Fishes of Spicer Lake

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Introduction

In a previous publication (2) on the open water plankton and benthos of Spicer Lake, Indiana; the acquisition, general description and the management of Spicer Lake Nature Preserve were discussed. Also, the significance of the floating mat area of the lake and the apparent small population of fishes were suggested as important aspects for future research. This study pertains to the fish population.

Method

The fishes were collected primarily by double-cone plastic minnow traps. Each trap was secured in position by a weight on the bottom and marked by a float. Some traps were lined with the fine mesh screen in order to catch the young of the year. Seines and dip nets operated from a boat were also used. Fishes were observed in the upper 0.5 m of water adjacent to the floating mat and in open areas of the mat. Breeding pairs of mudminnows and young were seen in depressions in the wooded floodplain in early spring. Repeated attempts with rod and tackle produced no fish. The open water of Spicer Lake was always quiet even on very windy days. However, no fish was ever seen "breaking water" while feeding on surface dwelling organisms.

For quantitative data 8 to 12 double-cone traps were distributed equally around the lake adjacent to or in open areas of the inner edge of the floating mat. The Petersen estimate (Lincoln index) was used to determine the size of the population in 1980 (1). The distal, rounded edge of the anal fin was clipped for recapture identification. Some traps were baited with banana peel, peanut butter and commercial bait.

Total length measurements were recorded in the field. Additional individuals were preserved and returned to the laboratory for measurements and stomach analyses to obtain food consumption data.

Results and Discussions

The Central mudminnow, *Umbra limi* (Kirtland) and the golden shiner, *Notemigonus crysoleucas* (Mitchell) inhabited Spicer Lake. The distribution of these species were limited to the floating mat area except in early spring when the mudminnow reproduced in microhabitats in the red maple floodplain which surrounds the lake.

The mudminnow was the only species found in Spicer Lake in 1978 and 1979. Three winters, 1976-77, 1977-78 and 1978-79, with low mean temperatures coupled with record-breaking snow cover, 129.2, 172.0 and 101.3 total annual inches, respectively (9) perhaps resulted in a winter kill of other species. However, prior to this study the only records of fishes in Spicer Lake were the reports of fishermen and residents in the vicinity. They reported that several species of game fishes were taken from Spicer Lake in recent years. The mudminnow is tolerant to very low oxygen concentrations (3), consequently, a small population survived the previous severe winter conditions. Baiting the double-cone traps did not increase significantly the number of mudminnows caught.

In the spring of 1980 the golden shiner was taken in the minnow traps and

observed in the floating mat area of the lake. The drainage of Spicer Lake is via the Dowling Creek outlet to the northeast which joins the Galien River in Michigan which then empties into the Saint Joseph River. The high water in the spring of 1980 in the Dowling Creek drainage permitted easy access for the golden shiner to Spicer Lake. The golden shiner inhabits vegetated waters of small streams and swamps, has wide ecological tolerance to many environmental factors, and spawns by scattering adhesive eggs on vegetation (3, 8). Spicer Lake and the drainage system is a natural habitat for the golden shiner.

The complex vegetative floating mat in Spicer Lake provided both protection from predators as well as an abundance of prey for the adult, carnivorous mudminnows. The mudminnow predators were limited to some insect larvae, and as a minor food item in the diet, the green frog. *Rana clamitans malanota.*

The breeding behavior of the mudminnow involves a shift of the population from stream or lake water to floodplains. The stimuli to spawn include the formation of suitable microhabitats and a rise in the temperature of the water (6). Small depressions, microhabitats, in the floodplain around Spicer Lake supported large dipteran populations which are major food items for newly hatched mudminnows. In early spring of 1980 pairs of breeding mudminnows were common in the floodplain on the east side of Spicer Lake. However, the extensive maple forested floodplain around the lake would support a very large population of mudminnows during the breeding season.

