

THE COMMERCIAL, GAME, AND ROUGH FISHES OF REELFOOT LAKE¹

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INTRODUCTION

The purpose of this paper is to set forth the more important facts regarding the commercial and game fishes of Reelfoot Lake. A careful perusal of the literature shows that little investigation has been carried out on this body of water. Conversations with sportsmen, commercial fishermen, and amateur anglers indicated the need for a study which will give the more important information relative to the food fish caught by commercial fishermen and anglers—the rough, forage, and predatory fish of the lake—and their abundance and economic importance. That was the object of this study. In addition there is included in this paper information from scientific bulletins regarding food for fishes, mating habits, spawning conditions, relationship of various fishes to each other, and the scientific characteristics of various fishes which is, in general, not available to the general reader.

A bulletin of this kind should serve to establish proper names for the more important fishes which are handled commercially and to enable the angler to distinguish the various types of game fishes that are caught. Common usage should determine the common name for a fish. For example, it is quite proper when in Louisiana to refer to the white crappie as the "sacalait" and to call the large-mouth black bass a "green trout," for these names have been accepted quite generally in that state. Fishermen, however, who travel from one locality to another and who fish in many different states find it difficult to name their fish. *Pomoxis annularis*, the white crappie, has twenty-four different common names, while *Huro salmoides*, the large-mouth black bass, has received forty-four different popular names. A test was made on a group of fishermen in an attempt to determine whether or not there is any uniformity in the common names used at Reelfoot Lake. In a general assortment of sunfishes the individual fishermen were asked to point out a "bream." It was found that *Helioperca macrochira*, *Eupomotis gibbosus*, *Centrarchus macropterus*, *Apomatis cyanellus*, and *Xenotis megalotis* were referred to as "bream" by those with years of experience in catching these fishes. *Pomoxis sparoides*, which has thirty common names, is known as "Calico Bass," "Black Crappie," and "Strawberry Bass."

¹Contributions from the Reelfoot Lake Biological Station No. 1.

On the other hand the author has been informed on many occasions that a "Strawberry Bass" is entirely different from a "Black Crappie" and that this latter fish is a form of white crappie which has "lived under logs or in darker places." Wherever there is uniformity and general agreement as to a common name, that name might continue to be used. In cases where the same name is used for several types of fish and where several names are given to the same fish, this bulletin will serve a very useful purpose by indicating the preferred name. Scientific names are of necessity included as these double Latin names permit the students of different states and even different countries to ascertain with some degree of assurance the particular fish under discussion.

The author wishes to emphasize the fact that this preliminary study is based on an investigation of three months and is necessarily incomplete. It is quite possible that several very important fish, which might be present in Reelfoot Lake, were not encountered. A majority of the specimens were secured from commercial fishermen at the State Fish and Game docks at Blue Bank on the south shore of the lake, at Samburg on the east shore, and at Walnut Log near the north-east end.

TABLE 1

*Catch of fishes at Reelfoot Lake per month in pounds**

NAME OF FISH	1933-1934	1935-1936
Large-mouth bass.....	2,185	1,583
Crappie.....	6,675	6,271
Sun-Fish.....	3,604	4,160
Yellow Bass.....	1,207	1,116
White Bass.....	70	50
Buffalo.....	18,934	20,105
Drum.....	3,296	3,500
Carp.....	6,547	4,516
Bullheads.....	834	1,273
Catfish.....	4,458	6,347
Eels.....	23	34
Spoonbill Cat.....	15	105
Total.....	47,848	49,060

*Figures of commercial catch were furnished by the Tennessee Game and Fish Commission.

The distribution and abundance of various types of fishes in the lake is largely unknown. Much additional investigation is necessary along this line. A creel census should be made so as to determine the number of fish per hour per person in one season. Until this is done, we cannot hope to reduce the "time between bites."

Some slight evidence of the amount of fish taken annually from the lake may be obtained from Table 1 which represent the commercial

catch on which royalty was paid. These figures do not include the great number of bass and crappie sold during the closed season nor those caught and sold under the legal size limit.

A distinction is made between commercial and game fish despite the fact that several types may be classed with either group. The game fish are those which afford a gamy fight when caught on a hook and are generally conceded to be worth more to the angler than to the commercial fisherman. Due to the increasing popularity of game fishes they are becoming scarce and certain legal restrictions are necessary to preserve their number. Such fishes for Reelfoot Lake should include the large-mouth black bass, the white crappie, the black crappie, bluegills, warmouth bass (goggle-eye), yellow bass (Jacks), and white bass (rock bass). For these fishes a closed season should be provided during which none may be taken, a size limit should be considered, the maximum number taken in one day should be stipulated, and none should be sold.

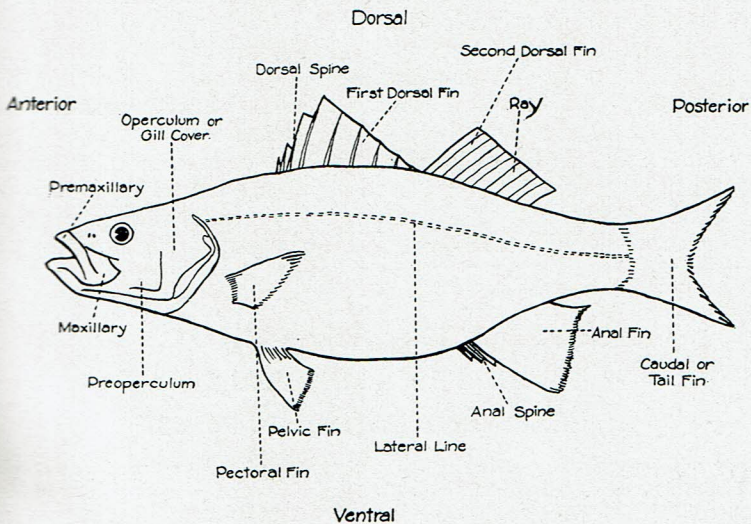


Fig. 1. An outline sketch of a typical fish illustrating the various technical terms which are included in the descriptions of fishes and defined in the glossary at the end of this paper. (From Churchill and Over, *Fishes of South Dakota*, 1933.)

Commercial fishes may include certain rough fishes as carp and buffalo which are abundant and predatory in their habits, along with drum, spoonbill cat, eel, pike, and catfish which are not usually sought by the anglers.

The gars and grindles are quite abundant since they have little or no commercial value and do not take to a hook readily. Since they are extremely predacious, it would be well for steps to be taken to remove these fish wherever possible.

Reelfoot Lake is characterized by abundant vegetation, a bottom practically without gravel, a fluctuating water level, shallow waters, high temperatures in summer, and few water currents. It is reasonable to believe that no trout, small-mouth bass, rock bass, jack salmon, and land-locked salmon are there, since these conditions are unsuitable for these fish. The great abundance of submerged aquatic vegetation and shallow waters makes of this lake a natural fish hatchery.

Only the larger and more common species of fish have been included in this preliminary study. Numerous other types of fish are known to be present, the details of which have been reserved for additional investigations.

In a work of this kind it is very difficult to give credit where credit is due. Most of the facts included are the results of painstaking research by experienced ichthyologists. References have been made in many cases, yet it is desired here to pay particular tribute to Forbes and Richardson of the Natural History Survey of Illinois, to Jordan, Everman, and Clark of the United States Bureau of Fisheries, and to J. N. Gowanloch of the Department of Conservation of Louisiana for the liberal use made of their outstanding studies on the fishes of North America. All information used in this paper regarding the feeding habits of fishes is attributed to the excellent researches of Stephen A. Forbes during the past five decades.

Reelfoot Lake furnishes a virgin territory for researches on breeding habits, growth rates, food conditions, and fish relationships of the various commercial and game fish and it is the plan of the author for this paper to be the first of a series of papers dealing with the fishes of Reelfoot Lake.

NOTES ON THE FISHES STUDIED

PADDLE FISH (FIGURE 2)

Polyodon spatula (Walbaum). No. 187²

Body with smooth skin and with a snout prolonged and expanded into a thin flat blade or paddle. Mouth broad, terminal, shark-like. Color pale to dusky bluish olive. Head $1\frac{1}{2}$, depth $4\frac{1}{2}$ ³. Length 5 to 6 feet.

The paddlefish, generally referred to as spoonbill cat at Reelfoot Lake, and duckbill, shovel-fish, and spadefish in other localities, is one of the most unusual and interesting fishes of the world. Found only in the Mississippi Valley at present, it is a survivor, along with a similar form, *Psephurus gladius* of China, of an ancient group of primitive shark-like forms which lived and flourished in Devonian

²This is the species number as given in Check List of Fishes, by Jordan, Evermann and Clark, 1930.

³The measurements of the *head* and *depth* are relative, being the number of times the length of the body is greater than that of the head or the depth of the body. Thus, Head 3, depth 6 means that the length of the body is 3 times the length of the head and 6 times its own depth. The length of a fish is the distance from the tip of the snout to the base of the caudal fin.



Fig. 2. Paddle Fish or Spoonbill Cat. The paddle fish frequents waters with a muddy bottom and the special straining apparatus borne by the gills (Fig. 3) enables it to live entirely on semi-microscopic animals, mainly Entomostraca and aquatic insect larvae, which are engulfed as it swims slowly over the muddy bottom. Little is known of its breeding habits, although Thompson of the Illinois Natural History Survey has observed the youngest specimens on record from the Mississippi River. They have the habit of swimming near the surface at night and commercial fishermen take advantage of this behavior by setting snag-lines near the surface.

and Carboniferous times. Its original discoverer, Walbaum, in 1792 described it as a species of shark. Despite its being called a "cat" and having a smooth skin without scales, it is in no way related to the catfishes. Its paddle-shaped snout, of no apparent use, has been regarded as an expanded sense organ (Kofoid, 1900).

It is found in the southern part of the lake and large numbers are seined from the Obion River at the Spillway and placed in the lake. The average size of those caught run from three to four feet and weigh from 15 to 40 pounds, although many specimens much larger have been reported. The maximum available record is 173 pounds for a fish more than six feet long. Despite these large sizes, it is now believed that a forty-pound paddle fish is ten to twelve years old.

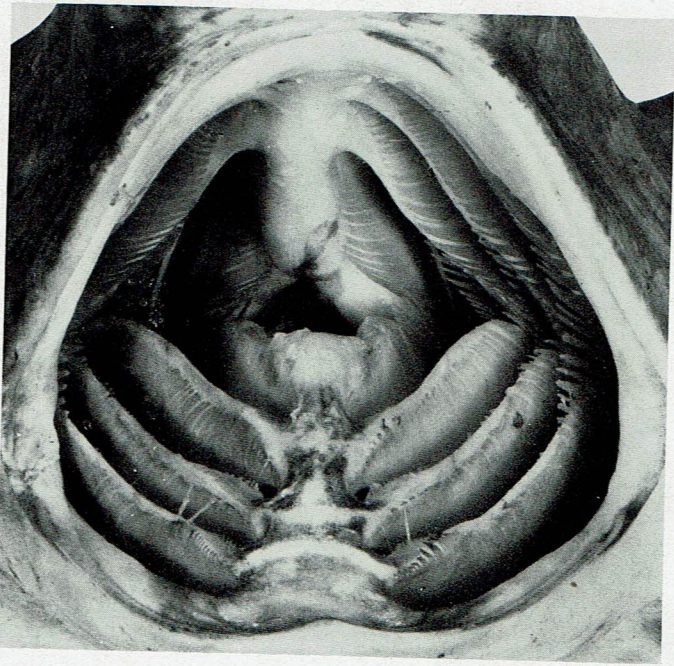


Fig. 3. The open mouth of a paddle fish showing the special straining apparatus borne by the gills.

Twenty-five years ago a million pounds annual catch was not considered unusual for the Mississippi Valley, but the sale of roe, at a high price, for caviar manufacture resulted in a steady depletion of the supply. There seems to be no market at present for the roe, and after a number of years during which few were caught the supply seems to have increased. The annual commercial catch at Reelfoot Lake has more than doubled in the past two years over a similar previous period. They are sold in the markets as "boneless cat" and are slightly inferior in quality to the larger catfishes.

THE GARS OR GARPIKES

The garpikes, like the paddle fish, are sole living representatives of a large group of ancient fish which flourished during the Carboniferous period of Europe and America. They are at present restricted to North America and Cuba. They have been successful in the long struggle for existence largely because of their heavy armor plate of ganoid scales and long snout with heavy conical teeth, which enable them to prey upon almost all fish, but in turn to be preyed upon by none. Gar scales are said to have been used by pioneer farmers to cover wooden plowshears (Smith, 1907), and in Louisiana many have been fashioned into Indian arrowheads (Gowanloch, 1933).

The gars are voracious eaters and feed almost entirely on the young of other fishes. Forbes and Richardson of the Illinois History Survey describe a young gar only an inch and a quarter in length that had captured and eaten a minnow. Another specimen only two inches long had sixteen tiny minnows in its stomach. Fortunately for Reelfoot fishermen, gars are not as abundant here as in the smaller ponds and lakes of Arkansas and Mississippi. Some unknown factor tends to keep the number down to a comparative minimum. The stumps of the lake would prevent effective seining such as is done in Moon Lake and Lake Center.

