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STATE OF ILLINOIS  
HENRY HORNER, *Governor*

## LAKE MANAGEMENT REPORTS

### 1. Horseshoe Lake near Cairo, Illinois

David H. Thompson  
and  
George W. Bennett

DEPARTMENT OF REGISTRATION AND EDUCATION  
JOHN J. HALLIHAN, *Director*

DIVISION OF THE NATURAL HISTORY SURVEY  
Theodore H. Frison, *Chief*

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## LAKE MANAGEMENT REPORTS

### 1. HORSESHOE LAKE NEAR CAIRO, ILLINOIS

DAVID H. THOMPSON and GEORGE W. BENNETT  
Illinois Natural History Survey

For many years the Illinois Natural History Survey has been measuring fish populations and fish production. Among the various types of Illinois waters studied, it has been found that each tends to have the capacity to support a certain number of pounds of fish per acre which is constant from year to year. This number of pounds per acre remains constant even though there may be ten times as many fish (of one-tenth the average weight per fish) in some years as in others. When this amount of fish flesh per acre is disturbed by putting in or taking out fish or by floods or drouths, readjustment takes place much more rapidly than is popularly supposed.

When a new lake is stocked with a few breeder fish the saturation point is usually reached in about a year. When one-fourth, or less, of the total amount of fish in a lake is removed during the course of a season, readjustment takes place so rapidly that changes in abundance are not detectable. This means that the yield of game fishes from an acre of water can be many times the amount taken out by ordinary fishing.

Fish grow to more desirable sizes and furnish a better quality of food and sport when their numbers are reduced enough to give rapid growth rates. Good farmers understand this view of livestock and crop production and practice it continually. The following is an account of the changes which have taken place in Horseshoe Lake since its reconstruction in 1931.

#### DESCRIPTION

Horseshoe Lake embraces about 2,400 acres of water with a 1,400-acre island in the center. The Illinois Department of Conservation owns the island and about two-thirds of the water surface and maintains it as a waterfowl refuge. The lake is located about 12 miles northwest of Cairo on Highway 150.

Horseshoe Lake is part of a former channel of the Mississippi which has grown up in cypress. Cypress, gum, willow and buck brush grow throughout all parts of the lake, although the trees are more scattering along the east side, leaving considerable areas of open water. With the exception of some flooded pasture lands, the remainder of the lake is grown up in timber and brush. The east side of the lake has a uniform depth of about six feet; the remainder is

#### KINDS, SIZES AND NUMBERS OF FISH IN HORSESHOE LAKE

Kind	Total No. Handled 1934-38	Average Total Length in Inches				Estimated Number in Lake during the Past Year
		1934	1936	1937	1938	
Largemouth Bass.....	235	12.4	16.2	15.4	16.2	5,000 to 10,000
White Crappie.....	1,044	10.3	10.7	10.9	8.5	250,000 to 350,000
Black Crappie.....	3,913	6.3	7.9	7.6	7.9	500,000 to 700,000
White Bass.....	3					
Yellow Bass.....	15					
Warmouth Bass.....	9					
Bluegill.....	969	7.3	6.9	6.8	6.8	150,000 to 250,000
Green Sunfish.....	2					
Flier Sunfish.....	825	5.3	6.0	5.8	5.9	4,000 to 15,000
Grass Pike.....	14					
Spotted Gar.....	2					
Dogfish.....	17					
Channel Cat.....	9					
Black Bullhead.....	1,122	9.1	10.0	10.5	11.1	150,000 to 250,000
Yellow Bullhead.....	329	10.8	10.9	12.1	11.4	35,000 to 50,000
Gizzard Shad.....	1,244	9.1	9.7	10.4	10.7	50,000 to 200,000
Golden Shiner.....	11					
Carp.....	217	19.8	20.8	21.5	22.6	25,000 to 50,000
Redmouth Buffalo.....	618	13.8	17.0	17.9	18.1	25,000 to 100,000
Mongrel Buffalo.....	33	15.2	20.3	22.7	21.7	1,000 to 5,000
Smallmouth Buffalo.....	12					
Quillback.....	9					
Redhorse.....	1					
Spotted Sucker.....	139	12.9	16.2	16.8	17.7	5,000 to 20,000
Chub Sucker.....	1					
<b>Total.....</b>	<b>10,793</b>					<b>1,200,000 to 2,000,000</b>





(Left)  
Cypress Trees Grow in the Open  
Waters of the Lake



(Right)  
Don Hansen Measures a Carp at  
the Ferry Landing

more shallow with depths ranging from one to six feet.

