

Original: Fish Division
cc: Education - Game
Institute for Fisheries
Research
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DIVISION OF FISHERIES
MICHIGAN DEPARTMENT OF CONSERVATION
COOPERATING WITH THE
UNIVERSITY OF MICHIGAN

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July 13, 1949

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Report No. 1229

POPULATION STUDIES DURING 1948

By

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If practicable management programs are to be derived for our lakes, some idea of how many fish of the various species are present in the lake under investigation is of prime importance.

Because of apparent inconsistencies in earlier population studies it was believed desirable to check on the efficiency of the method used in estimating fish populations. Population estimates had been made on East Twin Lake in Montmorency County (1939), Craig Lake in Branch County (1940, 1941, 1947), Bear Lake, Hillsdale County (1940, 1941), Big Bear Lake in Otsego County (1940, 1941, 1942, 1943, 1946), and Cadillac Lake in Wexford County (1947). The method used was the Thompson modification of the Schnabel formula. Fish were caught in trap nets, marked, and released at a central point in the lake, and the population estimate was based upon the number of marked fish recaptured to the number of unmarked fish taken at the same time. In reviewing the population estimates it was noted that succeeding estimates gave variable results for the same species. Estimates doubled and halved from one year to the next or from spring to fall. It thus appeared that there might be some inherent

difficulty in the method which would account for these differences, or the differences could be real.

Three bodies of water were selected for study in 1948. Cadillac Lake in Wexford County was chosen because a population estimate was conducted there in 1947. Weber Lake in Cheboygan County was chosen because it was to be poisoned at a later date in 1948 and the fish could be counted. Wolf Lake Hatchery Pond 24 was selected as the third water because it could be drained and the fishes recovered. Pond 24 was of large size (35 acres) and could be compared with some natural lakes.

The nets used in the study were the same as in prior years, with the exception of the addition of some smaller nets, about 1/8th the size of the original nets and with slightly smaller mesh size. The netting crew was composed of Donald Peterson, party leader, Kenneth Peterson and Rudolph Stinauer, assistants. Walter Crowe gave valuable assistance in starting the crew and Stanley Lievens and John Meyers helped in various ways during the netting of Cadillac Lake. Thanks are due the men from the various hatcheries who transported the nets from lake to lake and to Henry Hatt of Wolf Lake Hatchery and his men who drained Pond 24 and assisted in many ways. Conservation Officer James Skinner and his fire crew assisted in the pickup of dead fish at Weber Lake and Conservation Officer Skinner made several checks after the crew left, reporting the number of fish picked up. The fish removal operation was conducted by a crew from the Lake and Stream Improvement section. The population estimates were worked out in the office by Kenneth Peterson.

Clarence Taube supervised the draining of Wolf Lake Pond 24 and kept the necessary records.

Cadillac Lake Population Estimate

The netting of Cadillac Lake was done from June 16 thru July 9, 1948 and from June 4 thru June 24 in 1947. Thus a total of 18 net days in 1948, and 17 net days in 1947 was fished. In terms of net hours in 1948 the nets fished 408 hours as compared to 504 hours in 1947. The number of fish caught varied tremendously from 1947 to 1948. In 1947 5,684 fish were caught. In 1948 only 1,721 fish were taken. In 1947, 4,569 fish were finclipped and released, and 1,076 or 24 percent of the marked fish were recovered. In 1948, 1,343 fish were finclipped and released but only 92 fish or 9 percent were recaptured.

The population estimates for each year are presented in Table 1. The population estimate that is considered to be the best is one based on the summation of the individual estimates for various species. This summation is supposed to alleviate the differences occurring because of the different rates at which the species are caught in the nets.

In 1947 the population of legal-sized fishes in Cadillac Lake was estimated at 15,247 fish, with eleven species being represented. The estimate for 1948 gave a figure of 10,603 fish, with seven species being represented. No estimates could be made for the largemouth black bass, pike, black crappie or common sucker. When the totals for these four species are subtracted from the 1947 estimate, a figure of 11,211 fish is obtained. This is only 608 fish more than in 1948-- a reasonable increase.

However, upon a more detailed analysis of the data it is found that certain inconsistencies are present. In 1947 the estimate of the

yellow pike perch was 3,278 fish whereas in 1948 the estimate was 7,184 fish, more than double the previous year. The population estimate for the bluegill presents the reverse situation with the 1948 population of 1,752 fish being a reduction of not quite half as many as in 1947 when the estimate was 3,104 fish.

Population estimates in 1948 were not possible for some of the species because no recoveries of marked fish were obtained. This points very decidedly to the fact that in running a population estimate there can be no set time schedule for the netting crew. The crew must stay at the lake for an indefinite period until day to day population estimates even off and remain stable for several days in a row. Again if the crew has to remain for a long time--two and a half to three months--other complications arise such as the mortality of marked fish by natural causes or hook and line fishing. It is suggested that the size of the crew be enlarged so that they can handle more nets and thus take more fish in a shorter period. Additional work must also be done to determine the effective netting area of each net, and on the migratory habits of the species. Also a study should be made of the effects of fin clipping and tagging on the movements of fishes. There is a possibility that the handling of the fish and marking them may cause a change in their movement patterns.

