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FURTHER OBSERVATIONS UPON THE SPAWNING HABITS OF CENTRARCHID
FISHES IN DEEP LAKE, OAKLAND COUNTY, MICHIGAN - 1939

by
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Observations upon the spawning habits of Deep Lake centrarchids were begun in 1938 (Report no. 516), and were continued in 1939. This report will be preliminary in nature and definite conclusions will not be made until this work is completed.

The methods and equipment used in 1939 were essentially the same as those used in 1938, except for the following: 1. Dowling sticks, three and four feet in length, were used in place of marbles for marking all nests. This eliminated the difficulty encountered with the use of marbles, wherein the guarding males often removed or covered the marbles during nest building or fanning, which may have resulted, in some instances at least, in miscounting nests. 2. In 1938, it was found that small fish were continuously coming in to eat the fry from the nests from which fry were being collected. To eliminate this difficulty, circular screen wire bass fry traps were dropped over the nest before fry were collected. 3. Two

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maximum-minimum thermometers were used to obtain water temperatures at depths of three inches and five feet.

Observations were made upon the bluegill, common sunfish, rock bass and largemouth bass. The material contained in this report was collected between May 12 and August 15, 1939. Relevant observations made on the spawning activities of each of the species studied are as follows.

Largemouth bass.- The first observations on Deep Lake were made on May 12, at which time one nest was found with eggs. May 28 was the last day that spawning occurred (Table 1). A total of 23 nests were used by the bass. The nests occurred singly and were poorly defined. The majority of the bass preferred to deposit their eggs on dense masses of roots over a sand bottom (Table 2). The depth of water in which nests were found varied from 15 to 72 inches and averaged 26 inches (Table 3). The average diameter of the bass nests was 16 inches and varied from 6 to 24 inches. The number of fry averaged 6,832 for the three nests counted, and varied from 3,376 to 12,500 per nest (Table 4).

Rock bass.- Rock bass started to spawn on May 18 and continued until July 3, which was the last day that developing eggs were found in nests. Forty-nine rock bass nests were counted in Deep Lake. The nests occurred singly and were poorly defined. The majority of the nests contained roots over sand and/or gravel. The nests were located in water ranging in depth from six to 27 inches and the average depth was 16 inches. The average diameter of rock bass nests was 11 inches and varied from 6 to 18 inches.

Common sunfish.- Sunfish were found spawning from May 23 to July 24.

A total of 121 nests were counted in the lake. The nests occurred singly as a rule, but occasionally several nests were found together. The majority of the sunfish nests were well defined. Sunfish used all of the common bottom types either singly or in combination for their nests, but the majority of the nests contained roots over sand and/or gravel bottom. Nests were found in water that varied in depth from 10 to 54 inches, with the average being 24 inches. The diameter of the nests varied from 6 to 36 inches, with an average diameter of 19 inches. The number of fry in the 10 nests sampled averaged 5,990, and varied from 1,640 to 11,383 fry per nest.

Bluegill.- Bluegills spawned over a period of 68 days, from May 28 to August 3. A total of 621 nests were counted in the lake. The majority of the bluegills in Deep Lake nested in colonies (six out of the 621 nests were single). Over half of the nests were located on sand or gravel bottom, while the rest of the nests were found on muck bottom. Bluegill nests were found in water varying in depth from 12 to 56 inches, and averaging 24 inches. The average diameter of the nests was 19 inches, and varied from 12 to 30 inches. The number of fry per nest varied from 3,749 to 32,721 and averaged 16,155 for the nineteen nests counted.

Observations of the spawning activities of the four species studied are contrasted in Table 1. The pre-spawning period refers to that time when the nests were already under construction, or were already built, but eggs had not been deposited. The spawning period includes the interval from the first spawning observed, until the last eggs were deposited. The post-spawning period refers to the time when the last eggs and fry were on the nests until the male left the nest. Sometimes the male fish will hover over the nest for many days after all of the fry have left.

There is quite a variety of bottom materials found in Deep Lake (Table 2). All of the fish studied except the bluegill seem to prefer to spawn in weeds and roots with some combination of sand, gravel and muck. Bluegill nests were usually found in some combination of sand, gravel and muck. Sticks, leaves, shells, marl and clay were found in the bottoms of some of the nests used by each species.

The depth of water in which nests are found and the diameter of the nests of the fishes studied in Deep Lake are presented in Table 3. As all bluegill nests were oval, saucer-like depressions, two depth measurements were taken: one at the rim of the nest and one at the bottom of the nest. The diameter of the nests was taken to the nearest quarter of a foot.

The number of fry per nest varied considerably for each of the species studied (Table 4). Because of the small number of largemouth bass nests from which fry were secured, the results are probably not as representative as the averages obtained for the rock bass, common sunfish and bluegill nests.

