Proceedings of the Iowa Academy of Science

Volume 55 | Annual Issue Article 65

1948

# A Fish Population Study of an Artificial Lake

E. B. Speaker

# A Fish Population Study of an Artificial Lake

E. B. SPEAKER

Within the past fifteen years, eighteen artificial or man-made lakes have been constructed in Iowa to augment the fishing potentialities and general recreational facilities of the state. These little lakes range in size from twenty-five to some three-hundred surface acres. Most of them originally provided the citizenry with considerable fishing, but in recent years the anglers take in a few of them has fallen off sharply. Beeds Lake, a 130-acre impoundment in Franklin County, is a typical example. Constructed with federal assistance in the years 1934-1936, it was thought to be one of the outstanding lakes of its kind in the state. A limestone-masonry dam impounds a maximum of thirty feet of water, and nearly half of the area is shallow enough to suppport higher aquatic plants. Except for a limited number of limestone ridges, the bottom is covered with silt and sand loam. The source of water supply is surface drainage and a number of springs, and all of the immediate watershed is in pasture or park grounds. The entire land area is fenced to exclude livestock. A dyke, which previously formed the dam of an old mill pond, now divides the lake into two parts which will be referred to as the upper and lower sections.

The lake bed was cleared of all trees and shrubs before the water was impounded, and some *135* fish shelter and devices were constructed in the shallow areas. Portions of the shore line were riprapped with rock to prevent excessive wave erosion, and aquatic plants including potomagetons, *P. pectinatus* and *P. americanus,* soft stem bulrush *Scirpus validus,* arrowhead *Sagittaria latifolia* and others were planted in the littoral zone as the lake filled.

An attempt was made to remove all the fish in the watershed by seining the stream and its tiny tributaries with one-fourth and one-eighth inch mesh seines.

The upper section of the lake bed filled in 1935 but the gate in the main dam was not closed until 1936. The lake filled late that fall and was subsequently stocked with fish. The lake was closed to all fishing until June 15, 1939, when it was opened under the Iowa Artificial Lake law which permits anglers to take an aggregate of twelve fish of which not more than five may be bass or seven crappies.

A creel census taken for thirty days immediately following the opening of the lake (Aitken, ms.) attests to the good fishing existing there at that time.

## FISH STOCKING

The stocking program was designed to place emphasis on largemouth bass, crappies, bluegills and bullheads as these are among the most popular fish in the state. Crappies were stocked on the basis of 18.5 black to 1 white. A number of smallmouth bass and a few walleyes were added but, as expected, never produced any ap-

preciable amount of fishing. In later years a number of yellow perch were stocked experimentally but these never reached sufficient size or abundance to prove attractive to anglers. Forage fishes including fathead minnows *Pimephales p. promelas* (Agassiz) and golden shiners *Notemigonus crysoleucas auratus* (L.) were stocked to provide additional food. Prolific and abundant at first, they practically disappeared from the lake in later years. Carp and white suckers *Catostomus commersonnii commersonnii* (Lacepede) were never intentionally stocked in the lake, but either residual numbers were left in the stream before the water was impounded or they were stocked by well meaning sportsmen. A third possibility, of course, is the introduction through bait minnows, although virtually all of the minnows were inspected before anglers were permitted to use them.

Figure II represents the fishes stocked in the lake from 1935 through 1945. Fish stocked prior to 1937 were placed in the upper section of the lake which was later connected to the lower section.

## ANGLING

Precise creel census data are almost wholly lacking except for the first thirty days, but from fishermen's reports and observations of departmental employees, angling for the four major species held up until 1943. At this time the bass and bluegill population began to decline. Bullhead fishing was reportedly excellent in 1943, fair in 1944 and poor in 1945. Crappie fishing held up fairly well at all times, and it was virtually the only fish taken in the summer of 1946. Since only seven could be legally taken, it was quite simple to catch the limit.

In the early years after the water was impounded, heavy rains would cause the lake to become turbid for a brief interval but this condition interfered but little with the fishing. These short periods of turbidity seemed to have little or no effect on the aquatic plants, and they became so dense it was almost impossible to row a boat in the shallow areas. In 1943 the periods of turbidity lengthened, and by 1946 the lake remained murky all summer. Aquatic plants decreased in number until less than an acre remained at the time the lake was drained.

In the spring of 1946 test-netting (Rose, ms.) revealed the presence of a large population of carp. Bottom samples were taken late in August and only 0.1 to 0.4 cc. of bottom organisms were found per square foot. Forage minnows were practically extinct, some of the game fishes were either scarce or absent, and the fish population was composed almost entirely of adults. A meeting was held with the local people, and it was agreed that the only solution to the problem was to reduce the population of rough fish.