Further analysis of the data taken at Cadillac Lake points out the necessity for use of the same equipment each season. The use of the smaller trap net in 1948 resulted in a sampling of size groups (and therefore age classes) which were not taken in 1947, thus making ineffectual any real comparison between the two years' study. Age

determinations were made from the scale samples collected in each year. Table 2 presents this data. It will be noted that Age group IV almost doubled in numbers taken in 1948. This might be interpreted as evidence for the doubling in numbers of the yellow pike-perch in 1948. Yet in 1947 these fish would have been in Age group III and only 15 of Age group III were taken. A back calculation of growth indicates that the average size of these fish in age group III in 1947 was 12.0 inches, or just under the minimum length that the large trap nets as a rule will take. Thus this group was sampled only by the largest specimens of the group. But in 1948 with the smaller mesh net, a smaller minimum size was taken and thus we sampled a part of the population that was present the last season but was not taken in the nets. I believe this accounts for the doubling of the pikeperch population estimate.

I also believe that other changes, such as the halving of the bluegill population estimate is due entirely to the poor netting results and not the inherent mathematics of the formula for estimation of numbers. The fewer fish taken and the fewer recaptures influences the data far more than any population change.

Therefore I would suggest that the data obtained from Cadillac Lake be used only as a means for showing the need for more intensive study of population estimate methods and that any figures other than actual numbers of fish caught and the age and growth data should not be used.

Weber Lake Population Study

Weber Lake in Cheboygan County appeared to present an ideal location for an additional check on our population estimates method. It was to have the existing fish population removed in the latter part of the summer

and thus would afford an opportunity to check the figures obtained by the formula against the numbers picked up after the treatment.

While theoretically Weber Lake seemed to offer excellent opportunities for the purpose in mind, the results obtained were of little use. Most of the fish in Weber Lake were too small to be taken in the nets and thus no real estimate of population could be made.

During the netting operation 9 largemouth black bass were taken in the nets and marked. After the 4th day of netting only marked black bass were taken. This would seem to indicate that all the bass had been marked. Yet upon poisoning 10 largemouth bass of comparable size were picked up, in addition to 7 of the marked. Similarly with the suckers, 52 were marked and were repeatedly taken. Several were marked several times. Yet upon the pickup only 18 marked could be found and 6 unmarked. Thus no comparison is possible between the two sets of data. The numbers picked up are not the total population and not all fish apparently are susceptible to netting.

On the basis of this work plans were made for some detailed study of fish movements and their relative rate of capture in nets and other points of disagreement. Work is now in progress on this study in Minnewaukon Lake in St. Joseph County.

Wolf Lake Pond 24 Population Estimate

The study of Wolf Lake Pond 24 gave some reasonably close results although here, too, certain factors seem to throw shadows of doubt.

Five species were available for population estimates -- bluegills, largemouth black bass, smallmouth black bass, pike and suckers. A total of 1,894 fish were marked and 433 were recaptured in the nets, a percentage recovery of 22.86 percent. Table 3 presents the numbers

marked and recovered and the estimate of population. Table 3 also includes the numbers recovered upon drainage and the percent of accuracy of the estimate.

The estimate for the bluegill gave the greatest accuracy with 97 percent correct. However, there is some question to be raised on this count of bluegills upon draining. No separation was made by size for fish between 4 and 6 inches total length. The nets used seldom take fish below 5.5 inches total length and thus it was necessary to pro rate the numbers in each size class. It was assumed that there was equal distribution for the range and therefore one-fourth the total number of bluegills in the 4-6 inch class was taken as the number of fish between $5\frac{1}{2}$ and 6 inches in length. By using this figure plus the numbers of fish over 6 inches, 6,232 bluegills were recovered on draining as compared with 6,430 fish estimated by netting.

The second highest percent accuracy was for the largemouth black bass with a percentage accuracy of 91 percent. For the blue gill the estimate was too great, but for the largemouth the estimate was low.

The sucker estimate ranked third in accuracy with 78 percent. The estimate was greater than the actual count.

It is apparent that the numbers of fish present have an important bearing on the population estimate. This may be illustrated by the estimates of the population of pike and smallmouth bass in Pond 24. For the smallmouth the estimate of 123 fish was 68 percent accurate, being low in estimate. Yet the highest percentage recovery was obtained for the smallmouth, with 76% recovery on marked fish. A total of 48% of the fish were marked.

For the pike the estimate of 51 fish was too high, with 57% accuracy. 48 percent of the population was marked and 29 percent were recovered in the netting operation. It therefore appears that in small population densities a much greater percentage of recovery must be obtained to give accurate results.