A small creek about 25 feet wide feeds Horseshoe Lake from a large area to the north and east. In addition, a dredge ditch about six feet deep drains the hills from the north and west. During heavy rains these streams bring in a great deal of muddy water which often extends well down the lake. Although Horseshoe Lake is brownish in color, it is sufficiently transparent to allow bottom to be seen in one to three feet of water. Submerged aquatic vegetation is scanty.

The climate of this southern tip of Illinois is much milder than most upstate citizens realize. Cotton is grown in this vicinity; mistletoe parasitizes the elms and maples; and cane brakes are scattered in the lowlands. The fish have a growing season nearly twice as long as that of northern Illinois and pole-and-line fishing goes on throughout most winters.

#### HISTORY

In 1930 the old dam holding Horseshoe Lake washed out. The lake drained and lay completely dry for a year. The only water left was in the dredge ditch which feeds the lake. A permanent dam of concrete with deep foundations was built in 1931. Rains in late summer and early fall of that year partially filled the lake. In December, 1931, a stock of small bass, crappies, bluegills, channel cat, bullheads, small carp and buffalo were brought from the Illinois River at Havana and put in Horseshoe Lake. This was followed by some larger bass stocked in the early spring of 1932. Apparently a few other kinds of fishes survived the draining of Horseshoe Lake in the pools of the dredge ditch. The most important of these were the flier sunfish, the spotted sucker, and three species of forage fish—the live-bearing top minnow (*Gambusia*), the golden shiner and the gizzard shad.

#### FISH SURVEYS

Zoologists of the Natural History Survey have watched the course of events in Horseshoe Lake each year since it was rebuilt. In 1934, 1936, 1937 and 1938, a crew of men, outfitted with boats, nets and a miscellany of scientific equipment, caught, identified, measured, weighed and took scales from large numbers of fish. This information has made it possible to estimate the abundance of the important species in the lake, their rates of reproduction, rates of growth and death rates.

The first three of these surveys were made by Mr. Francis D. Hunt, then field naturalist for the Natural History Survey. In order to make the fishing methods for all years as uniform as possible, Mr. Hunt, who is now fish culturist for the Department of Conservation, assisted in making the 1938 survey.

Twenty-five kinds of fish were taken in hoop nets during these four surveys. Eleven of these kinds represent one percent or more of the total. A list of species and the numbers taken is shown in the accompanying tabulation, along with average lengths for each year of the more abundant kinds. From year to year the same nets were used and set in about the same places in the lake. As these nets were one-inch mesh, the small fish, up to a size of about four inches in circumference, escaped.

The same nets were used in the years 1932-1937 to catch fish for the population measurements in the lakes of the Illinois Valley. There it was found that in the warm weather of spring and summer each net caught the fish from about one-tenth of an acre in one day. The total number of fish taken during these four surveys in Horseshoe Lake represents the catch from about 20 acres of water. This makes it possible to estimate within certain limits the total number of individuals in the lake of each of the more common species. Certain kinds of fish are caught in these nets much more readily than others. These differences in behavior have been taken into consideration in estimating the total numbers shown in the tabulation.

#### ESTIMATES OF TOTAL POUNDAGE

At the present time it is estimated that Horseshoe Lake is supporting about 150 pounds per acre of bass, crappies and sunfish. The bullheads amount to an additional 65 pounds per acre. In addition to the above fish which may be taken readily on hook and line, there are probably about one-half million pounds of carp and buffalo, or about 200 pounds per acre. It appears that the total of all kinds of fish of edible sizes in the lake is about one million pounds or 400 pounds per acre.

