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ANALYSIS OF THE GAME-FISH CATCH IN A MICHIGAN LAKE--SECOND SEASON

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Last year the writer discussed the fishing for a one year period on Fife Lake, Michigan. Since that time another year's census on this lake has been concluded and comparative data for fishing during the two seasons are now available. The census was again taken by a crew of specially selected men from the Fife Lake C.C.C. camp under Foreman Erwin Moody's direction and was similar to the census of the previous year; details of taking the census are therefore omitted in this discussion. Only summer fishing, extending from June 25th to September 30th and winter fishing for the period the lake was ice-covered are here considered. It is assumed that all fishermen were seen in summer except a few (less than 5%) who fished at night. Of those who were seen all except 91 were contacted. Records for these 91 fishermen are not included below except in the final table where the fishing of those not contacted is regarded as having been average in every respect. All fishermen were seen and contacted in winter.

Blanks used for recording the data were similar to those used the previous year except that the items "heavy wind", "light wind", and "calm" were added under weather.

Summer fishing (1935)

Data for the summer fishing are summarized briefly below. Tables and graphs have, for the most part, been omitted.

Number of fishermen.--Census returns were obtained for a total of 3,594 fisherman-days, 2,831 for men, and 763 for women. A daily average of 36.7 persons fished the lake for the 98 day period.

Number of fish, catch per hour, fish per fishermen, and average size of all fish.--The 3,594 fisherman-days yielded a total of 11,375 fish having an average length of 8.1 inches, caught at the rate of 1.27 fish per hour. The fishermen averaged 3.2 fish per day's fishing (2.5 hours per fishing day). The catch per hour varied from 2.2 the first week to 0.7 late in the season.

Analysis of the catch by species (see Table 1).--The number of fish of each species caught, their average size, and the catch per hour of each species are shown in Table 1. There was considerable fluctuation in average size and in catch per hour from week to week for each of the various species, but the fluctuation was ordinarily not uniform. Most species were taken most readily the first week of the season. Fishing for bluegills and sunfish was best in mid-season. The catch included 782 smallmouthed bass, having an average length of 13.1 inches and taken at the rate of one fish per 11 hours of fishing; 470 largemouthed bass, having an average length of 13.6 inches and taken at the rate of one fish per 20 hours of fishing; 3,696 bluegills, average size 7.0 inches and caught at the rate of approximately one fish per 2 1/2 hours of fishing; 1,418 sunfish, average size 6.7 inches, caught at the rate of one fish per 6 hours of fishing; 2,384 rock bass, average size 7.5 inches and taken one every 4 hours; 2,340 perch, average size 7.3 inches long and taken at the same rate as the rock bass; also 154 walleyes, 53 northern pike, 72 bullheads, and 6 black crappies. The four large game species represented 12.8% of the entire catch.

TABLE 1. ANALYSIS OF THE CATCH. FIFE LAKE, SUMMER OF 1935*

Date Period	Smallmouth bass			Largemouth bass			Bluegill			Sunfish		
	No. Taken	Ave. size	Per hr.	No. taken	Ave. size	Per hr.	No. taken	Ave. size	Per hr.	No. taken	Ave. size	Per hr.
June 25-30	83	13.5	.12	90	13.9	.13	190	7.5	.26	128	7.2	.18
July 1-7	52	13.4	.05	37	14.4	.03	207	6.8	.18	136	6.8	.12
July 8-14	91	13.3	.09	82	13.0	.08	325	6.9	.31	63	6.7	.06
July 15-21	67	12.6	.09	42	13.1	.06	341	6.7	.46	122	6.4	.17
July 22-28	29	11.6	.05	32	12.6	.05	410	7.1	.64	85	6.5	.13
July 29-Aug. 4	47	11.6	.07	22	13.1	.03	396	7.0	.58	183	6.6	.27
Aug. 5-11	80	13.8	.07	49	13.6	.05	647	7.1	.60	258	6.5	.24
Aug. 12-18	135	13.3	.14	41	14.4	.04	468	7.0	.49	168	6.9	.18
Aug. 19-25	96	14.0	.09	27	13.2	.02	428	6.9	.39	174	6.6	.16
Aug. 26-Sept. 1	58	12.6	.14	24	14.2	.06	169	7.3	.40	31	6.8	.07
Sept. 2-8	9	11.9	.05	2	13.0	.01	95	6.8	.53	39	6.5	.22
Sept. 9-15	16	14.6	.15	8	15.2	.07	4	6.8	.04	17	7.1	.16
Sept. 16-22	17	12.0	.12	9	14.2	.06	10	7.9	.07	13	6.8	.09
Sept. 23-30	2	14.0	.05	5	14.0	.12	6	7.5	.14	1	9.0	.02
Total or Average	782	13.1	.09	470	13.6	.05	3696	7.0	.41	1418	6.7	.16

