

# A Comparison of Summer and Winter Fishing in Michigan Lakes

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## A COMPARISON OF SUMMER AND WINTER FISHING<sup>1</sup> IN MICHIGAN LAKES

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Fishing in winter either by spear, tip-up or hand line has frequently been held responsible for poor fishing during the summer season. In recent years certain states have enacted laws to prevent or curtail the take of fish through the ice. In the fall of 1935 in Michigan the number of ice lines permitted was reduced by Commission action from five to two. At the time this reduction was being considered the Institute was asked to advise concerning the wisdom of the proposed action. The facts which we had, indicated that winter fishing was not generally a large factor in reducing the fish supply in lakes, but the evidence was then insufficient.

Owners of summer cottages, resort operators and others dependent in whole or in part upon the tourist fishermen who vacation in Michigan, fear that winter fishing may deplete their lakes so as to reduce the next summer's harvest. Particularly is this true if these objectors are not year round residents. They occasionally drive past their favorite lake in winter or see pictures of it in the newspapers and are alarmed at the number of ice shanties or fishermen then in evidence. They do not stop to think that many of these shanties are only occupied on week ends or that the reason such pictures are published is often because they show an unusual concentration of fishermen. Nor do they remember that many of the species taken in summer ("largemouth" bass, "smallmouth" bass, rock bass, sunfish and bullheads) are protected or rarely caught in winter. The large winter catches which they hear about are also those which stand out in the memory of the narrator as unusual. It is true that at present there is no closed season on great northern pike and walleyes in certain Michigan lakes which have been designated as "pike lakes" nor in non-trout streams. Fishing for bluegills, perch and other pan fish is legal except from May 1 to June 25.

The proponents of winter fishing claim that ice fishing furnishes recreation in the out of doors at a time when it is especially needed and that they should be given consideration along with the objectors.

Opinions on the desirability of controlling winter fishing are numer-

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<sup>1</sup> "Summer" fishing here includes the period from June twenty-five to September thirtieth; "winter" fishing, the period of ice fishing (usually from late December to early April).

ous and varied; the facts, as revealed by Michigan's creel census are interesting and suggestive.<sup>2</sup>

Both the general state census which has been carried on for the past eight years and the intensive census of total fish yield on certain lakes contribute to the solution of the problem. The former is a random sampling of the fishing, carried on by the Conservation Officers in their regular pursuit of enforcement duties. Fishermen are contacted and are asked to report their catch for the day up to the time they are approached. The officer records the number and average length of each kind of fish taken, the number of undersized fish returned, the manner of fishing, hours spent on the lake or stream, etc. These reports are sent in to the Institute where the data are transferred to cards for machine or hand sorting and tabulating. Such a sampling yields valuable qualitative data but does not indicate the total number of fish taken from any one stream or lake during given periods. During the past three years complete or nearly complete records of the fishing for various seasons in certain lakes near C.C.C. camps have been secured through the cooperation of the Michigan Emergency Conservation Work and the States Division of the National Park Service. This year complete fish catch records on many additional lakes are being taken by the above agencies and in the Waterloo and Yankee Springs Projects of the Resettlement Administration. Methods employed in taking and analyzing these data were described by the junior author (Eschmeyer, 1935).

The data for this paper were taken from the general census for 1935 and from other Institute reports of general census on Michigan lakes. Intensive census on six lakes in both winter and summer now contribute the most valuable comparison yet available of the effects of the two types of angling on given fish populations. In order to throw further light on the nature of winter fishing, intensive census data for eighteen additional lakes are included.

#### COMPARISON OF WINTER AND SUMMER FISHING

*Methods of fishing:* The methods of fishing in summer are varied and well known. Winter fishing in Michigan is carried on in three ways: spearing (for great northern pike, muskallonge, suckers and other coarse fish) in January and February; line fishing with a short, limber rod; and the use of tip-ups. Spearing in shanties with decoy minnows is a popular sport on lakes containing pike.

A comparison of spearing and line fishing (Table 1) on six lakes where both methods are used shows that approximately one-third as many fish are taken per hour by spearing but that the average size of such fish is more than twice as great as those taken by line. Great

<sup>2</sup> Since the preparation of this manuscript a discussion of the possible effects of ice fishing has been published by T. T. Odell and W. C. Seanning, pp. 120-121 in A Biological Survey of the Delaware and Susquehanna Watersheds. Suppl. 25th Ann. Rept. N.Y.S. Conservation Department, 1935.