#### THE 1937 FLOOD

In late January and early February, 1937, the Ohio River flooded, covering a large part of several southern Illinois counties. The flood water backed up Bay Creek a few miles, cut across to Cache River, following its valley across the southern tip of the

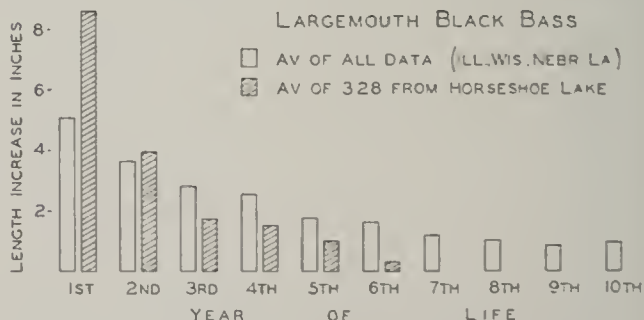
Left.—The black crappie made up 37 percent of all fish taken in hoopnets by the four surveys, 1934-1938. A huge brood of black crappies was spawned in the spring of 1932 from breeding stock placed in the lake a few months earlier. This brood grew at a normal rate during its first two years, reaching an average total length of 6 inches by the spring of 1934. After that, growth was retarded by dwindling food supplies. These fish reached an average length of 8 inches by 1936 and since then have not grown at all. Moderate reductions in the numbers of this 1932 brood from year to year have not resulted in increased growth among the survivors because of increasing competition by the white crappies. The black crappie, more than any other fish, has been responsible for destroying the young, not only of its own kind, but also those of most other species in the lake.

what changes the flood had made. We found no evidence that Horseshoe Lake had lost any of its fish. The only intruders were two spotted gars. Up to this time this species had not been taken in the lake, although it is present below the spillway. No spotted gars or other newcomers were caught in this spring's survey. If this flood had taken place in warm weather when fish are active, it seems certain that the fish population of Horseshoe would have been greatly disturbed and mixed up. Throughout the early part of the flood, the quieter waters were covered with ice and at no time did the temperature rise more than a few degrees above freezing. It appears that the fish of Horseshoe and vicinity lay quietly while the flood waters rose and went down again.