Date Period	Rock bass			Perch			Walleye			Northern pike		Bullhead	
	No. taken	Ave. size	Per hr.	No. taken	Ave. size	Per hr.	No. taken	Ave. size	Per hr.	No. taken	Ave. size	No. taken	Ave. size
June 25-30	618	8.1	.76	442	7.7	.62	16	19.6	.02	5	24.0	19	10.2
July 1-7	308	7.6	.27	402	7.1	.35	11	23.8	.01	4	24.3	8	9.9
July 8-14	298	7.2	.29	260	7.2	.25	15	22.5	.01	1	20.0	20	8.3
July 15-21	159	7.5	.22	100	7.0	.14	15	19.1	.02	1	24.0	0	0
July 22-28	177	7.2	.28	52	7.0	.08	28	21.3	.04	2	18.5	2	10.0
July 29-Aug. 4	174	6.9	.26	103	7.2	.15	32	22.3	.05	5	22.8	3	12.7
Aug. 5-11	223	6.9	.21	241	7.1	.22	21	21.3	.02	8	22.1	8	10.1
Aug. 12-18	135	7.6	.14	313	7.1	.33	7	19.9	.01	7	23.0	6	12.2
Aug. 19-25	166	7.3	.15	190	7.3	.17	1	25.0	tr.	4	20.0	4	10.0
Aug. 26-Sept. 1	46	7.6	.11	148	7.4	.35	5	18.8	.01	1	17.0	2	11.5
Sept. 2-8	18	7.3	.10	22	6.8	.12	1	26.0	.01	2	21.5	..	...
Sept. 8-15	6	8.3	.06	22	8.2	.21	..	...	...	5	23.4	..	...
Sept. 16-22	39	7.8	.23	14	7.4	.10	..	...	...	6	16.5	..	...
Sept. 23-30	17	9.1	.40	31	7.5	.72	2	16.0	.05	2	16.5	..	...
Total or Average	2384	7.5	.27	2340	7.3	.26	154	21.3	.02	53	21.5	72	10.0

* Black crappies were also taken. They constituted an insignificant portion of the total catch.

Methods of fishing and kinds of bait used (see Tables 2 and 3).--Approximately 95% of the fishermen used only one method in their day's fishing. Of the records indicating only one method 69% were for still fishing, 23% were for trolling, and 8% for casting. The method which yielded the most fish also yielded the smallest; the method which produced the fewest fish also produced, by a narrow margin, the largest.

Worms were used as bait more extensively than all other baits combined. They took the most fish per hour, also the smallest fish. Minnows, plugs, spinners, artificial flies and minnows were also used. The number of fish taken per hour by different types of baits was inversely proportional to the average size of fish taken.

