

Original copy: Fish Division
cc: Mr. Ruhl
Mr. Frank Bishop
Mr. Gerald Cooper
Mr. R.W. Eschmeyer

INSTITUTE FOR FISHERIES RESEARCH
UNIVERSITY MUSEUMS
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REPORT NO. 351

THE EFFECTS OF THE 1935-1936 WINTER KILL OF FISHES
IN THE FOLLOWING LAKES: BATTEESE IN JACKSON COUNTY;
MUD, STOFFER'S AND SUGARLOAF IN WASHTENAW COUNTY,
AND PARK IN CLINTON COUNTY

Batteese Lake, Jackson County

The 1935-36 winter kill of fishes in Batteese Lake, Jackson County, was the subject of an earlier Institute report (No. 344) which was based on observations made by an Institute party at the time (February 14, 1936) the fish were dying.

In this report the present writer estimated that somewhat over one hundred thousand fish had succumbed to the condition of low oxygen which prevailed under the thick ice during February, 1936.

As a second check-up on the effect of the 1935-36 winter kill of fishes in Batteese Lake, this lake was visited again by the writer on March 26, 1936. On this date approximately two-thirds of the surface of Batteese Lake was open water; the remaining one-third was still covered by ice, this area of ice being located in the northwest part of the lake and adjacent to the northern two-thirds of the west shore. A strong east wind had been blowing for the past 24 hours previous to the time of these observations. Due to this wind a noticeable westward current of water was present over the entire exposed surface of the lake. The dead fish which had been, and which were still rising to the surface were drifting toward the west shore--those fish from the southern third of the lake were being washed up along the southern third of the west shore; those fish rising in the northern two-thirds of the lake were drifting beneath the ice front (this we observed). Counts were made

of the number of dead fishes in short sections of the exposed portion (800 feet) of the west shore; these counts revealed an approximate average of 5,000 fish to each 100 linear feet of shore, or a total of 40,000 dead fish in this 800 feet stretch. Since our observations revealed that dead fish were being carried just as frequently beneath the ice front along the remaining two-thirds of this western shoreline as upon the stretch of shoreline which we observed, it appears safe to conclude that approximately 120,000 dead fish were concentrated along the west shore at the time of this examination. Counts made along the south, east and north shores indicated an additional 5,000 fish, bringing the total to 125,000.

At the time these observations were made, the writer estimated the per cent of the 125,000 fish represented by each of the fish species observed. On the basis of these percentages, the dead fish observed are divided as follows:

Species	Per cent	Number	Range in length in inches
Bluegill	40	50,000	2 to 10
Black crappie	20	25,000	3 to 10
Warmouth bass	10	12,500	2 to 7
Brown and yellow bullheads	10	12,500	8 to 12
Lake chub sucker	7	8,750	3 to 8
Pumpkinseed sunfish	5	6,250	3 to 8
Large-mouthed bass	3	3,750	10 to 18
Mud pickerel	2	2,500	4 to 8
Perch	2	2,500	3 to 7
Dogfish	1	1,250	10 to 25
Total	100	125,000	

Of these 125,000 fish, 90% were valuable food and game fishes and only 10% were coarse fishes or predators.

There is conclusive evidence that the actual kill of fishes in Batteese Lake was far greater than the 125,000 figure indicates, for:

1. At the time these observations were made, fish were still rapidly rising from the bottom of the lake, indicating that there still were considerable numbers of fishes on the lake bottom.

2. During our observations on this lake at the time of the fish mortality (February 14, 1936), large numbers of dying fish were noted to dart into the dense vegetation on the bottom of the lake. Many of these fish probably never would come to the surface.
3. Of the many small fishes which were known to have died in this lake, very few were represented in the count. Of the large numbers of mud-minnows, golden shiners and young chub suckers which were known to have died, none were represented in the above count; this was also true of the mad-toms, young bullheads and the smaller of the mud pickerel. Apparently these young fishes, in their decomposition, ^{do not} generate enough gas in the body cavity to bring them to the surface.
4. Large numbers of the fish floating at the surface had been, and were being eaten by gulls. Approximately 150 of these birds were present on the lake during our visit to the lake, and, according to local reports, these birds had been on this lake for the past two days. These birds were observed to be actively feeding upon the dead fish, and it is quite probable that they accounted for several thousand of them.

On the basis of these counts and observations, it is concluded that the loss of valuable food and game fishes in Batteese Lake was far in advance of 125,000 fish, and that the total kill was well over 200,000 fish, possibly two or three times that amount.

Mud Lake, at Waterloo

Conditions of winter kill on Mud Lake, Section 31 of Lyndon Township, Washtenaw County, were examined by the writer on March 26, 1936. This lake is approximately 3/4 mile long by 1/4 mile wide. The bottom is chiefly of organic debris, and the shallows have abundant growths of rushes. It is reported to be comparatively shallow. It has a rather small inlet which is the outlet from Sugarloaf Lake. Mud Lake has

a six foot dam at its outlet. At the time of this examination a strong east wind was blowing and fish were being washed toward approximately one mile of shore line along the west side of the lake, the lake being entirely free from ice. One-fourth mile of this shore line was examined and fish counts were made on three stretches of 100 feet each. Since the fish were scattered over a wide, weedy shoal-area and many had sunk to the bottom among the weeds, my count could be at best only an estimate. My estimate was that the shore line of the west half of the lake contained approximately 750 fish per 100 linear feet or a total of 40,000 fish; judging from prevailing winds during the preceding 24 hours, it is probable that most of the dead fish were along this shore line.

In addition approximately 10,000 dead fish were noted in Mud Lake above the dam at the outlet.