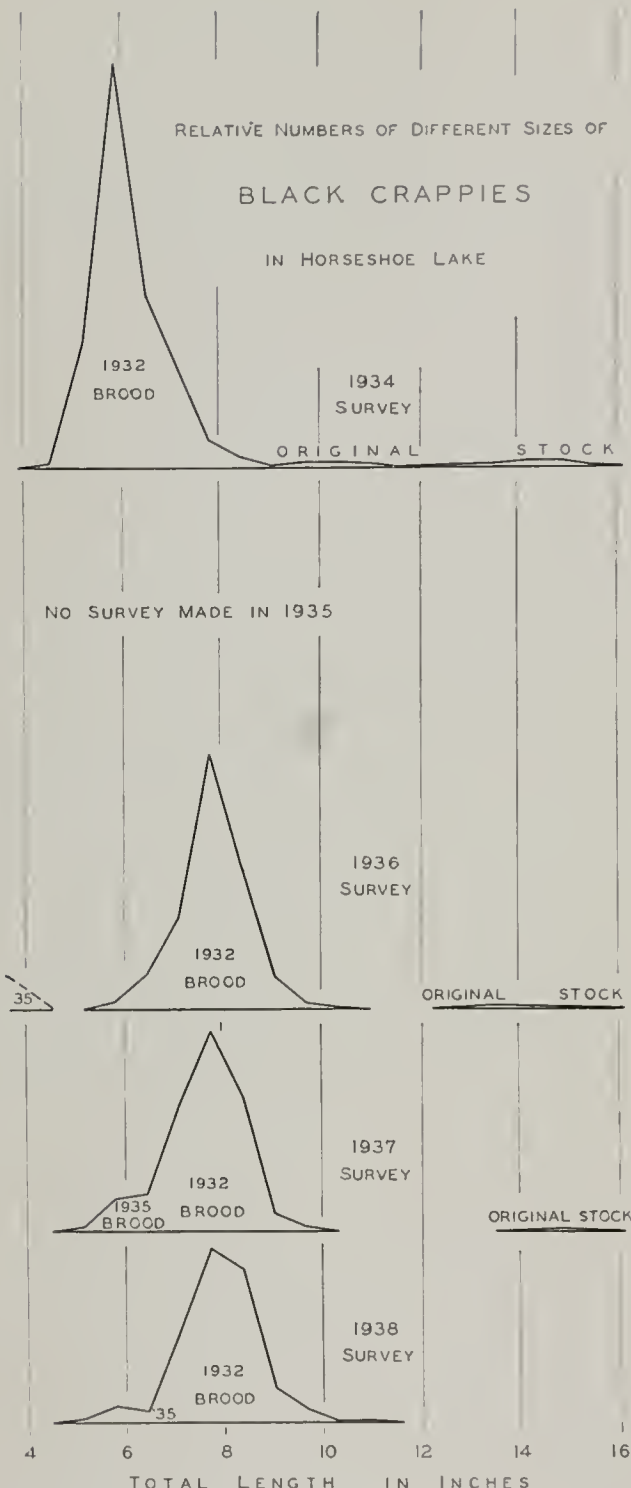
#### LARGEMOUTH BLACK BASS

Two of the diagrams show the essential facts about the largemouth bass in Horseshoe Lake.

When the lake was visited in May of 1932, as many as a quart of *Gambusia* could be taken in a short haul with a minnow seine, together with bass fry about an inch long and large numbers of fry of the flier sunfish. The top minnows and the fry of the flier sunfish probably made up the bulk of the food of the bass that first year and were responsible for their rapid growth. When the lake was visited in the summer of 1933 it was noted that the bass were growing very rapidly. The decline in the



After Horseshoe Lake was rebuilt, food was at first abundant. The bass responded to this favorable condition more readily than other species and grew very rapidly. At an age of one year they were almost twice as long and weighed six times as much as the average yearling bass in the Mississippi Valley. Increasing competition by crappies reduced growth in the bass to normal in their second year, then below normal, finally almost to zero. At the present time these bass are living on a subsistence basis.



state. Near Horseshoe Lake this water left the channel of the Cache to enter the Mississippi at Dog Tooth Bend. At the time of the flood it seemed likely that Horseshoe Lake might have lost a large part of its fish or that objectionable species might have moved in. The 1937 survey was made to determine



rate of growth and the reduction of the number of bass has resulted from competition and predation by the crappies, as well as from fishing. Hook-and-line fishing has apparently removed a larger percentage of the bass than of the crappies. In June, 1934, a group of wardens under the direction of Chief Inspector Erio contacted 2,097 fishermen and enumerated their catch during the first three days of the first open season. Their catch included 2,544 bass, but only 74 crappies. This is because bass seem to bite better than crappies in summer. The growing scarcity of bass in this lake does not seem to be due to their failure to spawn or to lack of spawning places.

The best way to reestablish the bass in satisfactory numbers would seem to be (1) to relieve them from competition and predation by taking out more crappies and (2) to plant bass too large to be swallowed by crappies.