TABLE 2. GENERAL DATA ON METHODS OF FISHING, FIFE LAKE, SUMMER OF 1935

Method	Repts. covering each method*		Fish taken by each method	Fish per day's fishing	Fish per hour	Ave. length of fish inches	Repts. indicating no fish caught	
	No.	%					No.	%
Trolling	770	23	1095	1.4	0.6	11.2	383	50
Casting	281	8	339	1.2	0.5	11.3	170	60
Still-fishing	2346	69	9558	4.1	1.6	7.6	733	31

* This computation does not include those records indicating the use of several methods of fishing in one day or not indicating which method was used.

TABLE 3. GENERAL DATA ON EFFECTIVENESS OF VARIOUS KINDS OF BAIT USED, FIFE LAKE, SUMMER OF 1935*

Bait used	No. of records	% getting no fish	Hrs. per fishing day	Catch per hour	No. of fish taken	Ave. size of all fish (in.)
Artificial:						
Spinner	137	52	2.3	0.5	169	11.2
Plug	412	62	2.4	0.4	352	12.7
Art. fly	25	36	1.9	1.1	53	9.4
Natural:						
Minnows	701	34	2.6	1.2	2067	8.9
Worms	1747	28	2.6	1.7	7467	7.4
Insects	14	14	3.3	1.6	77	8.4

* Not including those records for which no bait was listed or records indicating use of several baits in one fishing day.

Largemouthed bass were most successfully fished for with plugs; smallmouthed bass and perch with minnows; rock bass, sunfish and bluegills with worms; walleyes with spinner; and northern pike equally well with spinner and with minnows. Data for only the four most used baits (worms, minnows, spinners, and plugs) were utilized in making these determinations.

Relation between fishing and weather (see Table 4).--The records indicated three sets of weather conditions, with reference to clearness (clear, cloudy, rain), roughness (heavy wind, light wind, calm), and temperature (cold, mild, warm). One item in each category was checked. A large number of combinations of the nine weather conditions are possible, but data were compiled only for each condition irrespective of the others. Fish, in general, were best caught when the weather was mild, when there was a light wind and when the sky was clear. Whether fishing was best on a mild, clear day with light wind is not known since the combination of three factors may not necessarily produce good fishing even though each factor

may be best when not considered in combination with the others.

The weather conditions under which each species bit best were:

Largemouthed Bass: Mild, light wind, rain.

Smallmouthed Bass: Cold, little preference with respect to wind and cloudiness.

Rock Bass: Mild, calm, clear. Bit very poorly in cold weather.

Bluegill: Mild, windy, clear. Bit least in rainy weather.

Sunfish: Warm, light wind, clear. Bit least in cold weather.

Perch: Mild, light wind, rain. Poorest when cold and when calm.

Walleyes: Mild or warm, calm, clear.

Northern Pike: Cold. Number taken were too few to show other preferences.

Bullhead: No apparent preferences. Number too few to permit comparison.

It should be understood that the estimates of temperature are with respect to summer temperature, a "cold" day is not cold in comparison with winter or annual temperature.

A comparison of water temperature and fish catch and a study of Table 4 suggests certain interesting correlations. If adequate data were available for each species, they would probably show that species characteristic of young or "middle aged" lakes such as pike, walleyes and smallmouthed bass were ~~not~~ most readily taken when the weather was cool while fish characteristic of old lakes, e. g. bluegills, sunfish and largemouthed bass, were caught most when the weather was quite warm.

TABLE 4. NUMBER OF FISHERMEN, CATCH PER HOUR FOR ALL FISH AND FOR EACH SPECIES, UNDER VARIOUS WEATHER CONDITIONS, FIFE LAKE, SUMMER OF 1935