## DRAINAGE PROJECT

It was decided to remove the entire fish population for the purpose of eradicating the carp and restocking the lake with the proper balance of game fishes. The volume of the lake was computed by the

 

engineers to be 1,040 acre-feet or approximately 340,000,000 gal. Serious thought had been given to treating the lake with derris root, but because of the scarcity of the product and the fish removal difficulties, caused by the numerous fish shelters and devices in the lake bed, it appeared most expedient to drain the lake first.

The gate in the dam was opened to about four square feet on September 12, and by September 19 only a few small pools remained above the dam. The water was held at this level for some time to aid in the removal of the bulk of the fish.

Fortunately there was a dam in the outlet creek some two miles below the lake. The stream gradient was such that by closing the gate in the lake dam to catch the incoming flow of the stream, and by opening the gate in the dam below the lake, the stream could be practically drained. By manipulating the two control gates, the pool above the lower dam became a veritable catch basin, and nearly 79 per cent of all fishes except carp and suckers were removed in this area.

It was of interest to note that very few fish left the lake until the water above the lake dam was reduced to a mere pool. At this time the crappies, bluegills, and bass were the first to leave the lake. The carp, on the contrary, fought the current and worked their way upstream in the lake bed as far as possible. Because of this fact, about 83 per cent of the carp were taken above the dam.

## FISH REMOVAL

Four major methods were used to remove the fish from the lake: (1) seines, (2) traps, (3) electric shocking device and (4) cube root. H.T.H. bearing 70 per cent available chlorine was used, but none of the fish were killed by it.

A total of 42,833 pounds of fish, or 321 pounds per acre, were removed. Less than 0.7 per cent of the entire population was young of the year, and only a small percentage were in their second year of life, hence the bulk of the fish were mature.

During the periods of removal operations, intermittently from September 19 to October 22, the water temperature ranged from 49° to 54°F. The volume of water in the stream flowing through the lake bed was computed at seven to eight cubic feet per second except after one rain when it was temporarily increased to about twenty cubic feet per second.

As mentioned before, the first procedure was to lower the lake to a point where fish removal by nets and seines was practical. This accomplished, a trap net was set at Point C in the orifice between the upper and lower sections of the lake Figure III). As fish from the upper section dropped into the lower area they were trapped and removed. Approximately 8.2 per cent of the total fish population of the lake was removed at this point.

Linear seines with mesh size varying from ¼ inch to 1½ inch bar measure were used in the pool above the dam and in the operations in the stream and pool below the dam.

Nearly four to one carp were taken above the dam, and over three to one of the forage minnows, five to one of the crappies, suckers and perch, ten to one bass and bluegills and all of the other species were taken from the stream and pool below the dam. A total of 85.1 per cent of the entire fish population was taken by seines.

While the bulk of the fish had been removed with traps and seines, there were still considerable number remaining which had to be removed by other methods. Since derris root was not available, cube root was substituted in this optration. Use was made of an electric fish collecting or shocking device. This instrument was reported on several years ago (Hager, 1934) and (Haskel, 1939) but more recently improved and developed by Schneberger and O'Donnell of Wisconsin and others. The unit, used in this study, consisted of a 110-volt 500-watt portable generator equipped with two electrodes.

On October 2 the shocker was used from Point D to the old mill dyke at Point C. In the neighborhood of 1,650 pounds of fish, mostly carp, were taken. An additional ninety pounds of carp were taken from a small pool at Point C.

On October 11 the entire stream in the lake bed was treated (Moen, ms.) with cube root. Several small trap nets were stocked with fish and placed at strategic points in the stream to check the effectiveness of the treatment. Mixtures were made up on the basis of ten pounds of cube powder to thirty-five gallons of water. The first application was made at the extreme upper end of the lake at Point A. The mixture was added to the stream at the rate of 2.5 ppm. for fifty minutes. Immediately following this a second application was made below the silt dam at Point B. At this point the solution was added to the stream for fifty minutes at the rate of 3.2 ppm. A third treatment followed at the mill dyke at Point C for approximately twenty minutes at the rate of 8 ppm. About 1½ hours

