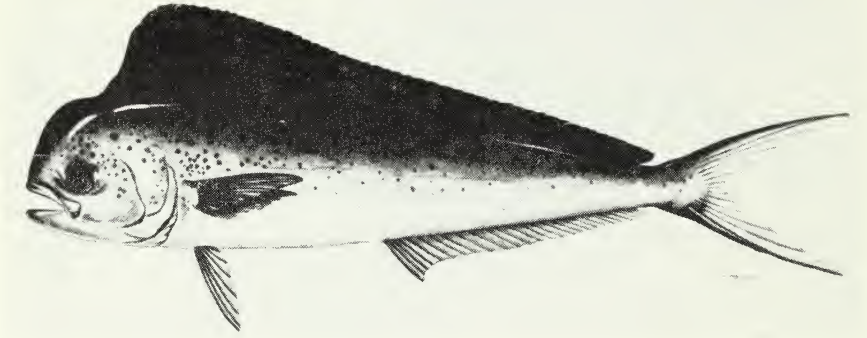

FIGURE 98.—The Dolphin *(coryphoena hippurus)* is an exceedingly fast fish found well off shore along the Georgia coast. This fish spawns in the spring in the West Indies and reaches a length af about 6 feet.

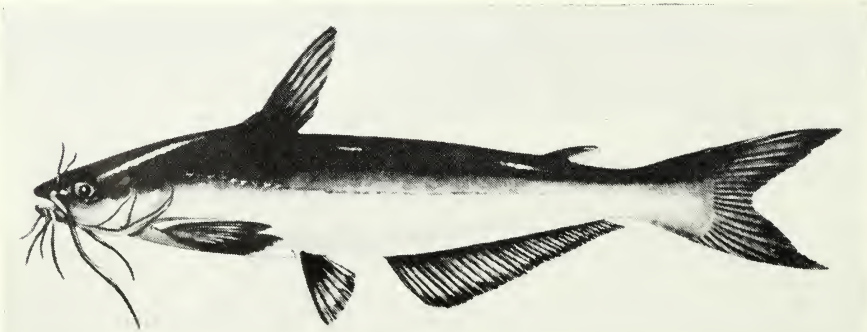

FIGURE 99.—Blue Catfish (*Ictalurus furcatus*) is important commercially. Blue Cats weighing over 150 pounds have been reported. It has excellent flavor.

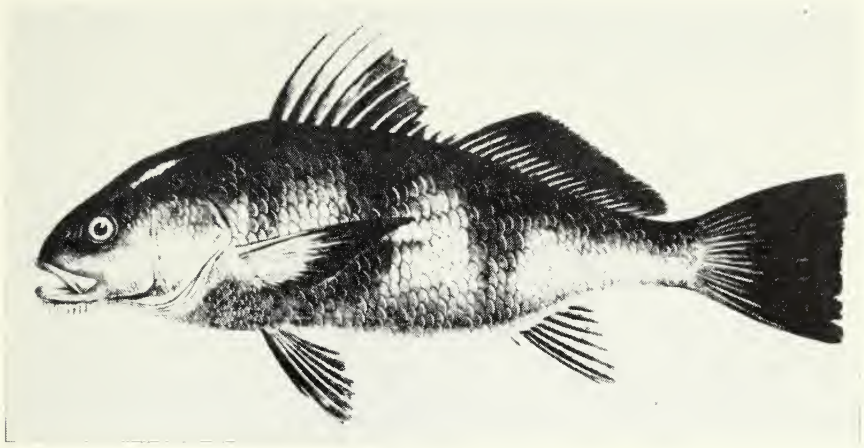

FIGURE 100.—The Black Drum *(Pogonias cromis)* is conspicuous in that little is known of its life history. It is best known for the loud noise it is able to make. This fish may reach a weight of 150 pounds. It is usually caught off the Georgia coast from April to October.

FIGURE 101.—The Pompano (*Trachinotus carolinus*) is common along the Georgia coast and a prize of commercial fishermen. This fish reaches a length of 18 inches and weight of about 2 pounds.

Some of the Other Species of Fish Caught Along the Georgia Coast

The Summer Flounder *(Paralichthys dentatus)* and the Southern Flounder. *Paralichthys lethostigma* are caught the entire year.

Black Sea Bass *(centropristes striatus)* caught during summer months.

Angelfish *(Angelichthys isabelita)* caught from early spring until late fall.

Little Tuna *(Euthynnus alletteratus)* caught from May through August.

Yellowtail or Silver Perch *(Baerdiella chrysula)* March through October.

Spot *(Leiostomus xanthurus)* caught from early spring to late fall.

King Whiting *(Menticerrhus americanus)* caught from early spring to late fall.