Weather	No. of fishermen	Total no. of fish taken	Hours fished	Catch per hour, all fish	Catch per hour								
					Largemouthed Bass	Smallmouthed Bass	Rock Bass	Bluegill	Sunfish	Perch	Walleye	Northern Pike	Bullhead
Cold	68	156	174 1/4	.90	.04	.12	.08	.38	.09	.17	tr.	.04	.01
Mild	2008	6753	4756 3/4	1.42	.07	.09	.33	.44	.16	.30	.02	.01	.01
Warm	1468	4293	3912	1.10	.04	.08	.20	.38	.17	.21	.02	.02	tr.
Heavy Wind[1]	635	1038	886 3/4	1.17	.04	.09	.20	.48	.14	.19	.01	.01	.01
Light Wind	1962	5954	4896	1.22	.05	.08	.20	.44	.17	.25	.01	.01	.01
Calm	848	2293	2104 1/2	1.09	.04	.09	.23	.39	.14	.17	.03	.01	tr.
Clear	1929	6354	4897 1/2	1.30	.05	.08	.27	.44	.17	.25	.02	.01	.01
Cloudy	1477	4434	3647 1/4	1.22	.05	.09	.25	.38	.15	.27	.01	.01	.01
Rain	156	415	363 1/4	1.14	.07	.09	.25	.29	.10	.29	.01	.01	.01
Catch per hour for entire season irrespective of weather					.05	.09	.27	.41	.16	.26	.02	.01	.01

[1] Data on roughness were not recorded early in the season.

Comparison of males and females as fishermen.--It was determined in the previous paper that fewer women than men took no fish. The data were analyzed in greater detail for the 1935 fishing. It was found that for three of the 14 weeks men took more fish, in proportion, than women, for two weeks both took equal numbers, on all other weeks the women caught more fish per hour than men. For the entire season the catch was 1.4 fish per hour for women and 1.2 fish per hour for men. The women fished for a slightly shorter average period than the men (2.3 and 2.5 hours respectively) but nevertheless caught more fish per fishing day. A comparison of these data with data for the general Michigan creel census indicates that Fife Lake is unusual in this respect. In general, women do not catch as many fish as men.

With the exception of the last two weeks, when few people fished, the males invariably caught fish of a larger average size. It is probable that women primarily still-fished with worms while a greater proportion of men used other methods or other baits which produced fewer but larger fish. The average size of fish caught by males and females was 8.3 and 7.5 inches respectively.

Comparison of residents and non-residents.--Of the 3,594 records, 1,249 or approximately 35% were for non-residents. The list of states and number from each state are:

Ohio - 596	Pennsylvania - 44
Indiana - 318	Minnesota - 3
Illinois - 229	Maryland - 2
Kentucky - 56	Iowa - 1

It will be noted that most of the non-residents were from three states, Ohio, Indiana and Illinois, with Ohio contributing approximately one-half of the entire number.

Residents from a large number of communities fished the lake. By approximate air-line distance the number represented in each 25 mile "zone" are as follows:

Distance from Fife Lake (Air-line)	Number of records
0 - 25 miles	1117
25 - 50 "	9
50 - 75 "	6
75 - 100 "	12
100 - 125 "	89
125 - 150 "	182
150 - 175 "	122
175 - 200 "	795
200 - 225 "	2
No answer	2
Not determined	9

It is interesting to note that with few exceptions the fishermen either were local or were from 100 or more miles away. Of the large number in the 175 - 200 mile zone, 704 were from Detroit. Including the non-residents, over half of the fishing on Fife Lake was by persons living over 175 miles by air-line (probably over 200 miles by road) from the lake.

The catch per hour and average size of fish caught were almost identical for residents and non-residents, the residents having a very slight advantage in both. Non-residents took approximately a third of the fish.

COMPARISON OF FISHING - SUMMERS OF 1934 AND 1935

There were some rather marked differences in the fishing for the two seasons, expecially in the composition of the catch. Whether or not changes in the catch reflect changes in the fish population is not known but some relationship probably exists between the two. A comparison of some of the factors is made below:

Number of fishermen.--Including the fishermen seen but not contacted, a total of 2,580 fisherman-days are recorded for 1934; 3,685 for 1935, an increase of 43% in 1935 over the previous season. This change is probably largely attributable to an increase in the number of resorters and tourists as a result of improved financial conditions. In 1934 women accounted for 23.5% of the fishing; in 1935, 21.2% of the records were for women.