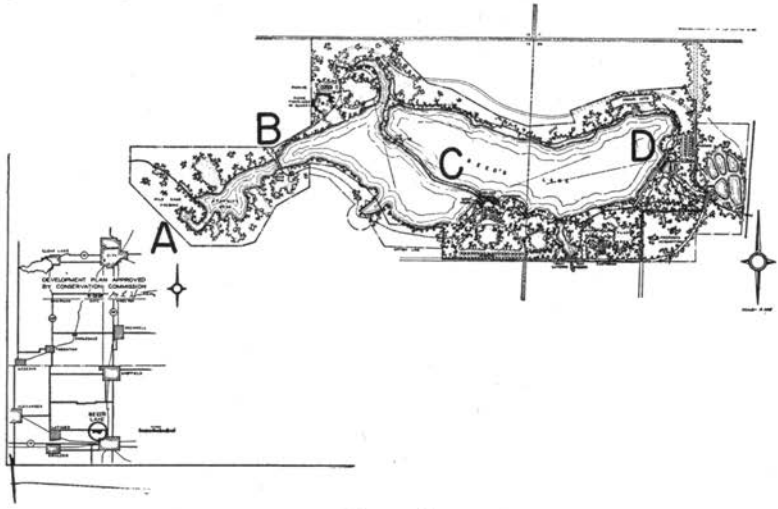


Figure I

later an additional sixty pounds of cube powder was added to the stream from the mill dyke to the main dam. Fish in the test traps and in the main stream in the upper part of the lake bed showed signs of distress but all survived the treatment. Three days later the gate in the dam was opened and the water drawn down. Approximately three-hundred pounds of carp, one-hundred and fifty pounds of crappies, and twenty-five pounds each of bluegills and suckers were found to have been killed in the pool of heavy cube root concentration immediately above the dam.

On October 16 the gate in the dam was again closed and the entire stream was treated (Moen, ms.) with H.T.H. bearing 70 per cent available chlorine. Fifty pounds of chlorine were added to the stream from Point A at the end of the lake to the main dam at the rate of about five pounds every thousand feet. A few small minnows succumbed to the treatment in the extreme upper reaches of the lake. Although other fishes seemed distressed at the time, they were all very much alive the next day.

On October 21 after the lake had been again drained, the shocker was used from the main dam to the silt dam at Point B. A total of 150 pounds of carp were taken in this operation. Only one fish was taken from Point D to the mill dyke at Point C, the area on which the shocker had been used previously. All fish were eliminated from the silt dam at Point B to the main dam except about one-hundred and fifty pounds of carp which remained in a pool near the mill pond dyke which was too deep and wide for effective operation of the type of shocker used. These fish were killed with a concentration of 8 ppm. of cube root.

A concentration of over 16 ppm. of cube root was then used from Point A at the extreme upper end of the lake to the silt dam at Point B. Approximately one-hundred and fifty pounds of carp, three suckers, and two stone cat were killed by this treatment. The silt dam was then cut and the water drained. The shocker was used through the area, followed by fine mesh nets and no fish of any kind were taken. For practical purposes it was assumed the entire fish population had been removed.

Figure III represents the fish taken by the various methods of removal.

## SUMMARY

In the eleven-year period, 1935 to 1946, a total of 938,216 fish were stocked in Beed's Lake. Thirty-six and 5/10 per cent were crappie, 31.9 per cent bluegill, 15.1 per cent bullheads, 13.4 per cent largemouth bass and 3.1 per cent all other species combined except forage minnows. In this interval an unknown quantity was harvested by anglers. In the fall of 1946, when the lake was drained, a total of 42,833 pounds of fish or 321 pounds per acre were removed. This population was made up of 70.7 per cent carp, 14.5 per cent crappie, 9.6 per cent suckers, 3.8 per cent bluegill, 0.8 per cent largemouth bass and 0.6 per cent of all other species.

The luxuriant growth of aquatic plants which covered nearly 40

per cent of the lake in 1943 was reduced to a few plants contained within an acre when the lake was drained.

The four major species of fish stocked, largemouth bass, crappie, bluegill and bullheads, comprised only 25.5 per cent of the poundage of fish removed from the lake. Carp were represented by 70.7 per cent of the total poundage and it is felt this excessive number was a primary factor in causing the turbidity of the water and subsequent disappearance of aquatic plants and food.

Food of all kinds was scarce to absent. Bottom organisms had been reduced to 0.2 cc. per square foot. The brush shelters were entirely devoid of food organisms although they were in remarkably good condition after eleven years of submersion. A few exertmely large fresh water mussles (*Anodonta grandis footina,* Lee and *Lasmigona complanta,* Barnes) and thick-shelled gastopods (tentatively identified as *Compeloma* Sp.) were found. Myriads of mollusk shells, however, were indicative of their former abundance. Numeruos holes in the earth were observed (Moen, ms.) along the banks and on the lake bottom presumably made by carp and suckers in quest of food.

Although approximately 85 per cent of the fish were removed with traps and seines, other treatment was necessary to insure complete removal. Chlorine, as used in the Beed's Lake project, was completely ineffective. Cube powder in concentrations of 8 ppm. or more was effective in the larger pools but was not lethal in concentrations up to 3.2 ppm. in fifty-minute applications in the flowing water of the stream. Small fish placed in test nets in the streams treated with cube powder appeared to be in distress during the treatment, but all recovered after the application. The electric shocking device used was ineffective in pools thirty to fifty feet wide and four to five feet deep, but was extremely effective in the stream in widths up to twelve or fifteen feet, and depths to two feet.