Just below Mud Lake, its outlet empties into a Mill Pond which has been formed by a dam in the center of Waterloo village. This mill pond is about one mile long and is very narrow. Approximately 25,000 dead fish were accounted for along its shores. According to local reports these fish were a part of those which had died in Mud Lake and floated down stream from this lake.

These counts and observations placed the number of fish killed in Mud Lake during the winter of 1935-36 as 75,000, or by species:

Species	Per cent	Number	Range in length in inches
Bluegills	60	45,000	4 to 10
Warmouth bass	15	11,250	3 to 7
Pumpkinseed sunfish	10	7,500	4 to 8
Large-mouthed bass	5	3,750	10 to 20
Perch	2	1,500	4 to 8
Black crappie	2	1,500	6 to 12
Lake chub sucker	2	1,500	2 to 10
Mud pickerel	2	1,500	6 to 10
Gar pike	+	1	15
Yellow bullhead	1	100	8 to 12
Brown bullhead	1	100	10 to 15
Dogfish	+	50	6 to 18
Black-nosed shiner	?	thousands	$1\frac{1}{2}$ to $2\frac{1}{2}$
Black-chinned shiner	?	"	$1\frac{1}{2}$ to $2\frac{1}{2}$

Of these 75,000 dead fish recorded from Mud Lake, approximately 95% were valuable food and game species.

Since, as for Batteese Lake, most of the smaller fishes were not represented in this figure of 75,000 dead fishes for Mud Lake, it is believed that the actual total kill was far in advance of this figure.

Stoffer's or Green Lake, Washtenaw County

During the past two months the Institute had received several complaints of a winter kill of fishes in Stoffer's Lake, located at the junctions of Sections 21, 22, 27 and 28 of Lyndon Township, Washtenaw County. This lake is also locally known as Green Lake and is referred to on the county soil survey map as McKane Lake. This lake has an area estimated to be about 75 acres and it is reported to be quite shallow. The lake was visited by the writer and Mr. F. W. Ouradnik on March 29, 1936. One-half mile of shore line was examined. On the basis of several counts, we estimated the number of dead fish along the shores as between 75,000 and 100,000, composed of the species as follows:

Species	Number	Range: length in inches
Bluegill	50,000	3 to 8
Pumpkinseed sunfish	10,000	3 to 7
Warmouth bass	10,000	2 to 6
Black crappie	5,000	4 to 9
Large-mouthed bass	15,000	6 to 22
Lake chub sucker	10,000	3 to 10
Dogfish	200	10 to 25

Several photographs showing the concentration of dead fishes along the shores of Stoffer's Lake were taken by Mr. Ouradnik, and these are available in the Institute files.

Sugarloaf Lake, Washtenaw County

Sugarloaf Lake, Lyndon Township, Washtenaw County, was examined on March 26, 1936. The lake was entirely open and there was a strong east wind. One-half mile of shore along the east side, and one-fourth mile of shore along the west side were examined. Twelve dead bluegills were recorded. Our observations and local reports

indicate that there was practically no winter kill on this lake during the past winter. This is of particular interest in view of the low oxygen values near the shore in this lake as described by Mr. Eschmeyer in Report No. 346.

Park Lake, Clinton County

Park Lake, located about 10 miles south of St. Johns, was examined on March 27, 1936 by Conservation Officer Frank Bishop and the writer. This lake is approximately one mile long and one-half mile wide and has an estimated area of 200 acres. It has no inlet or outlet. During this examination (1 to 5 p.m.) there was a strong west wind blowing across the lake, and the fish were found concentrated along the east and northeast shores. The west and southwest shores are almost inaccessible and were not examined, but it is probable that relatively few fish were drifted along these shores because of the present and preceding wind directions.

We examined almost all of the north shore, all of the east shore and part of the south shore--a total of one-half of the entire shore line. Along one 800-foot stretch, the fish had been washed up in a solid windrow 6 inches to 2 feet high and 5 to 10 feet wide, averaging about 100 fish to the linear foot; along another stretch of 1000 feet our counts averaged about 30 fish to the linear foot. Our estimate for the total number of fish which were lying dead along the shores of Park Lake was 150,000, and ^{we} agreed that this figure was conservative.

The 150,000 fish found dead along the shores of Park Lake included (approximately) the following:

Species	Per cent	Number	Range: length in inches
Bluegill	40	60,000	2 to 7 (small; possibly dwarfed)
Large-mouthed bass	15	22,500	4 to 22 (90%, 8" to 11"; ^{50%} 15" to 22")
Lake chub sucker	15	22,500	2 to 10
Black crappie	8	12,000	4 to 9
Pumpkinseed Sunfish	5	7,500	3 to 6
Bluegill x sunfish hybrid	+	Several	4 to 8
Perch	5	7,500	3 to 8
Mud pickerel	3	4,500	4 to 10
Warmouth bass	2	3,000	2 to 5
Yellow bullhead	2	3,000	6 to 12
Brown bullhead	+	300	8 to 12
Dogfish	+	500	15 to 30 (75%, 25" to 30")
Northern pike	+	200	10 to 30
Common sucker	+	100	12 to 24
Golden shiner	+	1	5

It was very evident in the examination of the dead fishes on Park Lake, as was noted for Batteese and Mud lakes, that the smaller fishes were not washed up on the shore at the same rate as larger fish; therefore our counts did not give the true picture in regards to these smaller fishes. Officer Bishop informed me that he had been present on Park Lake at the time the fish were dying and that the smaller individuals had been affected as severely as the adults (this was also observed to be true in Batteese Lake). Since, in a normal fish population, the number of small fishes (small species and young of game species) is usually several times the number of the larger individuals, the conclusion seems justified that the total fish kill in Park Lake was possibly several times the number included in the above table.

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By Gerald P. Cooper
Gerald P. Cooper