### CRAPPIES

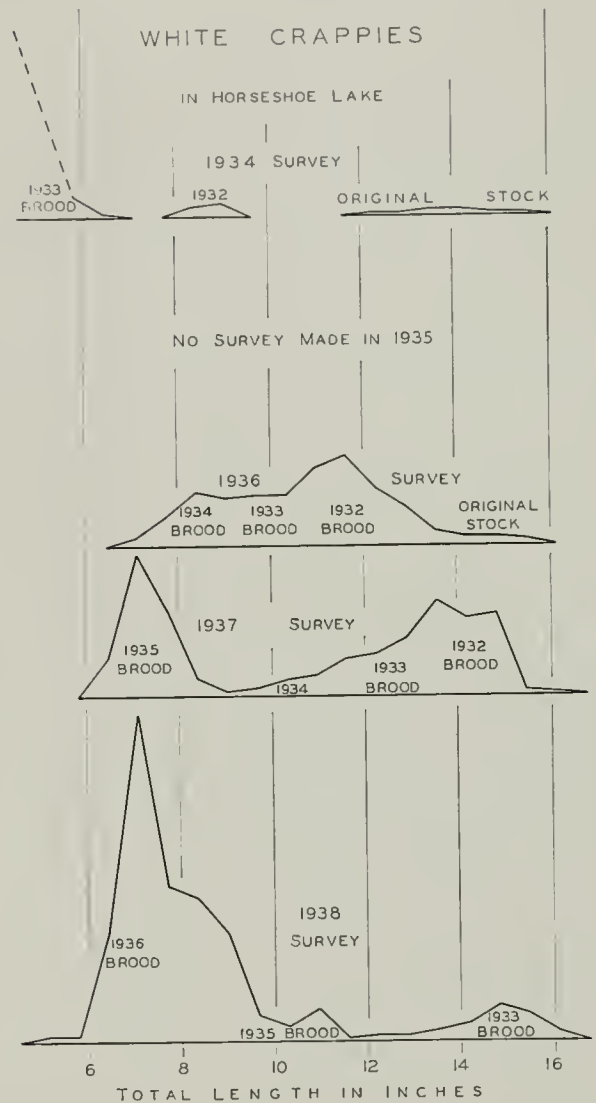
Crappies made up 46 percent of all the larger fish taken in the four surveys. The facts about their growth and numbers are shown in the accompanying diagrams. Of the very large carnivorous fishes, the white crappie is most numerous. It may be noted that the decline in abundance of bass has taken place at the same time as a corresponding increase in the number of white crappies.

Within the past few years, larger crappies of both species have been caught or handled in Horseshoe Lake than in other Illinois waters in recent decades. A few of the very largest of these have been identified as hybrids between the two species. The largest hybrid was 17.1 inches long and weighed 4.3 pounds. It was caught in March, 1936.

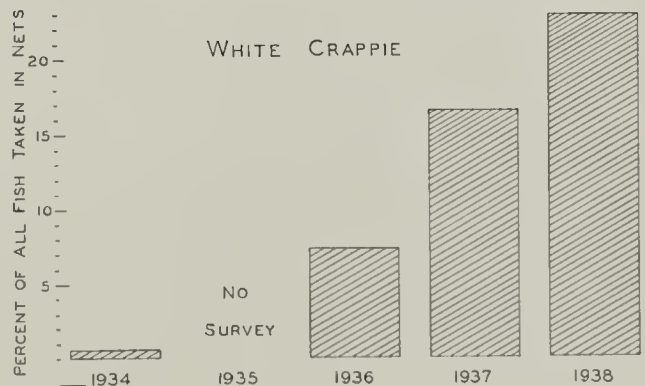
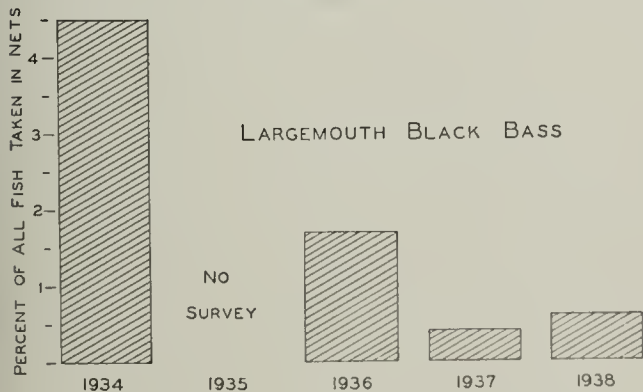
Fishermen have noticed that large specimens of most kinds of fish are usually females. For example, 23 out of 27 of these large white crappies were fe-

Below.—In the spring of 1932 the breeder bass previously placed in the lake spawned successfully. In the absence of many predators a large part of this brood survived. At the same time a large brood of crappies was also produced and survived. In succeeding years the bass spawned, but nearly all of the young have disappeared—probably eaten by the crappies. In each year since 1934, the number of legal-sized bass has been reduced to one-half or two-thirds of the number present the preceding year. The original 1932 brood still makes up over 90 percent of the bass population as shown by the 1936, 1937 and 1938 surveys.

