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THE STANDARD LAKE FISH POPULATION

Standard Lake lies at the intersection of Otsego, Charlevoix and Cheboygan counties. According to a survey made by the CCC (in winter), this lake has an area of 32½ acres and a maximum depth of 31 feet. A survey party from the Institute (David C. Chandler, Walter Crowe, E. L. Cheatum) made a further examination of Standard Lake in the late summer in 1937. The party found the lake to have a marl bottom on the shoal and peat bottom in the deeper areas. Vegetation was common but not abundant. The water was alkaline and of moderate hardness. It was relatively clear (Secchi disc reading 14 feet). The water was moderately warm at all depths and was unstratified.

Standard Lake consists of two basins which are similar in size and more or less alike in general physical, chemical and biological conditions. The basins are only a few feet apart and are connected by a rather wide channel.

The fish in the southern basin (16 acres) were eradicated by the use of rotenone on September 6, 1937. The same party which made the survey earlier in the summer assisted in the poisoning. Guy Lincoln, District Supervisor of Fisheries Operations, provided much of the necessary equipment. Mr. William Gerred, cottage owner on the lake, also helped in the poisoning. This report is an analysis of the fish population taken from the southern basin.

The method of poisoning was similar to that employed in removing fish from several other lakes. It is reasonably certain that all fish were killed.

On the day of the poisoning a large random sample was taken. For several days the remaining fish were counted, the perch, rock bass and suckers by species and the forage fish collectively.

The collected specimens were preserved in a 10 per cent solution of formalin. In the laboratory they were measured in millimeters and weights were taken in grams on a Welch balance. Scale samples were taken from all perch and rock bass in the random sample and age determinations were made by use of a micro projector.

Random Sampling

When fish are taken by one method or another the question always arises regarding the extent to which the sample is representative of the population. In Standard Lake a relatively large sample of dead fish was collected and later the remaining fish were counted. In the sample the relative abundance of suckers, rock bass, perch and minnows was in the ratio of 1:13:117:308; for the entire population the ratio was 1:16:62:180. In each the ratio of perch to minnows was about 1:3. The ratio of suckers to rock bass was similar in each, but, in proportion, the sample contained fewer rock bass probably because these floated less readily than did the perch and minnows.

Total Fish Population

The south half of Standard Lake contained a total of 20,192 fish (1,262 per acre) provided all were poisoned and seen. These fish had a total weight of 348.7 pounds (21.8 pounds per acre). The fish in

Standard Lake weighed less per acre than those of any of the lakes which have been poisoned to date. For comparison see Table 3 of Report 452. The number, average weight and total weight for perch, rock bass, suckers and forage fish are recorded in Table 1.

Table 1

Number and weight of fish in Standard Lake (south basin). September 6, 1937.

Kind	Number	Average Weight (Grams)	Total Weight (Pounds)
Perch	4,827	13.8	146.4
Rock bass	1,233	19.8	53.9
Forage fish	14,054	2.0	62.9
Suckers	78	497.2	85.5
Total	20,192	...	348.7

Legal-sized Fish

Based on the random sample, the lake contained only 2.7 legal-sized game fish per acre (2.4 perch and 0.3 rock bass). The 16 acre lake contained 42 legal-sized game fish--less than two limit catches. The lake was fished very little if at all. Fishing would obviously have been almost useless.

Perch

The perch were relatively numerous but were of little value because of their small size and slow growth. Many of the specimens were extremely emaciated and would probably soon have died of starvation. It was difficult to determine the age of some of the fish because of partial resportion

of the scales, but all fish in the random sample were "aged" so that an estimate of the relative abundance of the different age groups could be made. Some scales may have been incorrectly read and the growth data (Table 2) should be regarded as a close approximation for the older fish rather than as exact. The scales were read by Dorothy Woodbury.

The first four age groups were all well represented in the population (see Table 2). Fish of the IV group (5 summers old) and older were relatively few. The perch had a reasonably good first year's growth but grew very little after that year. As in other perch populations studied, the females grew more rapidly than the males. Both sexes were about equally well represented. Relatively few of the fish had attained a weight of one ounce (28.35 grams).

The condition of the fish declined each year up to the IV group. A somewhat similar decline has been noted in other perch populations. Those fish which reached the IV group (5 summers old) were in relatively good condition but most of them apparently failed to attain that age. It seems probable that there was a relatively heavy mortality in Standard Lake at the end of the third year of life.

Rock Bass

Rock bass were represented in the count by 1,233 individuals. All except two of those present in the random sample (144 specimens) were studied in detail in the laboratory (see Table 3). The annuli on the scales of these fish are easily located and age determinations are very probably correct. The rock bass grew very slowly, having attained a length of less than six inches in six years (7 summers). The males grew slightly faster than the females, but apparently were the shorter lived. The condition of the fish was more or less uniform from year to year.

Table 2

Number of female and male perch in each age group and average length, weight and condition of fish in each group (random sample only).