A conspicuous feature of gars is their ability to breathe air. The swim bladder resembles a lung in structure, and Potter (1927) concludes that "the capacity of the swim bladder and the rate of inhalation are great enough to supply sufficient air for the needs of the body." This explains why gars are able to remain alive in overflow basins of Reelfoot Lake long after the water has receded and evaporated down to only a sticky mud. The bowfin (*Amia calva*) is the only other American fish with this peculiar feature.

Some interesting experiments have been carried out by Colonel J. G. Burr of the Fish and Oyster Commission of Texas on destroying gars by shocking with an electric current. "The gar has contractile muscles in its arterial bulb, which is absent from other fishes, which probably augments the process of suffocation in the gar. . . . When the current strikes, the lung ejects air and, if the gar cannot get to the surface to take air, it will die within half an hour or so, because the gills do not supply sufficient oxygen." This method requires expensive equipment and open waters of uniform depth. Dr. Gudger of the American Museum of Natural History believes that they might be exterminated if a use for the skin or flesh was created, which would lead to large scale commercial fishery for them.

THE SHORT-NOSED GAR (FIGURE 4)

Cylindrosteus platostomus (Rafinesque). No. 189

Body elongate and subcylindrical with rhombic ganoid scales. Jaws elongate, forming a long slender snout. Length 2 to 3 feet. Body dark olive-green above, sides shading to light olive-yellow, belly white, fins with several black dots.

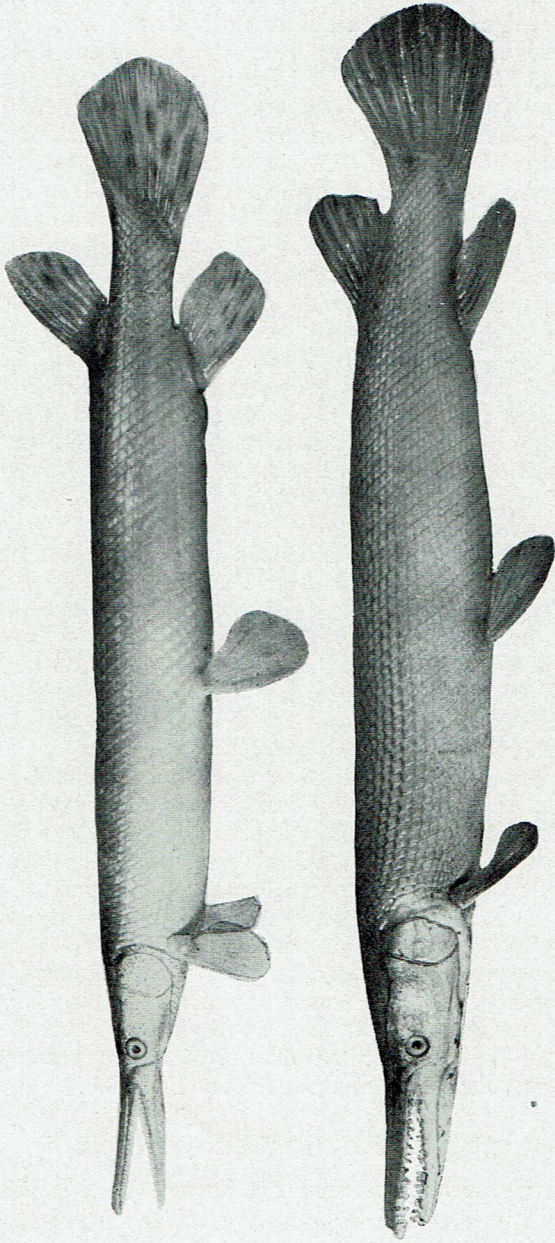


Fig. 4 (Above) The Short-Nosed Gar. Fig. 5. (Below) The Mississippi Alligator Gar. The gars are predacious, feeding almost entirely on other fish. They ought to be destroyed.

Snout pointed and broad at base, longer than rest of head. Teeth in upper jaw are in a single row. Head 3, depth 6.6.

The short-nosed gar, sometimes called "short-billed gar" and "duck-bill gar," is the most common gar of Reelfoot Lake. It frequents the quiet water, being especially abundant in that which is more or less stagnant, and are invariably found in outlying overflow basins. They probably spawn in May and June in shallow water among grass and weeds.

MISSISSIPPI ALLIGATOR GAR (FIGURE 5)

Atractosteus spatula (Lacépède). No. 194

Similar to *Cylindrosteus platostomus* except the adult is usually without spots. Snout is shorter and broader. Teeth in upper jaw are in two rows on each side. Head 3.7, depth 7.5.

This gar is comparatively rare in Reelfoot Lake, being more numerous in the Mississippi River. It is at home in the streams emptying into the Gulf of Mexico, from Mexico to Cuba. It ascends our Mississippi River to above St. Louis and fills the place among the fresh water fish that sharks occupy in the fish life of the sea. Specimens five and six feet are not uncommon while some have been caught ten feet long.

The long-nosed gar (*Lepidosteus osseus*) resembles the short-nosed and alligator gar in general habits and activity. It is known to frequent the Mississippi River, but no specimens were encountered in Reelfoot Lake during this survey.

GRINDLE (FIGURE 6)

Amia calva Linnaeus. No. 197

Body oblong, robust, with thick cycloid scales. Head blunt, with heavy bony helmet; mouth large. Dorsal fin long and low, nearly uniform, with base twice length of the head. Short anal fin. Tail heterocercal* and convex. Male with black spot at base of tail. Color dark olive, lighter on sides; belly cream colored. Head 4, depth 5. Adult male 20 inches, female 30 inches long.

This fish, along with the paddlefish and gars, completes the group of ganoid fish of Reelfoot Lake. It is also a sole survival of a once large family of fish chiefly represented today by fossils. Many "bowfins" lived during the Jurassic of Europe and the Eocene of Europe and North America.

The natural history of the grindle has been studied in detail by Dr. J. E. Reighard of Michigan. He found them breeding through April and May in Michigan, which means that they probably begin this process in early March at Reelfoot Lake. The nests are found in quiet embayments, usually well grown with vegetation. Places with stumps, roots, and logs are most frequented. The male builds

*Heterocercal: Unequal tail, the upper lobe the longer and the backbone apparently running into it.

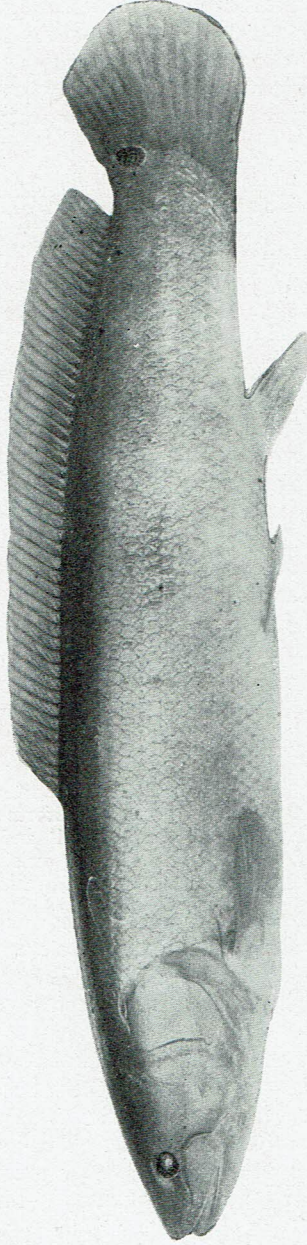


Fig. 6. The grindle is known by such names as bowfin, lawyer fish, dogfish, mudfish, blackfish, and cypress trout. The name "grindle" is preferred since no other fish bears it. It is abundant in the Great Lakes region, Mississippi Valley, and southern states generally. The grindle retains the primitive character of a lung-like air bladder opening directly into the gullet and this organ functions in respiration as a lung. Weeks after the low-lying basins have dried over, grindles may be found alive in the sticky mud. Jordan (1896) found that it could live out of water so long as the air passages to the lung-like bladder were kept moist. Their teeth are sharp and strong and they are exceedingly voracious and savage, feeding chiefly on fish. They are gamier than bass and may be caught with a live minnow or frog, while trolling for them with a spoon is excellent sport.

the nest, usually at night. The vegetation is rubbed or bitten off and the loose rubbish is brushed away with the tail and fins, leaving a bed of soft rootlets for the eggs. Spawning also takes place at night, and the male guards the eggs and later cares for the young until they have reached a length of about four inches. During this time the males are so aggressive that they have been known to bite the end of a pole pointed at them. The eggs hatch in eight to ten days, and the young may attach themselves to rootlets by adhesive organs on the snout. The male accompanies the young for a time after they leave the nest and are moving about in schools.

The grindle has the reputation of being a poor food fish, since the flesh is "soft and pasty." In Louisiana the flesh is sun-dried and packed away in dry salt. Thousands of pounds are sold and shipped annually from Reelfoot Lake from October to May at prices which hardly pay for transportation. Coker (1917) of the United States Bureau of Fisheries, gives an interesting account of the method of taking and preparing bowfin. It is peculiarly adapted to meet the requirements for a home-made or local-made product in cured fish. By properly smoking in a smoke-house, meat is obtained with an excellent flavor. Bowfin patties, bowfin on toast, salads, and broiled bowfin are a few of the ways in which the meat can be served.

According to Forbes and Richardson, "the hardiness of this fish and its willing endurance of conditions fatal to most species give it a predominance in our waters, which, combined with its numbers, activity, voracity, and wide range of food, make it, on the whole, a dangerous and destructive enemy to our fisheries. The time will doubtless come when thorough-going measures will be taken to keep down to the lowest practicable limit the dogfish and the gars—as useless and destructive in our productive waters as wolves and foxes formerly were in our pastures and poultry-yards."

THE GIZZARD OR HICKORY SHAD (FIGURE 7)

Dorosoma cepedianum (Le Sueur). No. 245

Body deep, compressed, covered with thin scales. Head small, scaleless. Mouth small, oblique, without teeth. Color silvery bluish above. No lateral lines. Last ray of dorsal fin extending back half the distance to tail. Anal fin long, caudal deeply forked. Stomach short, muscular, like the gizzard of a fowl.

This small usually unnoticed fish is one of the most useful in Reelfoot Lake, since it offers an almost inexhaustible food supply for game fishes, particularly the large-mouth black bass. It is well adapted to the waters of our lake because it lives mainly upon food derived from the muddy bottom. It has a very effective straining apparatus in its gills, by means of which it separates the finest particles of mud and silt from objects large enough to serve as food. The thick-walled muscular stomach, resembling the gizzard of a chicken, is another adaptation to a kind of food not available to most fishes. The young

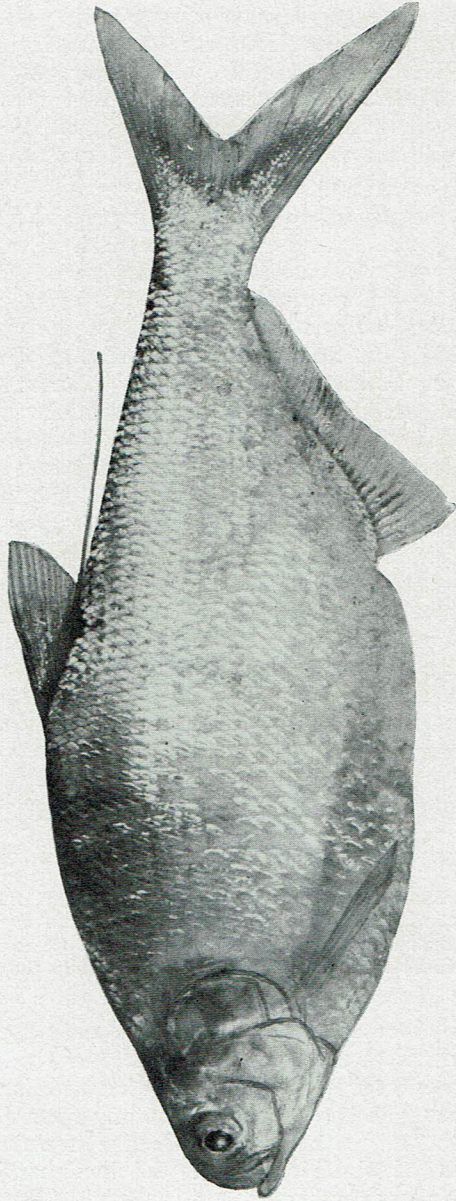


Fig. 7. The Gizzard or Hickory Shad. The flesh is coarse and not delicate in flavor, but is eaten by some. Fishermen, unfortunately, do not realize its economic importance as a fish food and they are picked from the nets and thrown away. Fortunately, their activity enables them to escape by leaping over the cork line or by burrowing beneath the lead weights.

possess teeth and eat small crustaceans and insect larvae as do other young fishes. Older specimens lose the teeth and subsist almost entirely on minute plants and vegetable debris. It is thus classed as an important forage fish and acts as a single link in the chain between small microscopic plants and adult fish.