### RELATIVE NUMBERS OF DIFFERENT SIZES OF



The white crappie, in contrast to the largemouth bass and the black crappie, produced a rather small brood in 1932 when the lake was new. Unlike these other species, it has produced moderate-sized broods each year which have escaped destruction. This has resulted in a progressive increase in their numbers which is shown in the diagram below.



males. This does not mean that the female grows faster, but that the male dies off sooner.

#### BLUEGILLS AND OTHER SUNFISH

The bluegill, more than any other species in the lake, has maintained a uniform population and a uniform size. It grows steadily and, apparently, reproduces successfully year after year. The bluegill does not feed on other fishes extensively, probably because of its small mouth, and is in the position of a bystander in the struggle among the crappies and the bass.

The flier sunfish multiplied rapidly during the first year and in 1934 constituted about one-fifth of all fishes taken. Since then it has declined and has almost disappeared. Only five were taken this year.

A few other kinds of sunfishes and related species have been taken in small numbers each year. None of them shows any indication of reaching important numbers, with the possible exception of the yellow bass.

#### BULLHEADS

The black bullhead spawned very successfully in 1932. This brood reached an average length of 9 inches by 1934. Since that time they have been growing one-half inch per year. There is no evidence of the survival of any subsequent broods. In April, 1937, the black bullheads were all thin. They seemed to be "all head and tail." Their flesh was extremely soft and, on dressing, much of it pulled off with the skin. During the present spring most of them seemed to be in good condition although a few were still poor.

The yellow bullhead also produced a large brood in 1932. Since then small broods have survived about every second year. The yellow bullheads also appeared to be starved in 1937, but not in 1938. A few were examined post mortem in 1937 but no evidence of disease or parasites was found.

Bullheads are desirable food and it would seem a good thing to make better use of those in Horseshoe Lake.

#### FORAGE FISH

There appear to be about one-half million pounds of game fish and bullheads in Horseshoe Lake which

feed almost entirely on fish. Experiments have shown that at moderate temperatures a largemouth bass must eat about one percent of its weight in fish per day in order merely to maintain its bodily processes, without any increase in weight. Since there are about 200 days a year when the water of Horseshoe Lake is warm, this means that one million pounds of forage fish are the minimal sustaining requirements for these fish. Growth of these game fish demands nourishment at the rate of 3 to 5 pounds of forage fish for each pound of new flesh added. Thus, it is not improbable that as much as two or three million pounds of small fish are consumed annually.

The principal items which compose this enormous quantity of fish flesh are:

(1) The young of larger fishes.

(2) Both young and adults of a variety of minnows and other small fishes, of which the golden shiner and the live-bearing top minnow have been of outstanding importance.

(3) The gizzard shad.

The gizzard shad, while not useful for human consumption, multiplies very rapidly and is an important food for game fish in lakes. It has a further advantage in that it feeds upon the microscopic life in the water and does not compete for food with edible species. From 1934 until 1937 the number of adult gizzard shad declined steadily, probably because they were eaten by increasing numbers of crappies of large sizes. Now that the large-sized crappies are disappearing, the gizzard shad again shows an increase.

#### ROUGH FISH

The carp and buffalo which make up the bulk of rough fish in the lake now average about 5 pounds each. Each female carp of this size produces one-half million or more eggs. The young fish which develop from these eggs are an important food item of the game fish and tend to offset whatever competition the carp and buffalo offer in other respects.

*NOTE:—Reprinted in part from Illinois Conservation, Summer, 1938. Cuts and type courtesy of Illinois Department of Conservation.*