A comparison was made between the Schnabel formula and one derived by Schumacher and Eschmeyer. The Schumacher and Eschmeyer formula gives a range within which the true population may fall with a certain probability. For example, the sucker estimate for Pond 24 by the Schumacher and Eschmeyer formula was 1602 ± 114 and with the Schnabel method it was 1576. Both estimates were high, as the actual count was 1231 suckers. For the pike the Schumacher and Eschmeyer gave 40 ± 8 fish, and Schnabel had 51. Here again the Schumacher and Eschmeyer gave closer results but was higher than the actual count of 29. The largemouth bass count under the Schumacher and Eschmeyer method was 605 ± 87 while Schnabel gave 667. In this instance the actual count was 736 and the reverse of the above two calculations appeared in giving estimates too low instead of too high. The bluegill estimate was again higher than the actual count in both formulae. Schnabel's method gave a count of 6,430 fish while Schumacher and Eschmeyer's gave 7612 ± 1104 , with the actual count of 6,232 fish. The Schnabel formula gave 123 smallmouth bass present and the Schumacher and Eschmeyer gave 117 ± 8 , both low in comparison to the actual count of 181.

With the exception of the estimate for the pike the Schnabel formula gave more satisfactory estimates than did the Schumacher-Eschmeyer formula. However, both still leave room for improvement.

A repeat of this experiment should be run again in the fall of 1950. In addition to the plan as carried out this time one major point must be

added and carefully followed. When counts are made upon draining the separation on size must be down to the lower limit of the size taken in the nets and even more important the number of marked fish from the population estimate must be counted and recorded. Over a month lapse between the netting and the draining occurs and if this count is given, a proportional evaluation can be made for losses between the end of netting and completion of draining. Unless this last is done I do not believe it would be worthwhile to rerun the experiment at all.

It is to be hoped that the Sugarloaf Lake and Minnewaukon Lake experiments of this year will add other pertinent methods to be added to the routine or used in the evaluation of the results.

INSTITUTE FOR FISHERIES RESEARCH

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Report approved by A. S. Hazzard

Report typed by B. J. Bair

Table 1. Population Estimate Cadillac Lake

1947 and 1948

Species	Population Estimate		Number of Fish Marked		Number of Marked Fish Recovered		Percentage of Marked Fish Recovered	
	1947	1948	1947	1948	1947	1948	1947	1948
Yellow Pikeperch	3,278	7,184	688	597	74	26	11	4
Bluegill	3,104	1,752	1,251	216	324	14	26	7
Black Crappie	2,493	...	1,210	101	411	1	34	...
Yellow Perch	1,876	2,875	163	181	7	6	4	3
Common Sucker	1,417	...	141	59	7	0	5	...
Rock Bass	1,016	631	435	195	112	35	26	18
Smallmouth Bass	960	724	308	85	58	5	19	6
Pumpkinseed	827	285	308	63	69	7	22	11
Dogfish	150	27	38	14	4	4	11	29
Largemouth bass	81	...	30	5	6	0	20	...
Pike	45	...	13	8	2	0	17	...
Total	15,247	13,478	4,569	1,343	1,076	92	24%	9%

Total Population Estimate

1947 1948

All Species Combined

12,140 12,818

Individual Species added

15,247 10,603

Number legal sized fish per acre

13.25 9.2

Total pop. est. ind. species added

Number legal sized fish per acre

10.50 11.14

Total pop. est. all species combined

Number net hours fished

504 408

Number fish caught

5,684 1,721

Catch per net hour

11.27 4.2

Table 2

	1947		1948	
	<u>Number</u>	<u>Average Size</u>	<u>Number</u>	<u>Average Size</u>
II.	0	--	25	11.2
III.	15	13.0	3	12.4
IV.	70	14.6	130	14.2
V.	97	15.5	43	15.3
VI.	74	16.8	22	16.4
VII.	28	17.7	23	17.1
VIII.	16	18.5	7	18.1
IX.	5	19.3	2	20.9
X.	2	22.6		
XII.	<u>1</u>	27	<u> </u>	
	308		255	

Population Estimate 3278

7184

Table 3
Wolf Lake Population Data

Species	No. of Fish Marked	Percent of Population Marked	Number of Marked Recoveries	Percent Recovery	Number Fish on Draining	Schnabel Formula Estimate	Percent Accurate	S&E Formula Estimate	Percent Accurate
Bluegill	1,117	18%	108	10%	6,232	6,430	97	7612 ± 1104	82%
LM Bass	137	19%	19	14%	736	667	91	605 ± 87	82%
SM Bass	86	48%	65	76%	181	123	68	117 ± 8	65%
Pike	14	48%	4	29%	29	51	57	40 ± 8	73%
Sucker	540	44%	237	44%	1,231	1,576	78	1602 ± 114	77%

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Al- ~~file~~ file 12/7/49

There seems to be quite a bit of inaccuracy in attempting to determine fish populations by any method other than an actual count. I'm almost inclined to wonder if it is worth attempting

(4)

trap nets, marked, and released at a central point in the lake, and the population estimate was based upon the number of marked fish recaptured to the number of unmarked fish taken at the same time. In reviewing the population estimates it was noted that succeeding estimates gave variable results for the same species. Estimates doubled and halved from one year to the next or from spring to fall. It thus appeared that there might be some inherent