They swim in schools at the surface of the lake and deposit their eggs at random, usually near the shore. The eggs are sticky and when they come in contact with any object in the water they adhere to it.

In addition to being the principal food for bass, during fall and winter this fish offers one of the principal foods for ducks. Trautman, of Ohio, found the diving ducks gorging themselves on this shad. A sudden change of temperature in the fall benumbs these fish so that they feebly swim or float near the surface of the water. Such weather conditions usually result in a flight of ducks from the north which alight on the lake and find a plentiful food supply awaiting.

THE AMERICAN FRESH WATER EEL (FIGURE 8)

Anguilla bostonensis (Le Sueur). No. 517

Body very elongate, compressed behind. Color brown, yellowish beneath. Scales minute, embedded in skin and hidden. Head conical, mouth large, with projecting jaws. Dorsal and anal fins continuous with the caudal. Lateral line present. Head 8.5, depth 12 to 17. 40 inches, 7 pounds.

This fresh water eel, although feeding on bass and pike, is of little importance in Reelfoot Lake as a predacious fish because of its scarcity. This lack of abundance is probably due to their most peculiar and unique life cycle—so peculiar that many fishermen absolutely refuse to believe the facts which have been very definitely proven time and time again. Most of what we know of this strange life cycle is due to the researches of Johann Schmitt (1925) of Copenhagen, who spent his life and entire fortune working out its life history. The American eel is found throughout North America in fresh water, including streams 7,000 feet above sea level in Colorado and also in salt water where a few have been taken 15,000 feet below the ocean's surface. All eels over fifteen inches in length are females, which may reach a length of four to five feet and a weight of four to six pounds. One specimen kept in captivity for over forty years reached a length of four and one-half feet. A female spawns only once, the number of eggs being close to ten million. The strange part of their cycle comes in the fact that *eels never spawn in fresh waters*. As a result many females never spawn. After remaining in fresh water for five to nine years, those that are able to migrate to open streams from the lakes and ponds begin the journey downstream, traveling nine to twelve miles a day. As they approach the salt water of the Gulf of Mexico, feeding is stopped, the back becomes darker, the undersides lighter, the eyes larger, and the animal is now called



Fig. 8. American Fresh Water Eel. This eel breeds only in the Atlantic Ocean south of Bermuda.

a silver eel. After both male and female reach the sea they spawn at a considerable depth, usually between the West Indies and Bermuda. In this same locality the European eels also spawn and the young of both types spend their early life together. Before this life cycle was known both of these types of young were described as separate species of fish. As the young continue their development, migration begins, first upward to shallow water, then with the Atlantic current for a time. The young European eels soon begin a definite migration eastward while the American forms turn towards the west. The latter forms spend approximately a year in their migrations to fresh water streams. Many fail to survive, but a few succeed in ascending to upper parts of rivers, streams, and thence to lakes and ponds.

They endure a remarkable range of living conditions, even to the extent of crawling about among the grass and weeds of swamps and elevated meadows on dark and rainy nights in order to reach isolated open waters. It is a far cry from the ocean depths south of Bermuda to Reelfoot Lake which explains why the eels will probably never be found in any abundance in this body of water.

The flesh of the eel is highly esteemed by many, and it brings a good price in northern and eastern markets. The flesh is usually salted or smoked.

THE SUCKERS

Body elongated. Head rather concial without scales. Jaws toothless and without barbels. Mouth usually protractile with thick lips. Dorsal fin rather long, without spines; anal fin short; caudal fin forked.

The sucker family includes many species of small fishes which never exceed four or five pounds. Several such as buffaloes, quillbacks, and redhorses may reach larger sizes. The flesh is well flavored, although full of bundles of small bones, which are troublesome. The abundance and considerable size of the buffaloes make them of considerable commercial importance. Approximately 250,000 pounds are removed annually from Reelfoot Lake. They have no rank as game fish and thus are left entirely to commercial fishermen. They do not take a hook except on set lines and are usually captured by seines, gill, hoop, and trammel nets.

The habits of all buffaloes are much the same. They are bottom feeders, feeding chiefly upon vegetation and inactive forms of worms, larvae, and eggs. They all spawn in the spring by running up the streams that enter the lake. It is possible that spawning occurs in the lake, although no observations have been made along this line.

As adults they are reasonably safe from predacious and voracious fishes against which they have no defense. Forbes found that the young were eaten by pike, grindle, catfish, drum, and sunfish, and that the number that are consumed is correlated with the abundance of gizzard-shad which is more accessible to predacious fishes.

Three species of buffaloes are known and all are found in Reelfoot Lake. The name "buffalo-fish" refers to the bull-like hump at the

neck in older individuals. There is no evidence of their cross-breeding and the view held by many fishermen that they cross with the carp is without fact or foundation.

They are easily seined at night as they come into shallow water to feed. They have the habit of whirling around in shallow water, or plowing along with the head buried in the mud, their tail occasionally showing above the surface. This act is thought by some to be associated with spawning, but is in reality merely a search for small animals living in the mud.

Fishermen at Reelfoot Lake claim that buffalo in years past seemed to come and go in great numbers with the spring overflow of the Mississippi River. Jordan (1902) reported unusual runs in the spring at spawning time. At the time of heavy rains when the tributary streams are full and the connecting marshes are flooded, these fish leave the lake in great numbers and spread over the flooded areas. They remain a few days and then disappear as suddenly as they came. Their brief stay permits great numbers to be speared and hauled away by wagon loads. After returning to the lakes, nothing more is seen of them until the next spring, or possibly not for several years. This account is a description of what occurred in northwestern Iowa thirty-five years ago, yet it seems to be equally applicable to Reelfoot Lake.

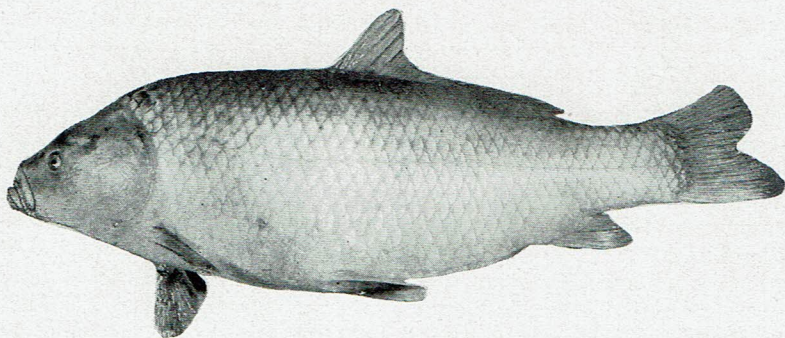


Fig. 9A. The Gourdhead or Common Buffalo Fish. The blunt nose and turned up mouth serve to distinguish this fish from the rooster and chopper.

THE GOURDHEAD OR COMMON BUFFALO FISH (FIGURE 9A)

Megastomatobus cyprinella (Cuvier and Valenciennes). No. 711

Body robust, somewhat elliptical. Head large and thick with blunt nose and a turned up mouth, which is large and oblique. Lips are thin with the upper lip level with the lower margin of orbit. Color dull brownish-olive, not silvery. Head 4, depth 3. Length 3 feet. Weight 20 to 50 pounds.

This common buffalo is generally referred to at Reelfoot Lake as the Gourdhead Buffalo. It is also known as redmouth buffalo, round-

head buffalo, bullhead buffalo, bigmouth buffalo, mud buffalo, and white buffalo.

This species eats algae, seeds of water plants, insect larvae, and numerous water fleas.

THE ROOTER OR SMALL MOUTH BUFFALO (FIGURE 9)

Ictiobus bubalus (Rafinesque). No. 713

Body considerably elevated, back compressed. Head small and pointed; mouth small, turned downward and forward. Distance from maxillary to mandibular symphysis less than orbit. Longest dorsal ray one-half length of fin. Color dusky; fins sometimes black. Head $4\frac{1}{2}$, depth $2\frac{3}{4}$. Length $2\frac{1}{2}$ feet. Weight 20 pounds.

This small mouth or rooter buffalo as it is called at Reelfoot Lake can be distinguished from the others by the level of the upper lip lying about half way between the chin and lower margin of the orbit. Its greater depth and compressed back has given it such names as razorback buffalo, quillback buffalo, humpback buffalo, roachback buffalo, and round buffalo.

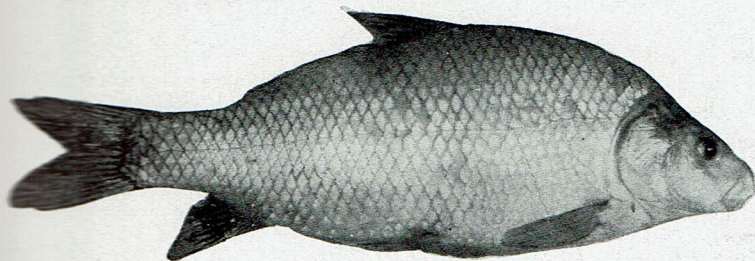


Fig. 9. The Rooter or Small Mouth Buffalo. The small head with the small mouth turned down and forward serves to identify this fish.

This buffalo prefers moving water and is not so frequently taken in shallow places. Much of its food is duckweed along with insects, mollusks, and water fleas. *Wolffia* and *Ceratophyllum* may sometimes constitute 95 per cent of the stomach contents (Forbes, 1878). Younger specimens feed on protozoa, rotifers, and unicellular water plants (Forbes, 1880).

THE MONGREL OR CHOPPER BUFFALO (FIGURE 10)

Ictiobus niger (Rafinesque). No. 712

Head thicker and blunter than *I. bubalus*. Eyes smaller, nose pointed and mouth turned down. Distance from maxillary to mandibular symphysis greater than orbit. Color a dark slaty gray, shading to black, all fins dark. Head 4; depth $3\frac{1}{2}$. Length 3 feet. Weight 40 pounds.

In Louisiana and Tennessee the name "chopper" is preferred by fishermen, although mongrel buffalo, black buffalo, prairie buffalo, and blue buffalo are all common appellations for *Ictiobus niger*.

The chopper buffalo can be distinguished from the gourdhead buffalo both by its much smaller and less oblique mouth, the upper lip falling far below the level of the lower margin of the orbit, and also by the coarsely striated lower lips; from the rooter buffalo by the more elongate and less compressed body and by the broad rounding of the front region.

It resembles the gourdhead in respect to food preference, eating about two-thirds animal material and one-third vegetable food (Forbes).

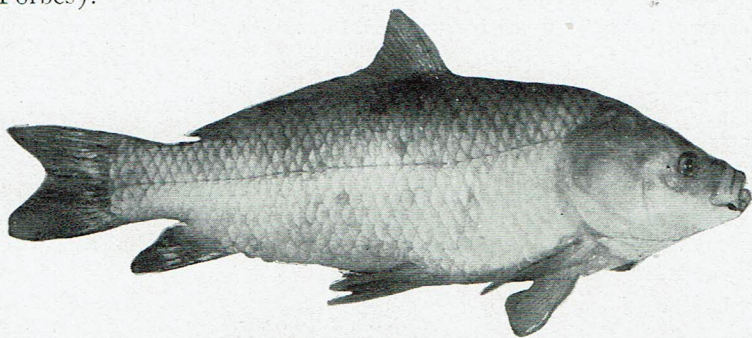


Fig. 10. The Mongrel or Chopper Buffalo. The long and compressed body and broad head distinguishes this fish from the rooter.

THE EUROPEAN CARP (FIGURE 11)

Cyprinus carpio Linnaeus

Body robust and compressed. Long dorsal fin preceded by strong spine serrated behind. Mouth with 4 long barbels. Snout rounded. Color blackish gray above, yellowish on sides and belly. Dorsal fin III, 17-21,⁵ anal III, 5. Head 3-4, depth 3. Length 2½ feet. Weight 30 pounds.

Some confusion exists in the minds of many fishermen encountered at Reelfoot Lake as to the races or varieties of carp. In Germany many types have been described, which may be compared to types of domestic chickens, cows, etc. Three varieties were introduced into the United States: (1) the scaled form, which may be a yellowish, silver color from muddy lakes or dark olive back with yellow belly from cleaner waters with dense vegetation; (2) the mirror carp, which has the body partly bare, with a few patches or rows of large scales along the sides; and (3) the leather carp, which has no scales on the body, the skin being thick, soft, and velvety. Any one of the three types might produce offspring like the others and intergrades might occur. The scaled variety, however, seems to breed true to

⁵Fins of fishes may be soft or spinous or may consist partly of soft rays and partly of spines. In descriptions, Roman numerals are used to indicate spines and Arabic numerals to indicate soft rays. "Dorsal VII, 10," for example, indicates a dorsal fin with seven spines and ten soft rays.



Fig. 11. European Carp. The carp, brought from China to Europe in 1227, was successfully introduced into the United States in 1877. They multiplied rapidly and by 1897 thousands had been distributed throughout the nation. Millions of pounds have been marketed every year since 1900. From Reelfoot Lake, while figures of past decades are not available, during the past four years more than sixty thousand pounds have been sold annually. In the lakes of New York it has been found necessary to adopt stringent measures for their elimination.

type and few of the other two varieties are encountered at Reelfoot Lake.