In 1938, a great deal of trouble was experienced in collecting fry because small fish were continuously rushing in to eat the fry from the nests from which fry were being gathered. In 1939, a regular bass fry trap was dropped over a nest before fry were collected, and frequently one or more small fish were trapped in the screen. These fish were dipped out and preserved. The results of the stomach analyses on these fish are presented in Table 5. Many fry that were contained in the mouths of these fish were regurgitated as soon as the fish were preserved. These fry, plus those contained in the mouths and stomachs of the fish, were entirely whole, with very few exceptions. The number of fry that had been eaten ran as

high as 2,270 for one fish (a bluegill x green sunfish hybrid, 4.2 inches in length). Several of the fish taken had not eaten any fry. This may have happened because the fish were collected before they had a chance to feed. We have found that ten or twenty small fish can just about clean all of the fry from one nest in a few minutes.

The estimated number of fry produced in Deep Lake is presented in Table 6, and was obtained by multiplying the average number of fry per nest by the total number of nests counted. The number of fry per acre was obtained by dividing the total number of fry produced by the area of the lake (14.9 acres). In each case this figure is just an estimation because it is impossible to tell how many fry died of natural causes or how many were eaten. These figures merely show the tremendous number of fry produced in Deep Lake.

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Table 1

Spawning Habits of Deep Lake Fish - 1939

Species	Duration of spawning season	Character of nests	Nests of other species used	Action of guarding male when approached by observers
Largemouth bass	Pre-spawning period, May 11. Spawning period, May 12-May 28. Post-spawning period, May 28-June 5.	Inconspicuous Single nests	Rock bass Old common sunfish and bluegill nests sometimes used. Two nests were used by largemouth bass in 1938.	Would not stay on nest. Usually stay within 10 or 15 feet of nest, but did not drive away other fish.
Rock bass	Pre-spawning period, May 17. Spawning period, May 18-July 3. Post-spawning period, July 4-9.	Majority of nests inconspicuous. Single nests	Largemouth bass Common sunfish Bluegill Rock bass One nest was used by rock bass in 1938.	Majority stayed on nest. Drove other fish away.
Common sunfish	Pre-spawning period, May 20-22. Spawning period, May 23-July 24. Post-spawning period, July 25-30.	Majority of nests conspicuous. May nest in colonies, but majority single. Some may nest in bluegill colonies.	Rock bass Largemouth bass Bluegill Common sunfish Many nests were used in 1938.	Majority stay on nests. Drove other fish away.
Bluegill	Pre-spawning period, May 22-27. Spawning period, May 28-August 3. Post-spawning period, August 4-9.	Well defined nests. Usually in colonies of 3 or more. Occasionally nest singly.	Rock bass Largemouth bass Common sunfish Bluegill Some nests used by bluegills three times during one season.	Majority retreated to deeper water. Did not drive other fish away.

♣Spawning had started when first observations were made.

♣♣Six out of the 621 nests were single.

Table 2

Spawning Habits of Deep Lake Fish - 1939

Bottom Types Used for Nests by Various Species of Fish

Species	Total no. of nests in lake	*Sand	Sand and gravel	Sand, gravel roots	Sand and roots	Sand and green plants	Muck	Muck and roots	Muck and sand	Muck, sand, roots
Largemouth bass	23	1	2	4	13	2	..	1
Rock bass	49	1	7	14	24	2	..	1
Common sunfish	121	15	28	19	29	..	7	8	6	9
Bluegill	621		**270			..	290		61	

* Besides the above materials, all nests may have contained sticks, leaves, shells, marl or clay.

** Bluegill nests were considered as part of colony; therefore, bottom types were not given for each individual nest.

Table 3

Spawning Habits of Deep Lake Fish - 1939

Depth of Water in Which Nests Were Found, and Diameter of Nests

Species	Depth of water (inches)			Diameter of nests (inches)		
	Maximum	Average	Minimum	Maximum	Average	Minimum
Largemouth bass	72	26.35	15	24	16.09	6
Rock bass	27	16.43	6	18	11.02	6
Common sunfish	54	24.21	10	36	18.66	6
Bluegill	♣56x50	26.2x22.04	15x12	30	19.42	12

♣ First measurement given is from center of nest, the second measurement was taken at rim of nest.

Table 4

Fry Counts, Depth of Water and the Type of Bottom Materials
Used in Each Nest, Deep Lake, 1939.