Hours fished and catch per hour.--Records show a total of 6,187 3/4 hours of fishing in 1934 and a total of 8,971 1/2 hours in 1935. The total catch was somewhat larger in 1935, consisting of 11,375 fish as compared with 10,656 in 1934. The actual catch was almost identical for the 2 years since a greater percentage of fishermen was not contacted the first summer (see Table 5). The difference in total catch was not nearly so great, in proportion, as the difference in number of fishermen and number of hours fished. The total crop was slightly larger in 1935 but the catch per fisherman and catch per hour were lower during that season. The catch per hour in 1934 was 1.72, in 1935 1.27, a decrease of approximately 35% over 1934.

An increase of 43% in fishing accounted for an increase of less than 2% in the total crop removed (including data for fishermen seen but not contacted.) If only a very small per cent of the total fish population were caught annually, it might be anticipated that twice the number of fishermen would take, approximately, twice the number of fish. The fact that a very considerable increase in fishing failed to produce an appreciable increase in the total number of fish taken, suggests the possibility that the lake is being fished to capacity, that the annual crop is large compared with the total population of fish. This is further suggested by the fact that the 1935 caught fish averaged smaller than the 1934 fish (8.1 inches and 8.33 inches, respectively).

Comparison of the catch by species.--Differences in the fish catch of the two seasons were relatively great. They may be noted by a comparison of the figures given below:

Total number of fish taken

	1934	1935
Smallmouthed Bass	992	782
Largemouthed Bass	294	470
Bluegill	1970	3696
Sunfish	1016	1418
Rock Bass	2129	2384
Perch	3755	2340
Walleye	119	154
Northern Pike	48	53
Bullhead	303	72

The total number of bass each year was almost the same but the number of smallmouthed bass declined decidedly in 1935, while the number of largemouthed bass increased decidedly. The number of bluegills almost doubled while the sunfish and rock bass each increased considerably. The Perch catch dropped decidedly in 1935. The total catch of the four species of pan fish combined increased somewhat in 1935 (8,872 in 1934, 9,838 in 1935). In both the bass and the pan fish, there is some evidence in support of the contention that as one species declines another (competing species) increases. The proportion of the four large predator species combined was almost identical for the two seasons. It may be, of course, that these changes in the catch are not in proportion to changes in the actual fish population. Walleyes and northern pike both increased in the catch, but these two species were not taken in abundance either year. The decided change in the figures for bullheads may be of very little significance. Since most bullheads are apparently caught after dark, the catch is dependent on the amount of night fishing for bullheads and the figures are dependent also on the amount of night fishing covered by the census.

Average size of fish taken:

	1934	1935
Smallmouthed Bass	12.25	13.1
Largemouthed Bass	13.5	13.6
Bluegill	7.2	7.0
Sunfish	6.8	6.7
Rock Bass	7.9	7.5
Perch	7.4	7.3
Walleyes	20.1	21.3
Northern Pike	21.8	21.5
Bullheads	10.5	10.0

In general, the average size for each species did not vary much. The smallmouthed bass and walleyes both increased considerably, while pan fish decreased slightly in size. The catch per hour dropped for the fish as a whole; increases and decreases in the per hour catch were, naturally, in proportion to increases and decreases in the total catch.

Methods and baits.--There was considerable variation in effectiveness of the different methods and baits and in the number using them, but the two seasons agreed

perfectly in one important respect: in both years the method or bait taking the largest fish took also the fewest per hour and was the least likely to take any fish at all; the reverse was true for the method or bait taking the smallest fish, and similar relationships invariably applied for methods and baits taking fish of intermediate size.