These carp are quite distinct from the buffalo fish and there is no evidence of the two crossing. It is interesting to note that the carp is a large sized minnow as is also the goldfish.

Several problems regarding the carp require serious consideration. Is the carp a predacious fish; *i. e.*, does it keep down the number of game fish in Reelfoot Lake by eating eggs, roiling the water, destroying the vegetation, and eating fish or fish food?

Forbes and Richardson (1920) found that carp were lazy fish, preferring warm water, not too deep, and with plenty of aquatic vegetation. They eat vegetable matter, insect larvae and crustaceans, and may pull up the roots of tender aquatic plants while feeding. They might even take into their sucking mouth certain fish eggs while feeding from the bottom, but since most game fish protect their nests while spawning the carp cannot be a serious menace in this way to them. In reality carp eggs are known to furnish an almost inexhaustible supply of food for young game fishes. The problem of roiling the water and destroying the vegetation makes the carp a desirable fish for Reelfoot Lake, for here we find an overabundance of vegetation and still waters that need to be agitated to free the noxious gases formed in the marshy bottom by vegetative decomposition. Their peculiar sucking mouth makes it difficult or even impossible to devour a live fish of any size. A fisherman who catches ten female adult game fish during the spring breeding season has destroyed far more game fish than all the carp are capable of doing in an entire season.

The female carp during the early spring deposits promiscuously, in shallow water among the vegetation, from 500,000 to 1,000,000 eggs, and these are fertilized by the male. No protection is given the eggs which adhere to roots and stems and the young are left to care for themselves.

While not a superior type of edible fish, the carp is sold in many cases under other names and no one is the wiser. It is a leading food fish of Europe and northern and eastern cities of this country and there is no valid reason why carp cannot be made a leading market fish in Tennessee.

In some localities carp-fishing contests are staged each year. A ten-pound carp furnishes a dogged fight, requiring skill to land because of the tender structure of the mouth in which the hook is embedded. Sweigart (1936), writing in the *Pennsylvania Angler*, finds that carp-fishing "requires patience and considerable study. Frequently, after locating a school of the big fish, the fisherman decoys them to a chosen spot by baiting the location he intends to try with sweet corn or corn meal for a week or longer. Included in popular baits are doughballs, in which some fishermen use molasses, corn, and corn meal. After a carp has found the bait with which it may toy for ten minutes or longer, moving it about on the bottom

until it has maneuvered the lure into suitable position for swallowing, it starts moving away. The hook is then set and the battle is on. In carp-fishing some anglers prefer a rather limber rod which is added insurance against tearing the barb from the quarry's mouth. Sinkers heavy enough to hold the bait on the bottom, and a black line not too heavy are also favored equipment. The line, instead of being stretched taut to the rod tip, is permitted to remain slack and resting on the bottom of the stream. Canned sweet corn is an effective bait and the largest corn of this type obtainable is used. Early morning, late evening, and night fishing are most popular."

THE CATFISHES

* With the exception of the buffalo fishes, the various types of catfishes constitute the bulk of the commercial fish taken from Reelfoot Lake each year. Close to 100,000 pounds are marketed annually. Three of the most important and larger species are the channel cat (*Ictalurus punctatus*), the eel or willow cat (*Ictalurus anguilla*), and the leatherhead or mud cat (*Opladelus olivaris*). Of lesser importance, yet of great abundance, are the smaller bullheads, including black bullhead (*Ameiurus melas*), the yellow bullhead (*Ameiurus natalis*), and common or brown bullhead (*Ameiurus nebulosus*). These common names are the ones used by fishermen from Illinois to Louisiana and in numerous books of scientific and popular nature on fish. At Reelfoot Lake, however, it is found that many fishermen refer to the mud cat and willow cat as "bullheads" and call the true bullheads "polywogs" or merely "polys." As a result the state fish docks weigh in five pounds of "catfish" to one pound of "bullheads" even though the true bullheads are caught in much greater abundance. The blue cat (*Ictalurus furcatus*), which reaches its peak of abundance in the South and spreads over into shallow bayous and back waters in the spring from the Mississippi River, has not been encountered by the author at Reelfoot Lake.

The catfishes dwell in the more or less muddy water, feeding on the bottom, and eating almost anything they encounter. Forbes and Richardson (1920) found that the indifference of several of the species to the past history or the present condition of their food distinguished them as the most important scavengers among our common fishes. The large mouth, wide esophagus, and short, broad stomach admits objects of relatively large size and of almost any shape. Their extreme tenacity of life and omnivorous habit favor their multiplication in almost any kind of situation, often enabling them to survive through drought or other hardships to which all their neighbors succumb. By their ability to live in situations avoided by most other fishes, they utilize in their bodies much food material which would otherwise disappear as natural waste, and since they are themselves eaten by other fishes, they may increase the general supply of game

fish in the waters they inhabit. This is only a generalization, however, as few investigations along these lines have been followed.

THE EEL OR WILLOW CAT (FIGURE 12)

Ictalurus anguilla Evermann and Jordan. No. 1151

Head large and heavy. Snout blunt, the cheeks prominent, bones of top of head covered heavily with flesh and thick skin. Upper jaw longer than lower. Dorsal fin low and rounded, longest ray little more than one-half of head. Color slaty-olive. No spots. Head 4, depth $4\frac{1}{2}$. Dorsal fin I, 6; anal 24. Weight 3 to 5 pounds. Length 18 inches.

There seems to be some dispute among fishermen at Reelfoot Lake as to whether this fish should be called a leatherhead, bullhead, or willow cat. Nevertheless, the broad, large, and heavy head with the eyes high and the dorsal fin low make it the true eel or willow cat of the Mississippi Valley. Adults vary somewhat in general appearance

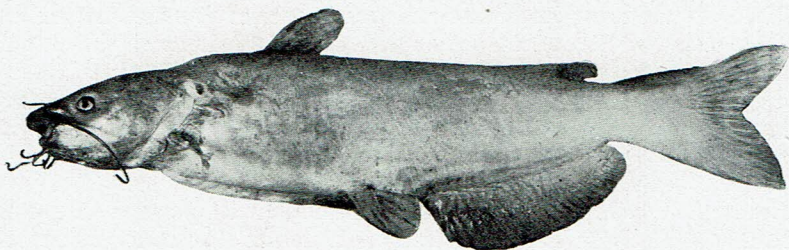


Fig. 12. The Eel or Willow Cat. The blunt snout, prominent cheeks, and flesh on top of head enable this fish to be recognized.

and a careful study is sometimes necessary for identification. The flesh of the willow cat is inferior to other catfishes, yet usually brings the same price in the markets.

THE CHANNEL CAT (FIGURE 13)

Ictalurus punctatus (Rafinesque). No. 1152

Body slender, back slightly elevated, mouth small, barbels long. Fin spines strong and smooth. Eyes large. Sides silvery, usually with small, round, dark olive spots. Dorsal fin high; caudal fin deeply forked. Head 4, depth 5. Length 2-3 feet. Weight 20-25 pounds.

This is one of the most abundant of the larger catfishes and well flavored. Whenever a person can be sure they are purchasing true channel cat, they have a meal well worth eating. It is a more active fish than any of the related species. Living in cleaner waters, it is sought after by anglers in some localities.

Forbes and Richardson found that the food of this channel or "fiddler" cat consisted of vegetable matter, mollusks, aquatic insects, and larvae of dragon-flies, gnats, and day-flies, which are found on the bottom.



Fig. 13. (Above) The Channel Cat. Its preference for clear waters makes this a favored food fish. Fig. 14. (Below) The Mud Cat. Sluggish waters with muddy bottoms are the favorite feeding grounds for this fish.

Doughballs and sour corn are used frequently as bait for nets and baskets.

Observations on spawning habits indicate that the breeding season begins in May. The channel cat may spawn when a year old and breed twice in a season. Shira (1917) of the United States Bureau of Fisheries found that a female deposits about 3,000 eggs in a nest and that the young are cared for by the male.

THE MUD OR LEATHERHEAD CAT (FIGURE 14)

***Opladelus olivaris* (Rafinesque). No. 1172**

Body slender, head broad and much compressed, lower jaw projecting. Barbels of mouth short; dorsal spine weak, and fin slightly concave. Color dark olive, belly yellowish or grayish. Anal rays 12 to 15. Length 5 feet. Weight 70 pounds.

This huge catfish is one of the largest of the Reelfoot Lake species. Some fishermen call it "morgan cat" while others use the term "leatherhead" along with the more familiar name of "mud cat."

Forbes found that the principal food of this catfish was sunfishes, minnows, and even bullheads. In spite of its predacious habits and activities it seems to prefer sluggish water to the more open waters of the lake, being found in bayous and overflow basins. It is frequently caught in the Mississippi River by jugging. Its flesh is regarded as the very best of the catfishes.

THE BULLHEADS

Body moderately elongate; head large and wide. Mouth large, the upper jaw protruding. Caudal fin not forked. Colors yellow, brown, black or mottled.

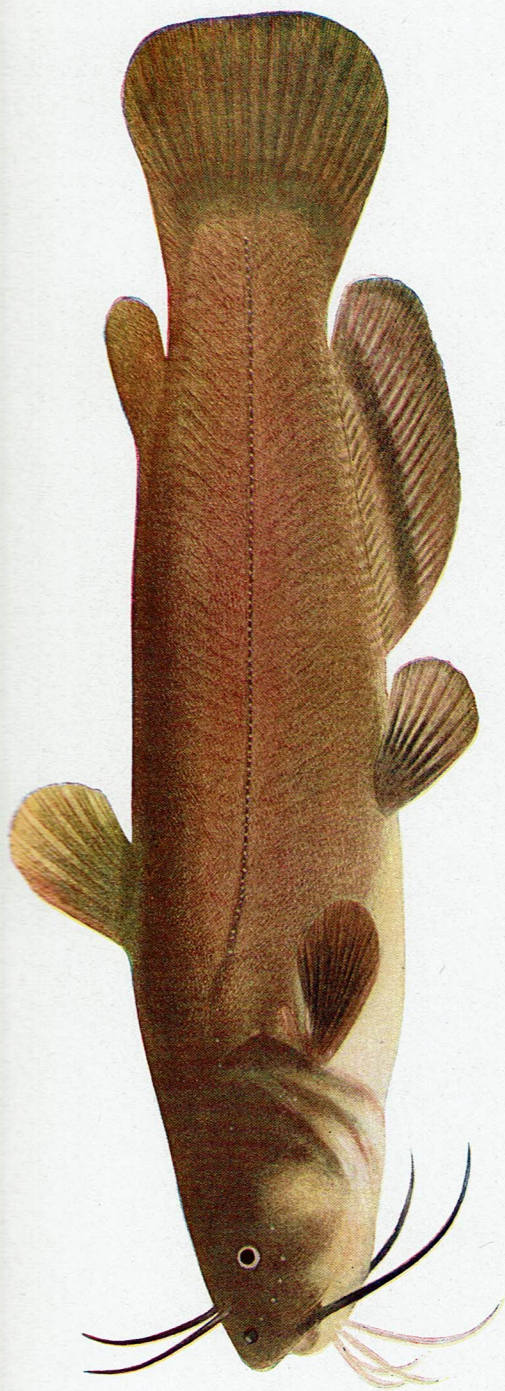
Three species of bullheads have been encountered in Reelfoot Lake. These are commonly known as yellow bullhead, black bullhead, and brown or spotted bullhead. They are quite numerous and may be found in deep waters, bayous, among dense aquatic vegetation, and in abundance in overflow basins. They are able to survive in very stagnant waters and seem to be quite comfortable so long as they can gulp fresh air and keep their body wet. They will lie dormant in the mud of dried up basins for weeks at a time without harm. All are smaller than the channel cats usually encountered, seldom exceeding fifteen inches in length. All are of value as food fishes.

THE COMMON OR BROWN BULLHEAD (FIGURE 15)

***Ameiurus nebulosus* (Le Sueur). No. 1164**

Head width greater than head length; skin thin; color usually a dark yellowish brown. Dorsal spine rather long; pectoral spine long, curved, and sharply pointed. Caudal fin deeply emarginate. Anal fin with 21-24 rays. Length 18 inches.

The abundance of the brown bullhead at Reelfoot Lake is largely unknown because of its being confused with the yellow and black



YELLOW BULLHEAD, *Ameiurus natalis* (Le Sueur)

bullhead by the local fishermen. The thick skin serves to distinguish it from the yellow forms while the short and deep anal fin of the black bullhead acts as a determining character.