There was a decided shift in the fish fauna, and the species less tolerant to turbid water conditions gave way to the carp, white crappie and suckers. The absence of young of the year fishes, forage minnows and insectivorous foods was reflected in the emaciated condition of the crappie. Since it would have been virtually impossible to increase the poundage of the desirable fishes under conditions existing in the lake, the most expedient thing to do was to eliminate the entire population and start anew.

## ACKNOWLEDGEMENTS

Acknowledgements are made to O. J. Koch, C. L. King, Ernest Thune, Tom Moen, E. T. Rose, W. W. Aitken, Lloyd Bailey, E. A. Saxton, and the engineers of the Iowa State Conservation Commission for assistance in this work.

## LITERATURE CITED

Hager, Franz.
1934. Die Electrizitat in Dienste der Wildbachfisherei Osterreich Fishchereiwirtschaft, Nr. 7/ Juli/August, 1934, S. 1-5.
Haskel, David C.
1940. An electrical method of collecting fish. Transactions American Fisheries 1939, Volume 69, page 210-215.

FISH STOCKING — BEED'S LAKE
1945 — 1935
Figure II

| Species | 1935 | 1936 | 1937 | 1938 | 1939 | 1940 | 1941 | 1942 | 1943 | 1944 | 1945 | 1946 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lm. Bass | 18,000f | none | none | 31,086 | 8,200f | 24,000f | 27,000f | 230y<br>2,000f | 12,678f | none | 150y<br>1,957f | none |
| Sm. Bass | none | 250y | none | 6,875f | 4,250f | 1,000f | 10,000f | none | none | none | 1,508f | none |
| Bluegill | 14,000f | 500a<br>2,000y | 3,600a<br>2,000y<br>1,600f | 409a | 32,000f | 54,000f | 500a | 1,500a<br>20,000f | 90a<br>139,000f | 5,000f | 1,000y<br>21,893f | none |
| B. Crappie | 24,000f | 5,000f | 200a<br>10,000f | 259a<br>25,500f | 600y<br>29,600f | 35,000f | 75a<br>87,375f | 80a<br>8,000f | 16,660f | 9,000f | 75,000f | none |
| W. Crappie | none | none | none | 5,000f | 700f<br>11,000f | none | 1,050a | none | none | none | none | none |
| Bullheads<br>(Yellow & Bl) | none | 3,600a | 4,100a<br>7,300y<br>24,000f | 2,000a | 22,000a<br>10,400y | 34,550a | 4,863a<br>23,000f | 5,000a | none | 1,000a | none | none |
| Walleye | none | none | none | none | 1,128f | none | none | none | none | none | none | none |
| Y. Perch | none | none | none | none | none | none | none | 950y<br>2,300f | none | none | 300y | none |
| Minnows | none | none | 300,000a | 300,000a | 300,000a | none | 276,000a | 15,000a | none | 3,000a | none | none |
| Warmouth Bass | 800f | none | none | none | none | none | none | none | none | none | none | none |
| Total<br>(exclusive of forage fishes) | 56,800 | 11,350 | 52,800 | 71,129 | 119,878 | 148,550 | 153,863 | 40,060 | 168,418 | 18,000 | 101,808 | none |

FIGURE III

Fish removed by various methods
Beed's Lake—1946

| Species | Seines lbs. | Traps lbs. | Shocker lbs. | Cube root lbs. |
|---|---|---|---|---|
| Carp | 25,206 | 2,400 | 1,890 | 750 |
| Crappie | 5,757 | 315 | 3 | 150 |
| Suckers | 3,476 | 583 | 3 | 28 |
| Bluegill | 1,409 | 198 | 0 | 25 |
| Lm. Bass | 317 | 15 | 0 | 45 |
| Yellow Perch | 91 | 0 | 0 | 0 |
| Golden Shiner | 90 | 0 | 0 | 0 |
| Bullhead | 44 | 0 | 0 | 0 |
| Walleye | 30 | 0 | 0 | 0 |
| Sm. Bass | 5 | 0 | 0 | 0 |
| Warmouth Bass | 3 | 0 | 0 | 0 |
| Totals | 38,428 | 3,511 | 1,896 | 998 |

FIGURE IV

Species composition of Fishes
Beed's Lake—1946

| Species | Pounds | % of total weight |
|---|---|---|
| Carp | 30,246 | 70.7 |
| Crappie | 6,225 | 14.5 |
| Suckers | 4,090 | 9.6 |
| Bluegill | 1,632 | 3.8 |
| Lm. Bass | 377 | 0.8 |
| Yellow Perch | 91 | 0.6 |
| Golden Shiner | 90 | |
| Bullhead | 44 | |
| Walleye | 30 | |
| Sm. Bass | 5 | |
| Warmouth Bass | 3 | |
| Totals | 42,833 | 100% |