Each year most fishermen still-fished, but trolling and casting increased decidedly in 1935 as compared with 1934. Trolling and casting produced relatively similar results each year in catch per hour, but in 1934 trolling produced the fewest and largest, while in 1935 casting replaced trolling in these respects. The catch per fishing day for trolling and casting was better in 1935 than in 1934, while the catch for still-fishing and for fishing in general declined.

The use of artificial bait increased decidedly in 1935 as did the use of worms, but minnows were used less extensively in 1935 than in 1934, this despite an almost 50% increase in the fishing. Artificial flies and insects, while relatively effective in taking fish were used by very few fishermen. For comparison the number of records, catch per hour and average size of fish for each bait are shown:

	Number of records		Catch per hour		Average length	
	1934	1935	1934	1935	1934	1935
Spinner	102	137	0.9	0.5	12.5	11.2
Plug	75	412	0.5	0.4	14.5	12.7
Art. fly	10	25	2.3	1.1	8.2	9.4
Minnows	857	701	1.9	1.2	8.4	8.9
Worms	832	1747	1.9	1.7	7.8	7.4
Insects	27	14	1.7	1.6	9.3	8.4

The effectiveness of the various baits in taking fish differed relatively little with relation to each other; all were less effective in taking fish in 1935 than in 1934. Of the four most used baits, worms were most effective both years in taking perch and smallmouthed bass. Walleyes were best taken on spinners each year. Largemouthed bass were best taken on plugs in 1935, on spinners in 1934. Northern pike were largely caught on spinners in 1934 and equally well on spinners and worms in 1935.

TABLE 5. COMPARISON OF ALL FISHING, FIFE LAKE, SUMMERS OF 1934 and 1935*

	1934		1935	
	Total Fishing	Per Acre	Total Fishing	Per Acre
Hours fished	6,676.25	8.3	9,199	11.5
No. of fisherman-days	2,580	3.2	3,685	4.7
Hours per fisherman-day	2.6	...	2.5	...
Number of fish	11,460	14.3	11,666	14.6
Fish per fisherman-day	4.4	...	3.2	...
Fish per hour	1.72	...	1.27	...
Average size of all fish	8.33	...	8.1	...
Perch				
Number	~~4040~~ 4038	5.1	2399	3.0
Perch per hour	.61	...	0.26	...
Average size	7.4	...	7.3	...
Rock Bass				
Number	2289	2.9	2445	3.1
Rock Bass per hour	0.34	...	0.27	...
Average size	7.9	...	7.5	...
Bluegill				
Number	2118	2.6	3789	4.7
Bluegills per hour	0.32	...	0.41	...
Average size	7.2	...	7.0	...
Smallmouthed Bass				
Number	1066	1.3	802	1.0
Smallmouthed Bass per hour	0.16	...	0.09	...
Average size	12.25	...	13.1	...
Sunfish				
Number	1092	1.4	1465	1.8
Sunfish per hour	0.16	...	0.16	...
Average size	6.8	...	6.7	...
Largemouthed Bass				
Number	316	0.4	481	0.6
Largemouthed Bass per hour	0.04	...	0.05	...
Average size	13.5	...	13.6	...
Bullhead				
Number	326	0.4	73	0.1
Average size	10.5	...	10.0	...
Northern Pike				
Number	52	...	53	...
Average size	21.8	...	21.6	...
Walleye				
Number	128	0.15	158	0.2
Average size	20.1	...	21.3	...
Sucker				
Number	10	...	...	...
Black Crappie				
Number	16	...	6	...

* Including data for fishermen seen but not contacted. It is assumed in this table that fishing by those seen but not contacted was average in every respect.

In Table 5 certain summary data for the two seasons are listed for comparison. This table includes data for the fishermen seen but not contacted as well as for those whose records are available. It is assumed in this table that the fishing of those not contacted was average in every respect.