The breeding habits of this species of bullhead in an aquarium has been described in detail by Smith and Harron (1904). A nest is made by removal of debris by the fishes' mouths. About 2,000 eggs are laid in masses similar to frog's eggs and are of a beautiful cream color. After five days the eggs hatch, during which time both parents guard the nest. The eggs and later the young fry are sucked into the parents' mouths and blown out with force. This act apparently cleans them of debris. Predacious habits of the parents occasionally overcome parental instinct and the tendency to suck in the young becomes greater than the inclination to spit them out, resulting in "infant mortality." In nature the eggs are deposited in open places under rocks, logs, chunks of wood, or around the bases of water plants. In pond culture it has been found necessary to place boards on the

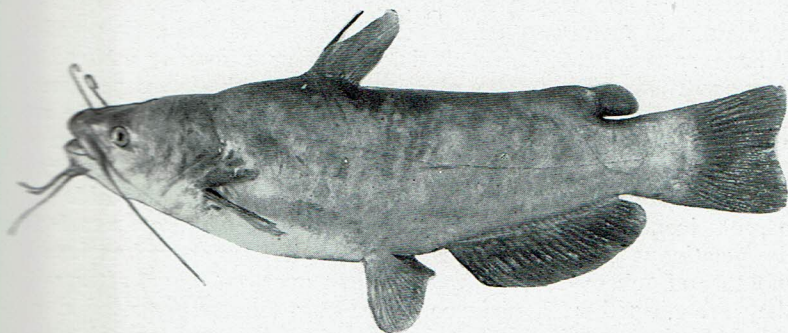


Fig. 15. The Common or Brown Bullhead. This is a very common catfish of the stumpy areas of Reelfoot Lake.

bottom in such numbers that each individual fish will have a home of his own as well as a nesting place. The cypress stumps of Reelfoot Lake thus serve as ideal dwelling places for fish of this type.

The flesh of this bullhead is inferior in quality to the other bullheads. It has been introduced from the Mississippi Valley into California, England, and continental countries, where the flesh is much esteemed.

THE YELLOW BULLHEAD (COLORED PLATE)

Ameiurus natalis (Le Sueur). No. 1162

Body short, thick, and tapering. Head large, broad, and somewhat depressed, with wide mouth. Color yellowish green above, the sides lighter yellow or waxy yellow. Belly yellow. Skin thick. Dorsal spine rather short. Pectoral spine strong. Anal fin long, its base more than one-fourth the length of the body. Caudal fin rounded posteriorly. Anal fin with 25-26 rays. Length 15 inches.

The food and habits of the yellow and brown bullhead are virtually identical. Both are bottom feeders, eating mollusks, insect larvae, and accidental rubbish. They will take any bait from an angleworm to a bit of soured dough and will invariably swallow the hook.

THE BLACK BULLHEAD (FIGURE 16)

Ameiurus melas (Rafinesque). No. 1169

Body plump, usually black or greenish. Skin loose and thick. Dorsal spine short and robust. Pectoral spine short. Caudal fin slightly emarginate. Anal fin short and deep, with 18 rays. Length 12 inches.

This bullhead is most abundant in streams and basins associated with the lake. It is said by Jordan to thrive in small ponds, especially in those with a mud bottom.

The breeding habits of this interesting little bullhead have been studied by Breder (1935) during the past ten years. If isolated in an aquarium, two healthy *Ameiurus*, physiologically capable of reproduction, will not spawn unless a rock or similar shelter is provided. Whenever this provision is made, spawning is usually assured and may occur twice in a season, after the water reaches a temperature of sixty-nine degrees F. This egg-laying is accomplished by the male and female in a quiescent side to side position, with the two fish facing in opposite directions and with their bodies in close contact. Several "spawning acts" are necessary before all eggs are laid. Both parents incubate the eggs by constant manipulation so as to loosen the gelatinous mass. At times the mass of eggs are taken into the mouth and "chewed" so as to roll them over and over, after which they are ejected with violence. The eggs apparently need a considerable amount of aeration, for if removed from parental care to still water, they usually die within twenty-four hours. Even after hatching the young fish are cared for by the parents who endeavor to keep them in compact schools by swimming about them. A more adventurous young fish that wanders away is caught in the parent's mouth and returned to the school. In laboratory conditions most of the young die at this time, and it is believed that "an item of behavior valuable in a state of nature would thus have to be considered lethal in the relatively close confines of an aquarium."

Their small size makes them a nuisance to markets, yet many are sold commercially each year.

THE GREEN PIKE (FIGURE 17)

Esox niger (Le Sueur). No. 1324

Body elongate, compressed posteriorly. Cheeks and opercle scaly; head long and flat. Mouth large with a projecting lower jaw. Color green with sides marked with numerous dark lines, forming a network. Eye midway of head. Brachioptegals 14; dorsal rays 14; anal rays 13; head $3 \frac{1}{5}$, depth $5 \frac{1}{2}$. Length 30 inches.



Fig. 16. (Above) The Black Bullhead. This catfish is fond of small ponds with muddy bottoms. Fig. 17. (Below) Green Pike. This predaceous fish is found only rarely west of the Alleghanies.

Only one specimen of the eastern pike or pickerel was encountered this past summer at Reelfoot Lake. All literature restricts its range to east and south of the Alleghanies from Maine to Florida. It is well that the lake is relatively free of these predators, for Forbes found them eating sunfish and black bass and on some occasions young ducks have been taken from their stomachs. It is a strong and active swimmer, preferring clean, clear, and cool waters. The flesh is said to be of a fairly good flavor but full of small bones.

LITTLE PICKEREL OR GRASS PIKE

Esox vermiculatus (Le Sueur). No. 1325

Similar to *E. niger* except smaller. Dark band downward from the eye. Snout short. Dorsal rays 12; anals 12. Length 12 inches.

This little pike is frequently mistaken for the young of the large pikes. It is most abundant in creeks and bayous. Despite their small size, they are destructive and predacious, eating minnows, sunfish, and aquatic insects.

SUNFISH

This large group of North American fresh-water fish, which includes many food and game fishes such as the black bass, crappie, blue gill, rock bass, bream, and smaller forms with various names, is the most important of all groups to the sportsman. While ranging in size from a small sunfish of two inches to a large-mouth black bass of 18 inches, they all have certain characteristics in common which enable them to be recognized. The prominent dorsal fin of two confluent portions, one with 6 to 13 spines, the other with soft rays, and the anal fin with three to nine spines, are diagnostic for the family. All members of this family spawn in the spring and build nests of holes scooped out in the leafy, marshy margins of Reelfoot Lake. For regular living conditions, however, some prefer the running water of creeks, some open waters, while others remain near dense submerged aquatic vegetation. Thus we find the blue gill and large-mouth black bass in greater abundance northward from Samburg, where there is a dense underwater growth of hornwort, while crappie dominate the open waters of the south end. The dense patches of aquatic plants furnish excellent spawning grounds for all these sunfishes and protection for the young.

The true rock bass (*Ambloplites rupestris*) and the small-mouth black bass (*Micropterus dolomieu*) have not been encountered in the lake and it is believed that these forms are not present in this broad expanse of pond water since they prefer cool, clear, rocky, and swift waters. The sunfish in the South take the place of the trout, salmon, and perch, which are those most sought for of northern game fish.

As has been pointed out before, the many common names applied to members of this family are most confusing. A special attempt has



THE WHITE CRAPPIE
Pomoxis annularis (Rafinesque)

been made here to bring some order out of chaos in the common names of the sunfishes. The identification of some types has troubled even the specialist in the field until recent years because of the frequent occurrence of hybrids between different species. Proof of this hybridization has been very cleverly obtained by Hubbs and Hubbs (1932) by experimental verification.

Quite frequently hybrids are encountered of the green sunfish (*Ayamotis cyanellus*) and the pumpkinseed (*Eupomotis gibbosus*) and also between the pumpkinseed and blue gill (*Helioperca macrochira*). The author encountered several sunfishes in this work which could not be properly identified as true species. These later proved to be hybrids between the warmouth bass or goggle-eye (*Chaenobrythus gulosus*) and the blue gill. To add to the confusion, the male of the cross is much lighter in color than the female which retained the dark coloration of the warmouth bass. Another common hybrid encountered at Reelfoot Lake is between the warmouth bass and the pumpkinseed. Several other hybrids have been studied by Hubbs of Michigan, one of which is a cross between the white crappie (*Pomoxis annularis*) and the black crappie or calico bass (*Pomoxis sparoides*). These hybrids, which result from crossings of different species of sunfish, are not due to the chance meeting of egg and sperm of different species, for all the sunfishes have a complex mating behavior involving elaborate nuptial performance over a nest previously prepared by the male. "They breed in quiet water, in which there would be little drifting of the eggs and sperm, and they breed at some distance from one another, because the male drives other fish away from the vicinity of the nests." (Hubbs and Hubbs, 1932.)

Hybrid sunfishes grow faster and produce larger fish than the pure parents. In general males predominate and are invariably sterile, the sex organs in many cases being degenerate (Hubbs and Hubbs, 1935).

THE CRAPPIES

Body moderately elongate, strongly compressed; mouth large, long lower jaw; dorsal spines 6 to 8; anal spines 6. Caudal fin emarginate.

The two species of crappie are very similar in habits, food, and general distribution. They differ from other sunfishes in their finely-toothed, long, and numerous gillrakers, which make an effective straining apparatus for the huge quantities of water fleas (*Entomostraca*) taken in.

While many fishermen use live minnows to catch crappies, specialists in this field of endeavor find that just as many, if not more, may be obtained by using a tiny half-inch to six-eighths inch long gold-plated spinner with a bare hook and a bit of flesh cut from the back of another sunfish. Either a bait-casting rod or a bamboo fly rod is used for real sport.

Both the white crappie and calico bass are quite numerous in Reelfoot Lake and afford thousands of fishermen a test of their skill.

While no creel records are kept, the legal commercial catch each year of 75,000 pounds, exclusive of those marketed during the closed season, gives an indication of our bountiful harvest of a natural resource. No attempts are made to prevent a fisherman from anchoring his boat in the midst of a colony of crappie nests and catching them out. Every fish taken from a nest means the death of thousands of young fishes. The crappie can protect his nest from other fish such as carp, buffalo, and catfishes, but a minnow on a hook is seized out of anger.

THE WHITE CRAPPIE (COLORED PLATE)

Pomoxia annularis (Rafinesque). No. 2351

Color silvery green, mottled with green above, and with indistinct vertical bars. Nose longer than eye; dorsal fin VI, 18; anal VI, 18; head 4, depth 2.3; length 12 inches.

The White Crappie. This fish is also known as pale crappie, bachelor, silver perch, speckled perch and shad. It is very abundant in many parts of Reelfoot Lake. The young swarm in overflow basins and large numbers perish each year when the waters dry up. It lives mainly on insects, crustaceans, and a few fishes. Its tender mouth makes necessary skillful handling of tackle to bring it in.

THE BLACK CRAPPIE OR CALICO BASS (FIGURE 18)

Pomoxis sparoides (Lacépède). No. 2352

Flat body, the back arching up sharply from head. Mouth large, oblique, lower jaw projecting. Green above, silvery white to yellow below, black blotches all over body and fins. Dorsal fin VII, 15; anal VI, 18. Head 3, depth 2.2. Length 12 inches.

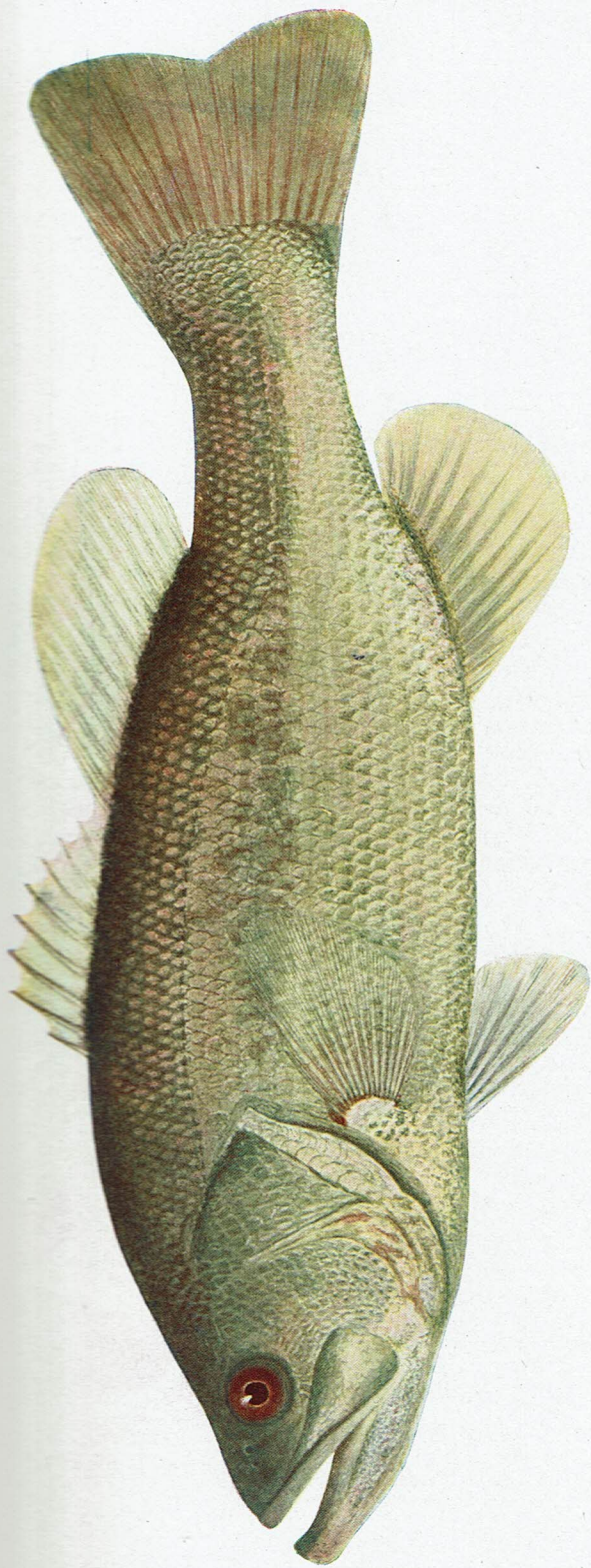
Despite the fact that this fish is closely related to the white crappie, many fishermen prefer the name "calico bass" rather than "black crappie." Other names frequently given to it are grass bass, calico bream, strawberry bass, chinquapin perch, lake bass, rockfish, and white perch. Since it is not black and is a distinct species from the white crappie, it would perhaps be well to establish "calico bass" as the proper common name.

