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An Unusually Large Population of Fish in a Gravel Pit Lake¹

By KENNETH D. CARLANDER

Lakes in gravel pits are usually relatively unproductive but Ruth's Lake near Marshalltown was found to have a larger fish population than has been reported for any other water, except for carp ponds where the fish are artificially fed. When this lake was treated with rotenone, over 1200 pounds of fish per acre, were collected, compared to the 100 to 400 pounds per acre found in most lakes and ponds (Carlander, 1950).

HISTORY AND DESCRIPTION OF THE LAKE

This lake, a mile east of Marshalltown, Iowa, (Marshall Co. R-17W, T-84N, Sec. 32) has an area of approximately 4.5 acres, an average depth of 12 feet, and a volume of 54 acre feet. The lake is an old gravel pit, with steep slopes and with no aquatic vegetation. The maximum depth is 20 feet. This gravel pit has been flooded since early in the 1930's and for several years was managed by Mr. George Ruth and his sons Paul and Lawrence as a fishing resort. Fishing for largemouth black bass and bluegills was good and a small fee was charged for sport fishing. In addition, the Ruths, under license from the State Conservation Commission, sold fingerlings and adults for stocking ponds around the state. A Marshalltown sportsmen's club has a small clubhouse on the shore.

In 1944 the Iowa River flooded, breaking through the dyke around the pit, and introduced several species of fish from the river, including carp, buffalo, and quillbacks. The dyke was repaired within a few weeks and there has been no further connection with the river. In subsequent years the fishing became so poor that the Ruths discontinued the practice of permitting public fishing. The water also became quite turbid. Prior to the flooding the water is reported to have been clear enough so that the bottom could be seen at a depth of 10 to 12 feet. Several attempts with seines, traps, and dynamite failed to get rid of the carp and buffalo. It was therefore decided in 1949 to poison the pond and start over.

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ELIMINATING THE FISH

In an attempt to estimate the fish population by the marking and recovery technique (Carlander and Lewis, 1948), not enough fish could be collected with the equipment and time available. From September 22-24, fifteen hauls were made with a $\frac{3}{8}$ inch mesh seine 10 feet long and 10 feet deep, and only 113 fish were caught, most of which were crappies (Table 1). In four hoop nets with 10-foot wings, set for two days and lifted each day, 17 bluegills and crappies were caught, and six wire traps set the same length of time took 16 fish. Only 14 fish were caught in 375 feet of experimental gill nets with mesh sizes ranging from $1\frac{1}{2}$ to 4 inches stretch measure. The catches in the various gear gave no indication of the abundance of buffalo which the poisoning demonstrated later.

During the week prior to the treatment with rotenone Mr. Paul Ruth caught 45 largemouth black bass and some bluegills by angling and transferred them to another pond so that they could be used for restocking purposes.

On September 29, 1949, the pond was poisoned, using 80 pounds of cube root. A slight excess of rotenone was used to ensure a complete kill. To secure the 0.5 p.p.m. concentration usually considered adequate, 70 pounds would have been necessary. The cube powder was mixed in tubs to form an emulsion, about 3 pounds of powder to a tub of water. The emulsion was distributed over the entire lake as soon as it was mixed. In addition about 20 percent of it was siphoned into the deeper water with a hose. After the poison was distributed the lake was stirred up by two outboard motor boats

Table I

The fish caught in various gear prior to poisoning,
Ruth's Lake, Iowa, September 22-24, 1949.

	Seine	Hoop nets	Wire traps	Gill nets
Buffalo	5	0	0	0
Quillback	2	0	0	2
Black crappie	15	2	2	4
White crappie	71	10	6	8
Bluegill	9	5	8	0
Largemouth black bass	2	0	0	0
Yellow bass	2	0	0	0
Golden shiner	7	0	0	0

and 4 charges of dynamite were discharged in the deeper water to ensure mixing and to drive fish from the holes.

Distribution of the poison was started at 7:30 a.m. and was completed in about an hour. Before the poison was all distributed, yellow bass, a few bluegills, golden shiners, other minnows, and crappies began to come to the surface showing signs of distress. It is believed that all yellow bass, bluegills and golden shiners were dead by 11:00 a.m. At noon large numbers of crappies were still coming to the surface but only a small proportion of them were recovered before they sank again. By early afternoon the crappies were all dead. Largemouth bass started showing up about 8:30 a.m. and by noon they had apparently all been killed. Fifteen bass, from one to five pounds were transferred to fresh water as soon as possible, but only 2 of them recovered. By 9:00 a.m. buffalo, carp and quillbacks started coming sluggishly to the surface. By noon over 600 of them were picked up, most of them not yet dead. After 2:00 p.m. there was no further sign of these fish. Channel catfish first

Table II
Fish picked up after poisoning the Ruth Pond,
Marshalltown, Iowa, September 1949.