Species	Nest no.	Date of collection	Number of fry	Depth of water (inches)	Diameter of nest (inches)	Type of bottom materials used in nest
Largemouth bass	1	May 24	12,502	18	12	Roots over sand
	2	May 29	3,576	15	12	Sand and roots
	3	May 29	4,421	18	12	Roots over sand
Rock bass	1	May 29	3,137	21	12	Roots, sand, gravel
	2	May 29	4,193	6	9	Roots over sand and gravel
	3	May 29	1,497	15	8	Sand and gravel
	4	May 30	809	15	12	Sand, few roots
	5	May 31	1,208	8	9	Sand, gravel and roots
	6	June 1	1,561	18	9	Roots, sand and gravel
	7	June 1	5,389	12	12	Sand, gravel and roots
	8	June 1	1,329	12	12	Roots over sand
	9	June 7	2,263	15	12	Sand, gravel and roots
	10	June 8	4,891	21	9	Sand, gravel and roots
	11	June 8	213	18	9	Sand, gravel and few roots
	12	June 13	1,195	12	12	Sand and roots
	13	June 13	2,108	18	12x16	Roots over sand and gravel
	14	June 20	2,027	18	6x10	Sand, gravel and roots
	15	June 22	2,411	24	1x6	Sand and roots
	16	June 22	1,173	18	6	Roots over sand
Common sunfish	1	June 5	11,383	24	18x30	Sand and gravel
	2	June 8	6,106	24x30	18	Sand
	3	June 13	5,515	30x32	15	Sand and roots
	4	June 21	8,535	24x30	18x21	Sand
	5	June 22	8,718	15	18	Sand and roots
	6	June 23	2,681	18	12	Sand, gravel and roots
	7	June 24	4,059	28x30	21	Sand and gravel
	8	June 27	1,640	16	12	Sand, Chara
	9	June 27	2,447	30	18	Sand, gravel and roots
	10	June 27	8,815	27	21	Sand and gravel
Bluegill	1	June 6	12,136	21x24	12	Sand and gravel
	2	June 6	3,749	20x23	16	Sand and gravel
	3	June 6	7,911	19x24	18	Sand and gravel
	4	June 12	32,010	25x29	18	Sand and gravel
	5	June 13	32,721	30x33	21	Sand and gravel
	6	June 13	11,904	24x26	12	Sand and gravel
	7	June 13	12,412	28x30	20	Sand and gravel
	8	June 14	5,524	24x27	16	Sand and gravel
	9	June 21	4,415	24x26	24	Gravel and sand
	10	June 23	22,929	27x30	18	Sand and gravel
	11	June 23	4,505	22x26	16	Sand and gravel
	12	June 24	9,347	24x27	18	Sand and gravel
	13	June 24	14,908	22x26	18	Sand and gravel
	14	June 24	18,551	24x26	16	Sand and gravel
	15	June 24	19,685	24x27	18	Sand and gravel
	16	June 25	17,987	27x30	18	Sand and gravel
	17	June 26	16,653	23x26	18	Sand and gravel
	18	June 26	28,939	15x20	24	Gravel and sand
	19	June 26	30,664	34x40	24	Sand and gravel

9 Fry counts for this nest include fry taken from stomachs of fish caught stealing fry from nest (see Table 5).

Table 5

Fry taken from mouths and stomachs of fish that were caught in screens placed over nests from which fry were collected, Deep Lake, 1939

Nest number	Date	Species of fish examined	Length of fish (mm.)		No. of fry in mouth	No. of fry in stomach	Total no. of fry
			Standard	Total			
Bluegill #9	June 21	Bluegill x common sunfish	59	75	456	None	456
Bluegill #9	June 21	*Bluegill x common sunfish	58	73	634	None	634
Bluegill #9	June 21	Bluegill	49	64	None	None	None
Bluegill #9	June 21	Largemouth bass	67	83	202	608	810
Bluegill #14	June 21	Bluegill x green sunfish	84	106	1,383	887	2,270
Bluegill #15	June 24	Bluegill	67	87	***1,116	26	1,146
Bluegill #15	June 24	Bluegill x common sunfish	77	98		4	
Bluegill #15	June 24	Bluegill x common sunfish	63	81		0	
Bluegill #16	June 25	Bluegill x common sunfish	67	87	271	53	324
Bluegill #16	June 25	Bluegill x common sunfish	83	105	190	223	413
Bluegill #18	June 26	Bluegill x common sunfish	86	111	1,192	714	1,906
Bluegill #19	June 26	Bluegill	84	107	None	None	None
Common sunfish #9	June 27	Bluegill x common sunfish	79	101	None	None	None

*Part of the fry in the mouth were regurgitated as soon as the fish were preserved.

**These fish were placed in separate bottles.

***Three fish were placed in one bottle; therefore, it was impossible to determine the number of fry each fish had regurgitated.

Table 6

Number of Nests in Lake, Number of Nests Examined, Number of Fry per Nest
and Estimated Number of Fry Produced in Deep Lake, 1939

Species	Number of nests in lake	Number of nests examined	Number of fry per nest			Estimated no. of fry produced in lake	Estimated production of fry per acre
			Maximum	Average	Minimum		
Largemouth bass	23	3	12,500	6,832	3,576	157,000	10,500
Rock bass	49	16	5,389	2,213	213	108,000	7,300
Common sunfish	121	10	11,383	5,990	1,640	725,000	48,600
Bluegill	621	19	32,721	16,155	3,749	10,032,000	673,300
Totals	814	48				11,022,000	739,700