The calico bass is an excellent pan fish and thrives in company with other pond fish when used for restocking ponds. It is suited to relatively high or low temperatures and feeds among aquatic vegetation often at the surface of the water.

THE LARGE-MOUTH BLACK BASS (COLORED PLATE)

Huro salmoides (Lacépède). No. 2314

Body elongate, becoming deeper with age. Mouth very large, oblique, lower jaw projecting. Color dark green on back and sides, obscurely mottled with ill-defined blotches. Belly greenish white. Three dark stripes across cheeks.



THE LARGE-MOUTHED BLACK BASS
Huro floridana (LeSueur)

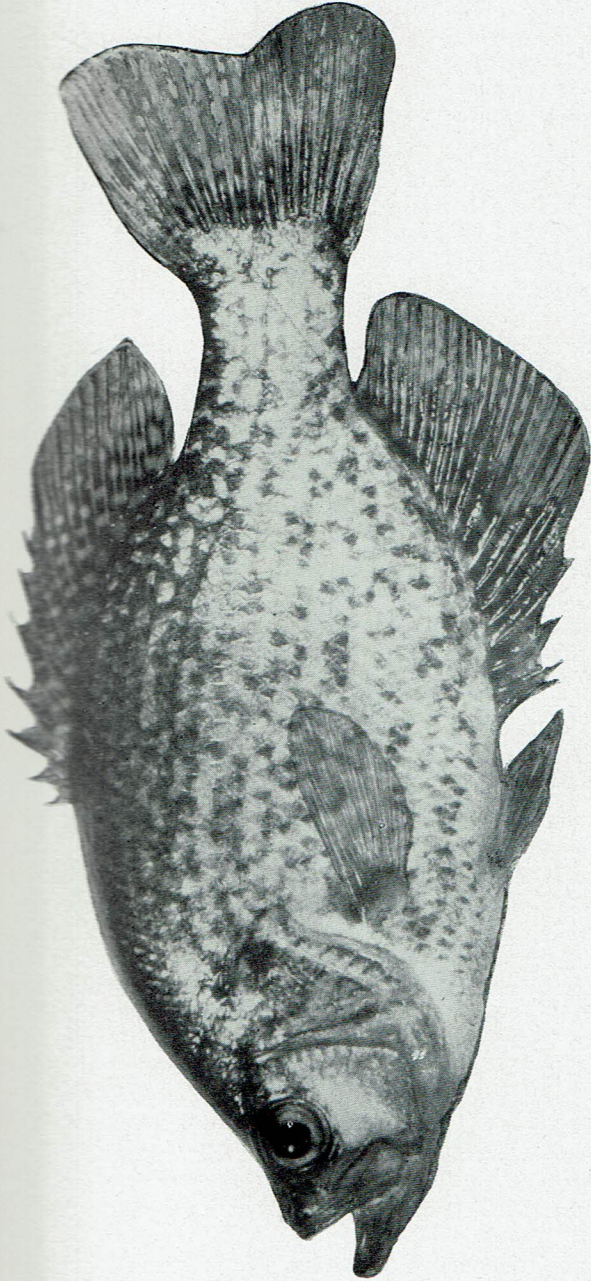


Fig. 18. The Black Crappie or Calico Bass. Many fishermen believe this fish to be merely a dark form of the white crappie, yet it is quite distinct. It can be distinguished from this white species by its seven or eight spines in the dorsal fin and its shorter nose; the white crappie has six spines and a longer nose.

Dorsal fin with deep notch between spinous and soft rayed portions. Head $3\frac{3}{4}$, depth 3. Dorsal fin X, 13; anal III, 11. Length 1 to 2 feet. Weight 3 to 8 pounds.

This handsome member of the sunfish family, more than any other fish, makes Reelfoot Lake a popular fishing ground for sportsmen from the Great Lakes to the Gulf of Mexico. It has been granted the title of America's national game fish and is found from Canada to Mexico in lakes and streams. Henshall (1917), author of *Book of the Black Bass*, states that "The black bass is eminently an American fish; he has the faculty of asserting himself and making himself completely at home wherever placed. He is plucky, game, brave, and unyielding to the last when hooked. He has the arrowy rush of the trout, the untiring strength and bold leap of the salmon, while he has a system of fighting tactics peculiarly his own. He will rise to the artificial fly as readily as the salmon or the brook trout, under the same conditions; and will take a live minnow, or other live bait, under any and all circumstances favorable to the taking of any other fish. I consider him, *inch for inch*, and *pound for pound*, the gamest fish that swims."

The Kentucky bass or spotted bass was recognized as a distinct species of black bass in 1927. People of Kentucky prefer the first name, and it is particularly common in that state, while fishermen of other states prefer the name "spotted bass" because there is a row of prominent black spots along the side of the body. It is found from Ohio to Georgia and westward to eastern Oklahoma. It is quite possible that this southern bass is found in Reelfoot Lake naturally and has been overlooked due to its close resemblance to the large-mouth black bass. The Department of Fish and Game Conservation of Tennessee introduced several thousands of this species into the lake in August in an attempt to insure an abundant supply for the future.

Reelfoot Lake is one place that still has an abundance of large-mouth bass. No creel records are kept, yet the commercial catch from June 1 to April 1, when only twelve may be taken by each fisherman for the market each day, shows that more than 25,000 pounds were sold annually in 1933 and 1934, while the amount was reduced to less than 20,000 pounds annually during the past two years. It is believed this decrease in catch is due to the decrease in the available supply. Tennessee stands indicted as one of the few states that allows this premier fish to be taken and sold commercially. It is worth fifteen cents a pound in the market and one dollar a pound to the sports fishermen. A very substantial portion of the revenue derived from sale of non-resident fishing licenses in Tennessee is due to our allowing fishermen from Missouri, Illinois, Indiana, and Kentucky to catch as many as twelve bass during the spawning season. The depletion of one of Tennessee's greatest natural resources will inevitably follow.

The breeding habits of this fish have been studied by a host of investigators. Dr. Reighard (1906), of Michigan, finds them nesting

in early spring in water from six inches to two feet deep among dead leaves and water plants. Spawning occurs at dusk and "the male was in the nest or near it and repeatedly the female approached." The nests have been described as shallow, circular areas measuring from two to three feet across and a foot deep. "The female was seen to approach the nest and to turn on her side with her head pointed obliquely downward and to float thus, as though half dead. In this position she entered the nest and the male followed and took up a similar position. . . . The tails of the two fish could be seen and from their position it was clear that the fish lay side by side on the bottom with their tails together and parallel. . . . At this time no doubt the eggs were emitted. After being in the nest for a short time the fish came out and the female was seen to be still floating. . . . That the male of the large-mouth bass habitually receives more than one female into his nest or receives the same female a second time after a considerable interval is shown by the fact that in three nests in which eggs were examined in their earlier stages some were found that had been recently laid and others that had been laid for forty-eight hours." Several thousand eggs are laid and they stick to roots, leaves, or other debris in the nest. Hatching occurs three to ten days later, depending on the temperature. After hatching the young remain in the nest for a week or ten days during which time they are guarded and protected by the male. A fisherman at Reelfoot Lake can take such a male from the nest legally with hook and line and thereby cause the death of as many as 6,000 young bass. It is a poor sportsman who will take unfair advantage of the fighting instinct of this parent bass to protect its young in order to lure him to his destruction. Unless the bass are given a chance to spawn unmolested, we cannot expect good bass fishing to continue at Reelfoot Lake.

The growth of this bass has been studied by Juday (1933), of Wisconsin. He finds a majority of these fish, in their second year, five inches long, and in their fifth year, a majority were more than eleven inches long, which is the minimum legal size limit. A bass weighing four pounds is twenty inches long and has lived for thirteen years. Incidentally, the largest large-mouth black bass ever caught was eleven pounds, fifteen ounces in weight, and this was in Michigan. It is only on rare occasions that one is taken from the lake weighing more than six pounds, the average weight being very close to three pounds. No investigations have been made in southern waters regarding the rate of growth of these bass. It is believed by Juday that this growth and weight depend on climate, length of feeding time, and availability of food. Thus we would expect Reelfoot Lake bass to grow much faster than those in Wisconsin.

The food of this bass is mainly fishes, such as gizzard shad, catfish, sunfish, and crayfish. In some cases where this food is scarce they may become cannibalistic.

Fishing for this bass has instigated an ambitious industry in lure making, for more than eighty per cent of all black bass are caught by

bait casting with a short rod using plug lures, or on live bait. Lincoln (1935), of the *Sportsman Magazine*, suggests a bait casting rod from five to five and one-half feet with an off-set handle. A twelve- or fifteen-pound test soft braided silk line with a wobbling wooden plug which floats on the surface is preferred. Other plugs recommended are the pikie type or the wounded minnow, which when agitated gently in the water, creates in the bass a desire to put this living object out of misery. Pork-rind lures seem to be particularly effective in the lily pad beds of Reelfoot Lake. In addition, many fisherman prefer live bait such as minnows, crickets, crayfish, cockroaches, and dragon-fly nymphs which are sometimes called "bass bugs." During the summer the bass remain in deep water, feeding at daybreak and at dusk near the surface. Many a fisherman has failed to get a strike because of not knowing this fact.

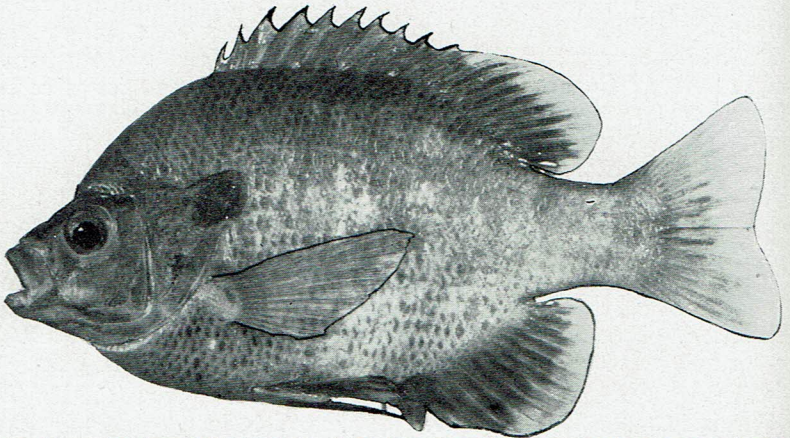


Fig. 19. The Blue-Gill Sunfish. The amateur fisherman catches more of this type than any other. Many people refer to them as "bream."

THE BLUE-GILL SUNFISH (FIGURE 19)

Helioperca macrochira (Rafinesque). Nos. 2331-32

Body deep, flat on sides, arching up very sharply from the head. Flap of the operculum dense black with no colored margin. Olive green back with purple luster; belly of coppery red; six or more dusky vertical bars on sides. Lower part of cheek and operculum light blue. Pointed pectoral fins as long as head. Head 3; depth 2. Dorsal fin X, 11; anal III, 11. Length 8 to 10 inches.

When people speak of "bream fishing" they are generally referring to this most important member of the true sunfish family. Blue-gills are found from the Great Lakes to the Rio Grande and from New York to Missouri. Some of the other common names are: blue bream, blue sunfish, copper-nosed sunfish, black-eared pondfish, perch, and sunfish. It is the largest of the sunfishes, sometimes reaching a length of twelve to fourteen inches and weighing almost a pound. Its flesh

is firm and flaky and excels all others as a pan fish. It brings a good price in the markets where thousands of pounds are sold annually.

The blue-gill bites well at all seasons, particularly in the spring and early summer, and, from July to September, many amateur fishermen are able to catch all they desire. There is no legal limit on these fish at any season of the year. Cane poles are usually used with small minnows, cockroaches, grasshoppers, angleworms, or small pieces of fish. They are also taken on the artificial fly. They move about in schools near patches of submerged vegetation and many are seen within and around the open cypress stumps. When hooked they put up a vigorous fight which makes the blue-gill "the gamest of all fishes for its size."