	Age Group					
	0	I	II	III	IV	Over IV
Number:						
Female	160	223	123	105	18	3
Male	210	173	103	140	21	2
Total	370	396	226	245	39	5
Average standard length in mm.						
Females	63.5	98.2	110.9	114.1	123.2	148.7
Males	62.7	94.1	102.5	107.6	110.7	124.9
Average total length in inches:						
Females	3.0	4.6	5.2	5.4	5.8	6.9
Males	2.9	4.5	4.9	5.1	5.2	5.9
Average weight in grams						
Females	4.5	15.1	20.6	20.7	29.5	53.6
Males	4.3	14.3	17.3	18.6	22.3	35.7
Average condition (K)						
Females	...	1.61	1.50	1.39	1.55	1.63
Males	...	1.72	1.56	1.49	1.62	1.83

Table 3

Number of female and male rock bass in each age group and average length, weight and condition of fish in each group (random sample only).

	Age Group						
	0	I	II	III	IV	V	VI
Number:							
Sex not known	11	...	...	...	...	...	...
Females	...	9	12	22	31	2	1
Males	...	10	12	14	21	...	...
Total	11	19	23	36	52	2	1
Average standard length in mm.:							
Sex not known	32.0	...	...	...	...	...	...
Females	...	59.4	73.8	81.3	86.5	92.5	110.0
Males	...	59.2	75.4	88.0	93.3	...	...
Average total length in inches:							
Sex not known	1.6	...	...	...	...	...	...
Females	...	3.0	3.7	4.1	4.4	4.8	5.6
Males	...	3.0	3.8	4.4	4.7	...	...
Average weight in grams:							
Sex not known	1.5	...	...	...	...	...	...
Females	...	8.3	16.1	20.4	24.3	30.6	47.5
Males	...	8.3	17.0	26.2	32.0	...	...
Average condition (K):							
Sex not known	4.30	...	...	...	...	...	...
Females	...	3.90	3.95	3.73	3.73	3.36	3.57
Males	...	4.00	3.84	3.78	3.87	...	...

Suckers

The random sample included 11 suckers and 67 were counted along the shore. The 78 suckers were all of moderately large size, having an average weight of 497.2 grams or 1.1 pounds. No young suckers were noted. Whether the young had all been eaten or whether there was no natural reproduction could not be determined. Suckers were probably present for a number of years and it seems probably that some natural reproduction has occurred in the past or the species would have been absent. The suckers seen at the time of the poisoning were of no value as forage for the other fish.

Forage Fish

Seven species of forage fish were found in the lake. Only three of these were present in significant numbers.

The random sample included 3,361 forage fish (see Table 4) of which 89 per cent were blunt-nosed minnows. In addition to the sample 10,667 were counted. If the sample was representative, the following number of fish of each species was present:

Red-bellied dace	33
Fine-scaled dace	8
Iowa darter	33
Mud minnow	25
Golden shiner	351
Black-nosed shiner	1,077
Blunt-nosed minnow	12,500

These fish had an estimated total weight of 28,826 grams (64.36 pounds), or a weight per acre of about 4 pounds.

The golden shiners were almost all adults (average weight 10.7 grams), but in the blunt-nosed minnows various sizes were well represented. Both the perch and the golden shiners appear to live in the open waters, while blunt-nosed tend to be on the shoals. It seems possible that the perch

Table 4

Species, number and weight of forage fish in Standard Lake (random sample only).

Species	Number	Average Weight (Grams)	Per Cent of Total
Red-bellied dace	8	1.5	trace
Fine-scaled dace	2	5.0	"
Iowa darter	8	0.9	"
Mud minnow	6	5.2	"
Golden shiner	84	10.7	2
Black-nosed shiner	258	2.3	8
Blunt-nosed minnow	2,995	1.8	89

had consumed most of the young golden shiners, but that they had eaten relatively few young blunt-nosed minnows. In Howe Lake the blunt-nosed were chiefly adults and it is probable that the bass had consumed most of the young. Bass were obviously foraging on the shoal to a considerable extent (in Howe Lake).

The limited observations mentioned above suggest an important point in relation to stocking forage fish--a point which might well be more thoroughly investigated: It is possible that fish will die of starvation before leaving their customary habitat to obtain food, i.e. open-water fish will possibly not forage on the shoal to any great extent even if food isavailable there and is scarce in the open water.

Do shoal inhabiting forage fish serve as food to any great extent for fish ordinarily living in open water and do open-water forage fish serve appreciably as food for fish normally feeding on the shoal? The value of stocking forage fish in general in nothern waters has been questioned (Report 452). If the planting of forage fish should prove desirable, much effort might possibly be wasted in stocking them unless a forage fish is selected which occupies the same habitat as the fish which is to feed on it. Very limited evidence suggests that of the two best known forage fish, the blunt-nosed might best be planted for bass and the golden shiner for perch--in lakes having both shoal and open water. The whole forage fish problem is seriously in need of further study; the theories suggested above are by no means proven.

Further Study of the Standard Lake Fish

Standard Lake is unique in that it has two similar basins almost completely separated. It seems exceptionally well suited for certain types of study. It is planned that this lake will be poisoned locally or entirely

(both basins) within the next year to note primarily the difference in growth as a result of removal of about half the fish. If the stunted fish will grow rapidly as a result of a decrease in number (more food for the remaining fish) a partial removal of the fish in other overpopulated lakes might be desirable. From limited experiments it is believed that nest building fish can be rather easily controlled by destruction of some of the spawning beds. Whether or not perch spawn could be collected practicably in adequate quantity to control the numbers of perch is not known. The Standard Lake study might indicate ways of managing lakes which now provide little or no angling because of an over-abundance of fish.

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