Species	Total length size range in inches	Number picked up	
		Sept. 29	Sept. 30—Oct. 7*
Buffalo, <i>Megastomatobus cyprinella</i>	14-29	958	200
Quillback, <i>Carpionodes cyprinus</i>	11-17	27)	107
River carpsucker, <i>Carpionodes carpio</i>	13-17	39)	
Carp, <i>cyprinus carpio</i>	18-30	35	3
Golden shiner, <i>Notemigonus chrysoleucas</i>	5-7	17
Channel catfish, <i>Ictalurus punctatus</i>	9-17	79	271
Black bullhead, <i>Ameiurus melas</i>	7-11	3	11
Largemouth black bass, <i>Micropterus salmoides</i>	7-20	23	15
Bluegill, <i>Lepomis macrochirus</i>	3-7	118	30
Orangespot sunfish, <i>L. humilis</i>	2-5	5
Green sunfish, <i>L. cyanellus</i>	3-5	5
Black crappie, <i>Pomoxis nigromaculatis</i>	6-8	79)	325
White crappie, <i>Pomoxis annularis</i>	6-8	207)	
Yellow bass, <i>Morone interrupta</i>	3-8	291	125

*Most of these came to the surface October 2nd and 3rd.

were seen about 11:00 a.m. and no bullheads were seen until shortly after noon. A few bullheads with a little life were picked up on the next day, but there was no other sign that other fish survived that long. The kill was apparently complete for there has been no sign of fish life in the lake in the year since treatment except for the bass and minnows which have been stocked.

Although no study was made of the other aquatic life in the pond, it was noted that frogs, whirligig beetles, and backswimmers were still alive and appeared to be healthy 36 hours after the poisoning.

ESTIMATE OF POPULATION AND DISCUSSION

All fish which came to the surface or which could be seen lying on the bottom were collected and counted, except that no attempt was made to collect the minnows or other fish less than three inches long (Table 2).

It is probable that the actual population was considerably higher than the number of fish collected would indicate. Many of the fish probably settled to the bottom. On September 29, only 3 of the 5 buffalo marked prior to the rotenone treatment by clipping off the left pelvic fin were recovered and for the other species the numbers of the marked fish which were recovered were even smaller:

White crappie	2 of 95
Black crappie	1 of 23
Bluegill	2 of 22
Golden shiner	2 of 7
Largemouth black bass	
Quillback	0 of 4
Yellow bass	1 of 2

On the basis of the average size of the fish (Table 2) the weight of the fish actually collected was 5,559 pounds or 1,235 pounds per acre (Table 3). It is difficult to estimate how many additional pounds of fish sank to the bottom, but the known population is very high. In 22 artificial lakes in Illinois studied by George Bennett (1943) the average population was 446 pounds per acre. One oxbow lake with a poundage of 1,145 per acre was the only one that exceeded 800 pounds. The Ruth gravel pit population was a sustained population and not just a recent influx from a larger area. No connection with the river or other body of water has existed since 1944. It is of interest to note that largemouth black bass, bluegills, and yellow bass had spawned successfully in 1949, and also the previous year. There was no evidence of successful reproduction of the other species. The average weights of the carp and buffalo were slightly

Table III
 Estimate of the population in the Ruth Pond,
 Marshalltown, Iowa, September, 1949.

Species	Number picked up	Average weight in pounds	Total Poundage
Buffalo	1158	3.95	4574.10
Quillback and carpsucker	173	1.65	285.45
Carp	38	4.91	186.58
Channel catfish	350	0.74	259.00
Bullhead	14	0.75	10.50
Largemouth black bass	38	2.00	76.00
Bluegill	148	0.20	29.60
Crappies	611	0.15	91.65
Yellow bass	416	0.11	45.76
TOTAL			5558.64

below weights of carp and buffalo at the same length in the few other waters from which data are available (Carlander, 1950), but the fish did not appear noticeably emaciated or thin.

Less than 7 per cent of the poundage of fish in the lake was suitable as game or pan fish. The crappies and yellow bass were almost all less than 8 inches long and none of them weighed over a quarter of a pound. Most of the production was going to buffalo and other rough fish.

It was also noted that the lake cleared up almost immediately after poisoning. The next day, Mr. George Ruth stated that the water was clearer than it had been at any time since the river fish had gotten in. About a month after the rotenone treatment, 3 to 4 inch largemouth bass fingerlings were stocked and apparently thrived for they were about 8 inches long in mid-July the next year. Additional 10 inch bass were stocked early in June and apparently spawned successfully. In the summer of 1950 the pond was beautifully clear, with a moderate amount of submerged vegetation.

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