They feed on aquatic insects, crayfish, and large quantities of the floating aquatic vegetation. They in turn serve as excellent forage fishes for the calico bass and the large-mouth black bass.

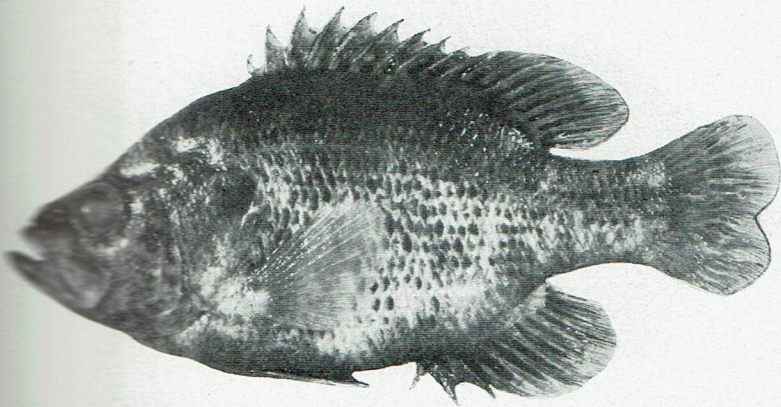


Fig. 20. The Goggle-Eye or Warmouth Bass.

Their nesting habits resemble other sunfish in that a circular nest is made. They differ in that nests appear to be grouped in colonies of ten to fifteen nests. Richardson (1920), of Illinois, finds the nests near willow bases, in some cases a dozen to one tree. A hard bottom of sand and mud with fine grass, leaves, twigs, etc., is preferred. David and Wiebe (1930) found the blue-gill best suited for pond propagation. They may produce 150,000 to 200,000 fingerlings per acre. Each female may lay from 10,000 to 20,000 eggs so that only a few per acre are required as stock.

THE GOGGLE-EYE OR WARMOUTH BASS (FIGURE 20)

Chaenobryttus gulosus (Cuvier and Valenciennes). No. 2342

Body robust and oblong. Mouth large, oblique, with lower jaw projecting; tongue with teeth. Color olive green, sides brassy with blotches of blue, red, or green, a dusky spot on each scale. A bit of crimson near the pupil. Three

oblique dusky or reddish bars radiating from eye. Head $2 \frac{2}{3}$, depth $2 \frac{1}{8}$. Dorsal fin X, 10; anal III, 9. Length 10 inches.

While this fish is generally called the Warmouth bass in various parts of the country because of its large mouth, few fishermen at Reelfoot Lake are acquainted with this name and all refer to it as "goggle-eye." Since such a uniformity exists, perhaps this name should be adopted by the Reelfoot Lake Biological Station. Other names sometimes encountered are red-eye, big mouth, sun trout, bream, mud chub, jug mouth, and black sunfish.

The goggle-eye takes a hook freely and fights well, yet on account of inhabiting the muddy waters of bayous and marshy portions of the lake, the flesh is sometimes reported as having a "muddy taste." Its food consists of smaller fish and aquatic insects.

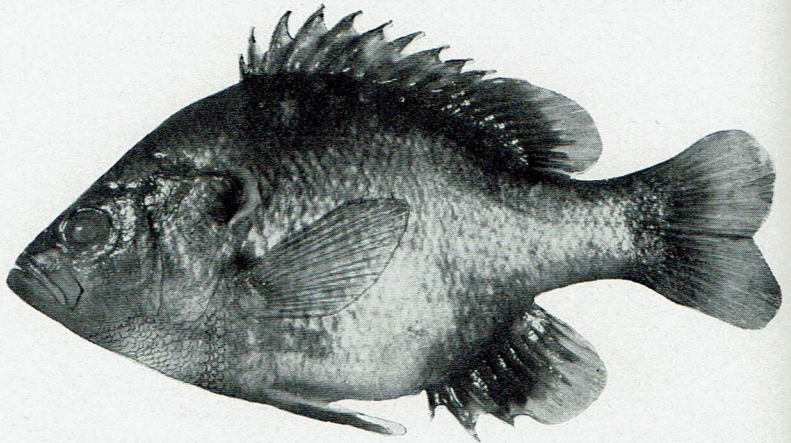


Fig. 21. The Pumpkin Seed Sunfish. This is the small "perch" of streams and ponds.

THE PUMPKIN SEED SUNFISH (FIGURE 21)

Eupomotis gibbosus (Linnaeus). No. 2341

Body short and deep. Color greenish, the upper portion golden flecked; cheek with 4 to 5 orange and blue streaks; belly orange-yellow. Opercular flap black with scarlet on lower posterior margin. Pectoral fin as long as head. Head and mouth small; snout short. Head 3, depth 2. Dorsal fin X, 11; anal III, 11. Length 8 inches.

This fish has many names ranging from common sunfish, sunny, bream, sun bass, yellow belly, to yellow perch, pond perch, grass perch, and sand perch. It is not a perch, yet is called a "grass perch" or "yellow belly" by many of the Reelfoot Lake residents. Since it has several names, it would be well to adopt "pumpkin seed" as its proper common name.

The pumpkin seed sunfish is known to bite at times when no other form can be caught. It is common in clear brooks and small ponds and is pre-eminently the small boy's fish. It is a good pan fish and may be found occasionally at the markets. Its principal food is small mussels and snails with a small amount of insects and small crustaceans.

In breeding, Dr. Reighard (1906) found that the males prepare a circular nest by removing leaves and dead aquatic plants for a space a foot in diameter and three to four inches deep. The nests are usually in shallow water and encircled by emergent aquatic plants. The male alone builds the nest and later guards the nest and the young, although the female may be present. The spawning season is from May to June, in Illinois.

THE RED-EARED SUNFISH (FIGURE 22)

Eupomotis microlophus (Gunther). Nos. 2338-9

Body oblong and compressed. Color dark green, mottled shading to silvery belly; throat yellow. Mouth wide and oblique. Black opercular flap with wide border which is red in males, plain in the female. Pectoral fin extends beyond anus and tip of anal fin. Dorsal fin X, 11; anal III, 10. Head $3\frac{1}{4}$, depth $2\frac{1}{4}$. Length 6 to 8 inches.

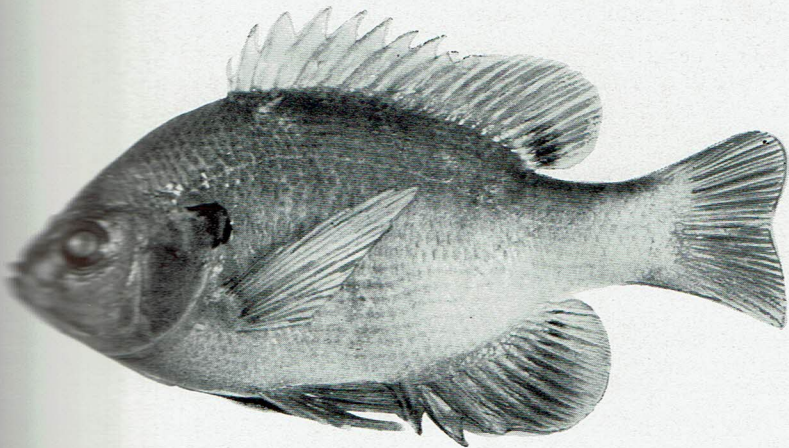


Fig. 22. The Red-Eared Sunfish. Only the males have the red tip on the opercular flap.

The red-eared sunfish, which is also called a grassperch at Reelfoot Lake, can be distinguished from the pumpkin seed type by its longer pectoral fin which is slender and pointed. It occurs from Illinois south to Florida and the Rio Grande. Its size keeps it from being of much importance and the great majority that are caught are returned to the lake as being under the legal limit of six inches.

THE ROUND SUNFISH OR FLIER***Centrarchus macropterus* (Lacépède). No. 2350**

Body ovate, compressed. Mouth small and oblique. Opercular flap broad and thin, not prolonged. Color yellowish green, with rows of dark brown spots along the sides; a dark spot below the eye. Dorsal fin XII, 13; anal VIII, 13. Head $3\frac{1}{4}$, depth 2. Length 6 inches.

This little fish was found only once during the summer at Reelfoot Lake. It generally inhabits lowland streams, ponds, and bayous from Virginia southward to Florida and Louisiana. It is said by Jordan to possess considerable gameness and takes a hook baited with an anglerworm or a small cockroach with an avidity which doubtless gave rise to the name "flier," by which it is generally known. It is easily recognized by rows of dark brown spots along the sides, one spot generally under each scale and by its long dorsal and anal fins.

THE GREEN SUNFISH***Apomatis cyanellus* (Rafinesque). No. 2317**

Small blunt body. Low dorsal fin. Black spot on posterior part of soft anal and soft dorsal fin. Large mouth. Blue green in color, each scale with a spot of emerald green. Sides with 7 or 8 vertical dusky bars. Black opercular spot covers only the hard portion of the opercle. Pectoral fin short and rounded. Dorsal fin X, 10 to 12; anal III, 9 to 10. Spines short but strong. Head $2\frac{1}{2}$, depth 2.2. Length 4 to 6 inches.

This beautiful sunfish prefers creeks and moving water and is not particular about mud. It is an excellent pan fish and a favorite with the young fishermen since it takes a hook baited with anglerworms or grubs. It lives on smaller fish, crayfish, and insects.

The green sunfish is sometimes referred to as little red-eye, bream, perch, red-eye, wood bass, and black-eye.

THE SCARLET SUNFISH***Sclerotis miniatus* (Jordan). No. 2327**

Body short and deep. Color dark olive; sides striped with rows of bronze or purplish spots. Opercular flap black, with silvery margin. Iris red. Dorsal and anal spines low. Dorsal fin X, 10; anal III, 9. Head 3; depth 2. Length 4 inches.

The coloration of this small and rare sunfish makes it easy to identify. The bronze spots on the sides distinguish it from others of the sunfish family. Its size keeps it from being of much value as a food fish.

THE LONG-EARED SUNFISH (FIGURE 23)***Xenotis megalotis* (Rafinesque). No. 2329**

Body short and deep. Mouth small. Pectorals short and rounded. Opercular flap extremely long, entirely black. Color brilliant blue and orange, the blue in wavy streaks, the orange in spots. Fins mostly with orange membranes; the

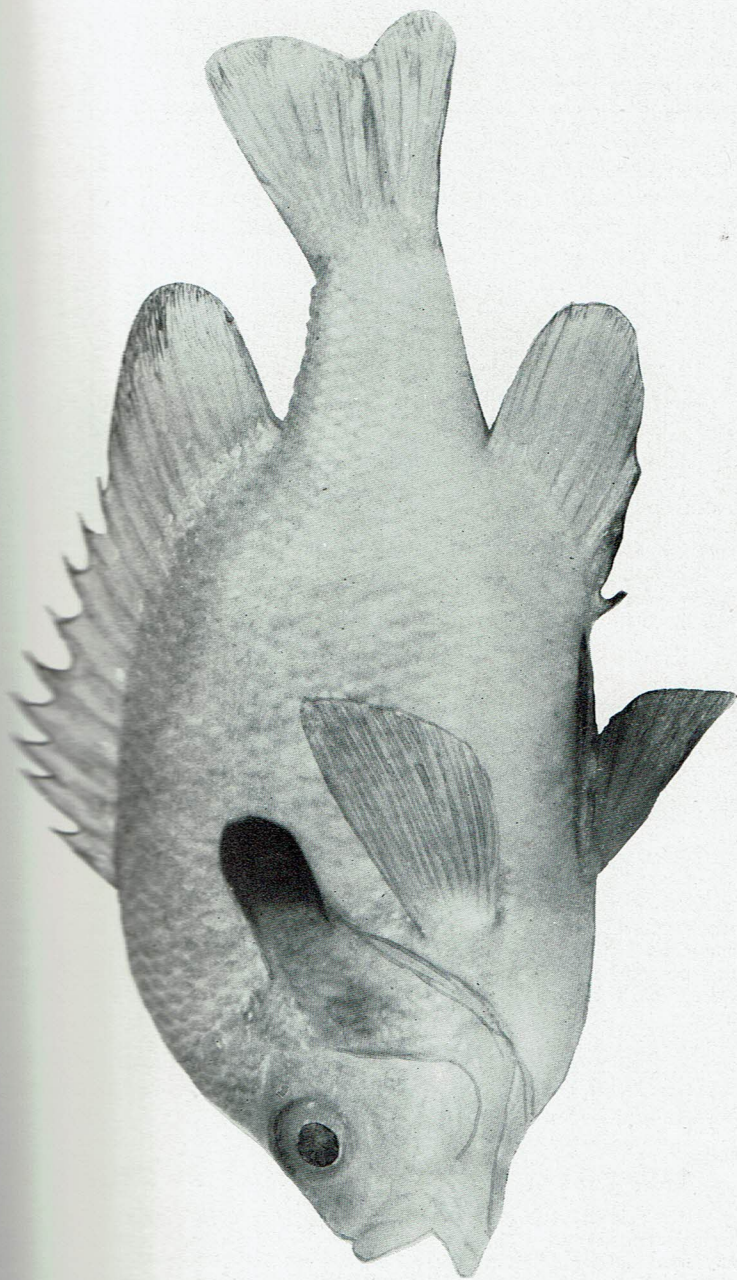


Fig. 23. The Long-Eared Sunfish. A beautiful sunfish with blue and orange coloration.

rays blue. Head 3, depth 2. Dorsal fin X, 11; anal III, 10. Length 3 to 6 inches.