Growth rings, annuli, are not formed in the scales of the mudminnow, thus age determinations are not feasible by a study of the scales. A study of otoliths is difficult and the results are inconclusive (5). However, an analysis of the length frequency has been used by numerous researchers (4, 5, 6, 10). In this study total length measurements were used because the homoceral tail minimizes possible error and the dark pigmented caudal region inhibits standard length determinations.

The mudminnows collected in Spicer Lake during this study ranged in total length from 12 to 140 mm. Smaller individuals were observed in the microhabitats in the floodplain during the breeding season. Young of the year travel from floodplain to the main body of water at total lengths ranging from 20 to 30 mm (5, 6, 7).

Sample collections of 200 individuals in late summer 1980 indicated 4 age groups when plotted in a histogram. The young of the year ranged in total length from 30 to 60 mm and the second year individuals from 60 to 80 mm. The numbers in each sample were represented about equally in these two age groups. A third group, three year, ranged from 80 to 95 mm. Less than 1.0% of the mudminnows collected obtained this age category. Those placed in the fourth year range, 110-140 mm, were represented by less than 0.05 percent.

The Petersen estimate (Lincoln index) with the margin of the anal fin clipped as a marker, resulted in populations estimates ranging from 8,000 to 12,000 mudminnows in Spicer Lake in late summer of 1980. These are perhaps very conservative estimates. However, the small total number and the distribution of individuals in the four age groups indicate that the severe winter conditions, 1976-79 perhaps reduced the total population of mudminnow in Spicer Lake. Future studies would be of interest to determine the possible growth of the mudminnow population.

The food habits of the mudminnow in Spicer Lake, as indicated by stomach

analyses were very similar to those studied in a small stream (6). The mudminnow was carnivorous, and size of food items was more important than the species of prey. Planktonic organisms, in particular cladocerans, were abundant in the stomachs of the young of the year mudminnows. Also, red mites and small annelids were common food items. Quantitative data on the size of the various invertebrate populations in the floating mat area were not established. However, the frequency of invertebrate taxa eaten by adult mudminnows was perhaps correlated directly to the abundance except for immature Odonata. Damselflies and dragonflies were extremely abundant in the floating mat area, however, few appeared in the stomach analyses. The most common prey were Diptera in the families Tendipedidae and Culicidae. Coleoptera, chiefly Dytiscidae, Hydrophilidae, Gyrinidae and Haliplidae were significant food items. Also, to a lesser extent, Hemiptera families were represented by Gerridae, Corixidae, Notonectidae and Belostomatidae. A few snails, leeches, mayflies and caddisflies were consumed by mudminnows.

The golden shiners taken in Spicer Lake in 1980 consist of three distinct size groups within a size range, standard length, from 39 to 88 mm. Fifty-one percent of the 91 individuals collected ranged in size from 39 to 56 mm; 36 percent 60 to 66 mm and 13 percent 71 to 88 mm. The golden shiner inhabited the same area of the lake as the mudminnow. No golden shiners nor mudminnows were collected from the open water in the central portion of the lake. The intestinal tract of golden shiners contained fine detritus.

Summary and Conclusions

The Central mudminnow, *Umbra limi*, was the only species of fish collected from Spicer Lake in 1978-79. Three severe winters may have destroyed populations of other species. *Notemigonus crysoleucas* entered the lake in 1980 via the Dowling Creek drainage system. The adults of both species of fishes inhabit the floating mat area and the mudminnow reproduced in the surrounding floodplain.

Based on total length measurements the mudminnow population consisted of four age groups with a total range in size from 12 to 140 mm. The present population was judged to be in the range of 8,000 to 12,000 by using the Petersen mark-capture estimate. Food and shelter in the extensive floating mat, a lack of predators, as well as an abundance of microhabitats for reproduction indicated that the Spicer Lake ecosystem could support a much larger population of mudminnows. The major food items of the young mudminnows were chiefly planktonic taxa; Cladocera was predominant. The adult consumed various invertebrate taxa in particular insects.

The golden shiner population consisted of three distinct size groups within a total range in size, standard length, from 39 to 88 mm. The intestinal tract of the golden shiner contained only fine detritus.

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