WINTER FISHING (WINTER OF '35 - '36)

Winter fishing extended from December 1, 1935 to April 30, 1936. During this 5 month period 191 fishermen fished the lake for a total of 1,002 3/4 hours. The fishing yielded a total of 136 fish taken at the rate of about 0.14 fish per hour. The fish had an average length of 12.0 inches; the catch included 94 perch of an average size of 7.0 inches, 40 northern pike averaging 24.0 inches long and 2 six-inch bluegills. Fife Lake produced, for the winter period about one fish per 6 acres.

Comparative data for the two winter seasons are given below. It will be noted that the catch per hour was almost identical for the two seasons; fishing was only about half as intensive during the 1935-'36 season however, as during the 1933-'34 season. Perch increased, in proportion, in the catch while northern pike decreased. It may be safely concluded that the winter catch was too meager to deleteriously effect the subsequent summer fishing.

TABLE 6. COMPARISON OF WINTER FISHING, WINTERS OF '33-'34 AND '35-36

	1933-'34	1935-'36
Hours fished	2,098.25	1,002.75
No. of fisherman-days	467	191
No. of fish	286	136
Fish per hour	0.13	0.14
Average size of all fish (inches)	16.9	12.0
Perch		
Number	133	94
Average size	9.0	7.0
Northern Pike		
Number	116	40
Average size	25.4	24.0

A few bullheads, walleyes, suckers and shiners were also taken in 1933-'34, two bluegills were taken in 1935-'36.

GENERAL DISCUSSION

Factors limiting the production have not yet been determined. Fife Lake contains extensive shoal area, extensive vegetation, and apparently a relative abundance of food. It appears that the lake should produce several times the number of fish per acre shown by the census. A biological, chemical and physical survey of the lake has recently been made. It is possible that this survey together with a continued creel census will suggest reasons for the limited production.

Some of those individuals interested in the lake attribute limited production, and especially a decided decline in northern pike fishing over a period of years, to extensive illegal spearing in the outlet each spring. If these reports are true, the gradual decrease in summer fishing for great northern pike is explained.

A considerable percentage of the fishing is directed toward catching the larger species. The catch per acre would be higher in number, though perhaps not in pounds produced, if the fishing were largely or entirely for pan fish.

Several "improvements" have been made: gravel spawning beds were placed in the lake and those properly located were used by the bass during the last spawning season; brush shelters were harboring many young fish, especially bluegills and rock bass. The improvements were installed by the Fife Lake C.C.C. camp. It will be of interest to note whether or not these several species increase decidedly in the catch in the next few years, even though it would be impossible to definitely prove that these structures were responsible for such changes.

Fife Lake has been stocked with several species of fish. Stocking records at the Harrietta Hatchery indicate that the lake was planted with bluegills fingerlings almost every year since 1929, with walleye fry in 1935 and '36, perch in 1932 and 1933, largemouthed bass in 1932 and '33, and a few smallmouthed bass in 1931. Half a million Great Lakes shiners were planted in 1935; none were recovered by our survey party in 1936. Some plantings were made prior to 1929. Mr. Chester Johnson who has for some years been interested in fishing in this lake indicates that the first walleyes (fry) were planted in 1927, that several years later an undersized walleye

was caught, and that since then the walleye catch has been increasing each year. He indicates also that the walleyes are more or less uniform in size and that each year the average size increases. The census for 1934 and 1935 confirms his statement for those two years regarding increase in size and number of walleyes taken. It would appear that the fish caught are the result of a single year's plant. It therefore appears that a part of the stocking program for Fife Lake, at least, was successful.

The creel census on Fife Lake is now nearing the end of it's third consecutive season. If it can be continued for a period of years, coupled with annual studies of rate of growth, tagging operations to help determine total population and fish movements, and with other studies it will eventually provide much added information to our knowledge of fish conditions in the lake, consequently, to our ability to manage the fish population of this and similar waters.

LITERATURE CITED

Eschmeyer, R. W. 1936. Analysis of the Game-fish Catch in a Michigan Lake. Trans. Am. Fish. Soc. Vol. 65, ~~1935,~~ pp. 207-223.

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