This brilliantly colored sunfish is quite variable in coloration. Many have been found in the bayous and streams entering Reelfoot Lake. Its small size makes it of no commercial importance, although the larger forms are taken for pan fish. It has a great variety of common names, including big-eared sunfish, black-tailed sunfish, bloody sunfish, bream, common sunfish, red-bellied sunfish, small green sunfish, and sun perch. It feeds largely on aquatic insects and flies. It is frequently found in company with the green sunfish (*Apomatis cyanellus*).

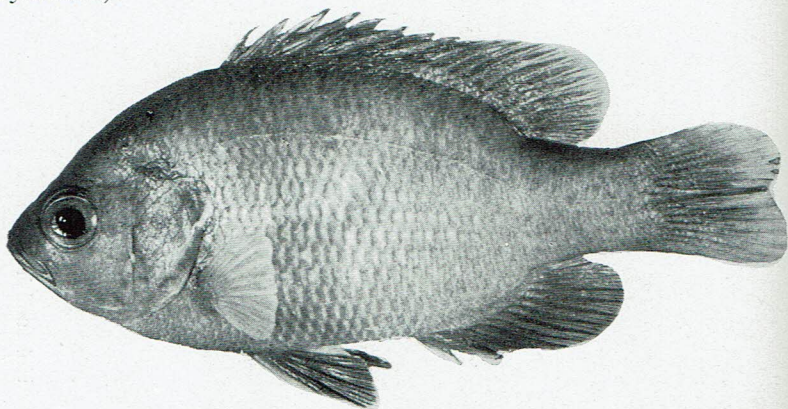


Fig. 24. The Orange-Spotted Sunfish. While of no importance as a game fish because of its small size, this sunfish is one of the most highly colored of the group.

THE ORANGE-SPOTTED SUNFISH (FIGURE 24)

Allotis humilis (Girard). No. 2328

Body slenderer than in other sunfishes. Color olive with sides sprinkled with fine golden dots; belly deep orange. Anal spines high, the fin short. Mouth moderately small, not reaching to below middle of eye. Black, flexible opercular flap with the pale margin. Pectoral fins usually but little shorter than head and rather sharp. Dorsal fin X, 10; anal III, 9. Head $2\frac{1}{2}$, depth 2.4. Length $3\frac{1}{2}$ inches.

This showy and brilliant little fish is for ornamental purposes only. It frequents the bayou and small streams. It is sometimes called red-spotted sunfish, bream, perch, or merely sunfish.

Lethogrammus symmetricus (Forbes). No. 2322

Body robust; dorsal and ventral outlines equally curved, giving a distinctively symmetrical appearance. Color dark green with coffee colored specks on body and fins. Black opercular spot. Incomplete lateral line. Protruding lower jaw. Each scale with small brown spot at base. Dorsal fin X, 10; anal III, 9. Head 2.8, depth 2. Length $2\frac{1}{2}$ inches.



Fig. 25. The White Bass. This fish is primarily an open lake fish and is known at Reelfoot Lake as the rock bass since the true rock bass (*Ambloplites rupestris*) of deeper and cooler waters is absent. Fishermen the country over know it only as white bass and it creates confusion to call it by any other name.

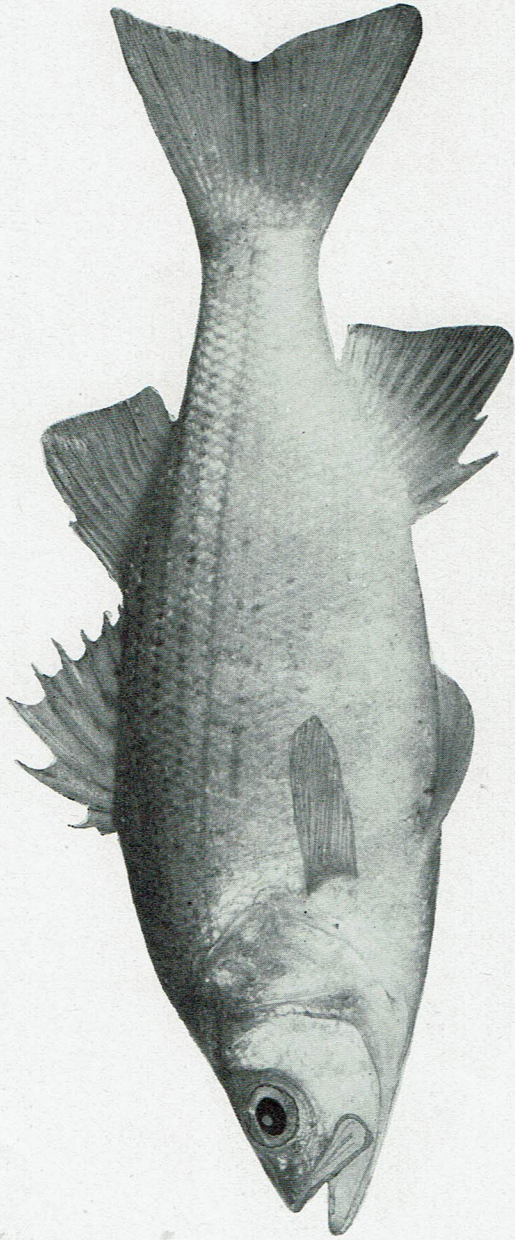


Fig. 26. The Yellow Bass. This fish is quite similar to the white bass in excellence of flavor, gamy qualities, and feeding habits. It is found in southern waters much oftener than its white relative; and is much more abundant in Reelfoot Lake, preferring open sloughs and shallow portions of the lake. Some 14,000 pounds are marketed annually here by commercial fishermen under the name of "Jacks." "Yellow bass" is the accepted name throughout the country. The average size is about one pound, but it may reach a weight of as much as five pounds. Little is known of its spawning habits.

This is an extremely rare sunfish with no common name. It can be identified by the incomplete lateral line which extends about one-half the length of the body.

THE WHITE BASS (FIGURE 25)

Lepibema chrysops (Rafinesque). No. 2367

Body deep and compressed; back elevated. Silvery in color with about 6 distinct dark longitudinal stripes on sides. One patch of teeth on base of tongue. Lower jaw projecting. Two separate dorsal fins. Dorsal fin IX-I, 13 or 14; anal III, 11 to 13. Head 3.2, depth 2.8. Length 12 to 18 inches.

This noble game fish, which is regarded by many anglers as equal to the black bass in its lightning-like darting for a lure and display of a fighting prowess, has become almost extinct at Reelfoot Lake. Despite its excellence as a pan fish, it is still taken by the commercial fishermen. Their total catch for this fish has decreased thirty per cent during the past four years. Several fishermen at the lake state that ten years ago thousands of these fish could be seen in schools near the surface but now they are difficult to find. It is a fish of the lakes and deeper waters from Canada to the northern Mississippi Valley. It is hoped that definite action will be taken at once to protect this very desirable game fish and prevent its disappearance from the lake entirely.

The white bass feeds mainly on insects such as may-fly larvae, and an occasional crayfish or small sunfish.

THE YELLOW BASS (FIGURE 26)

Chrysoperca interrupta (Gill). No. 2368

Similar to *L. chrysops* except with a deeper body. Color brassy yellow with 7 distinctly dark longitudinal lines; those below the lateral line interrupted posteriorly. Base of tongue toothless. Two dorsal fins joined slightly. Head 3, depth 2.6. Dorsal fin IX-I, 12; anal III, 10. Length 12 to 18 inches.

THE DRUM (FIGURE 27)

Aplodinotus grunniens (Rafinesque). No. 2734

Body with back strongly arched forward and profile steep. Plain, silvery gray on sides and back, white on belly; iridescent with a pearly luster. Lower part of nose white in a broad band. Dorsal fin IX, 1, 28; anal II, 7. A deep notch between spinous and soft portion of dorsal fin. Head $3\frac{1}{2}$, depth 3. Length 2 to 4 feet.

GLOSSARY OF TECHNICAL TERMS⁶

ANAL FIN: Fin behind anus or vent.

ANAL SPINE: Spine in front part of anal fin.

ANTERIOR: The forward or head region.

⁶In the preparation of this glossary that of Jordan and Evermann has been of assistance.

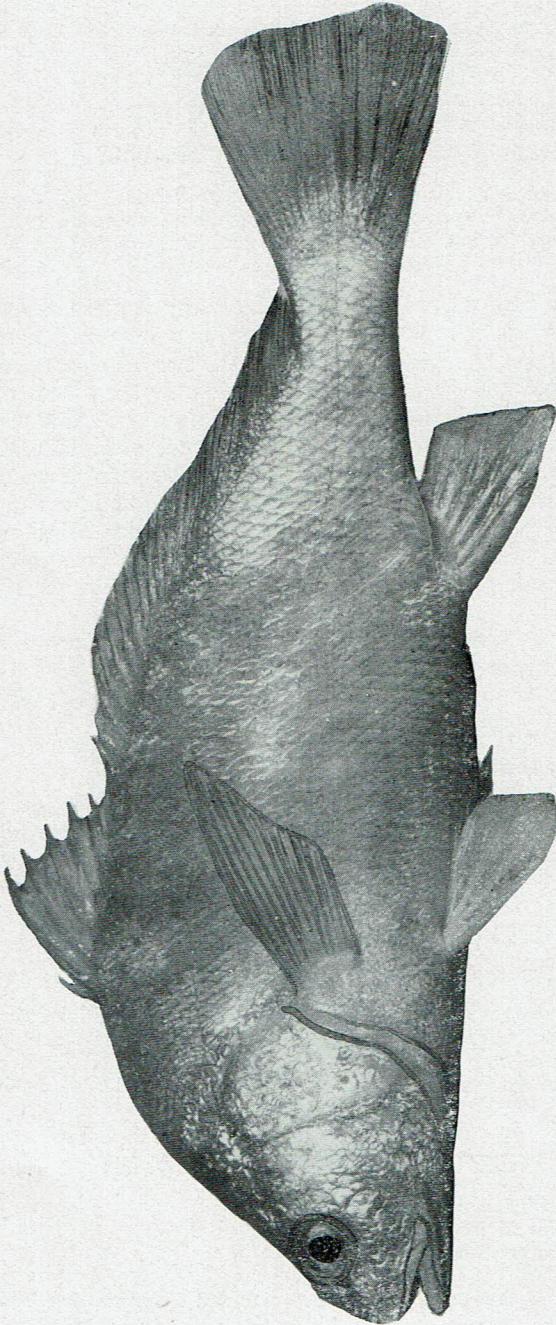


Fig. 27. The Drum. This unusual fish is found in lakes and rivers from the Great Lakes to Texas and Mexico. It is known as sheepshead, white perch, thunder pumper, and croaker, in various localities. The name "drum" is preferred since it is the only fish of fresh water equipped with special muscles in the abdomen which produce sounds by vibrating against the air-bladder. It is a fish of sluggish habits, living on the bottom and eating mollusks, crayfish, and aquatic insects. The mouth is equipped with powerful, paved, mill-stone-like teeth that enables it to crush shelled forms. The drum is not a game fish, yet may be taken with hook and line. It is abundant and more than 40,000 pounds are sold annually from Reelfoot Lake. Nothing is known concerning the breeding habits of this fish. It is said to spawn in May.

- ANUS:** External opening of alimentary canal; vent.
BARBEL: Fleshy feeler near mouth in some fishes.
CAUDAL: Pertaining to the tail.
CAUDAL FIN: The tail fin.
DORSAL: Pertaining to the back.
DORSAL FIN: A fin on the back of fishes.
FILAMENT: Any slender or thread-like structure.
GANOID: Scales covered by enamel, as in gars.
LATERAL LINE: A series of mucous pores forming a raised line along the sides of a fish.
OPERCULUM: Gill cover; the posterior bone of the side of the head, in fishes.
OPERCULAR: FLAP: Prolongation of the upper posterior angle of the operculum, in sunfishes.
ORBIT: The bony eye socket.
PECTORAL FIN: The anterior or uppermost of the paired fins, in fishes, corresponding to the anterior limbs of the higher animals.
PELVIC FIN: The ventral paired fins.
POSTERIOR: Pertaining to the rear end of the fish.
RAY: A cartilaginous rod for the support of a fin.
SPINE: Fin rays which are unbranched, and, as a rule, stiffened and sharpened.
VENT: The external opening of the alimentary canal.
VENTRAL: Pertaining to the lower side of a fish.
VENTRAL FINS: The paired fins behind or below the pectoral fins in fishes, corresponding to the posterior limbs in higher animals.

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