TABLE 1. COMPARISON OF LINE FISHING AND SPEARING, INTENSIVE WINTER CENSUS ON SIX MICHIGAN LAKES (PERIODS OF CENSUS ARE GIVEN IN TABLES 2 AND 3)

Lake	County	No. of fisherman		Hours fished		Catch per hour		Ave. size of fish caught		Ave. size of northern pike caught		Catch per hour of northern pike	
		Line	Spear	Line	Spear	Line	Spear	Line	Spear	Line	Spear	Line	Spear
Houghton	Roscommon	3,169	1,024	17,973	5,965	0.22	0.11	12.0	21.2	21.3	21.7	0.05	0.11
Fife	Kalkaska and Grand Traverse	142	332	715	1,383	0.21	0.09	11.8	22.8	25.2	25.4	0.02	0.07
Crescent	Oakland	266	69	767	247	0.19	0.06	9.1	23.9	17.0	24.1	trace	0.03
Round	Jackson, Washtenaw and Lenawee	4	43	8	169	0.27	0.04	8.0	28.6	....	28.6	....	0.04
Wampers	Jackson and Lenawee	98	650	520	3,591	0.18	0.08	11.1	21.8	20.2	21.9	0.03	0.08
Hess	Newaygo	947	18	4,890	96	0.43	0.13	8.9	19.5	21.5	19.4	0.08	0.11
Total or Average		4,626	2,136	24,873	11,451	0.25	0.08	10.2	23.0	21.0	23.0	0.03	0.07

northern pike make up a large percentage of fish taken by spear. The data further show that spearing takes twice as many pike per hour as line fishing and tends to remove the larger pike. The catch per hour of pike is exceedingly slow by either method (average 0.03 pike per hour by line, 0.07 per hour by spear).

Reports from various sections of the state indicate that the change from five to two ice lines has affected the fishing in lakes containing pike. The tip-up seems to have been practically eliminated. Many former tip-up fishermen evidently took up spearing, and in addition operated two ice lines inside their shanties. Most complaints concerning the change in regulations (from two to five lines), came from fishermen frequenting lakes containing perch, pike and walleyes. The change in regulations particularly affected those who formerly fished with tip-ups for perch and walleyes since these species cannot be taken legally by spearing. The fish usually came slow with five tip-ups; two are not considered worth watching.

*Number of lakes fished and number of fishermen:* The number of lakes where winter fishing is practiced is small compared with the number fished in summer. Lakes not on or near the main travelled roads are seldom if ever visited by ice fishermen. Of twenty-eight lakes in the Waterloo Project area, ice fishing of any significance took place on only two during the past winter. The great majority of lakes in northern Michigan which are popular with the summer tourist are little if any fished in winter.

The total number of fishermen contacted during the intensive census on the six lakes which were checked by the C.C.C. was 13,077 in summer and 899 in winter, i. e., more than fourteen times the number of fishermen used the lakes in summer than in winter. The average number of ice fishermen per lake-acre on twenty-four lakes covered by intensive census (Table 3) was 0.2 as compared with an average of 4.8 fishermen per acre on the six lakes checked in summer.

*Length of fishing day:* The average number of hours spent on a lake by a fisherman seems to be inversely proportional to his luck. In winter when the catch per hour was low, fishermen spent, on the average, 3.6 hours; in summer the average "fisherman-day" was 3.0 hours.

Even though the fisherman-day is longer in winter than in summer, the effects of winter and summer fishing upon a lake are by no means balanced because of the smaller number of anglers in winter and the smaller catch per hour.

*Species caught:* In his papers on the fish catch in Fife Lake, the junior author (1935, 1936) has shown that most of the species which make up the bulk of the catch in summer, i. e., rock bass, bluegill, "smallmouth" bass, "largemouth" bass, walleyes, pumpkinseed sunfish and bullheads were rarely if ever caught in winter in this lake. In a pike lake such as Houghton Lake where walleyes, great northern pike

TABLE 2. COMPARISON OF RESULTS OF INTENSIVE CENSUS IN "SUMMER" AND "WINTER" ON SIX MICHIGAN LAKES

Lake	County	Area (acres) <sup>1</sup>	Period of census (days)	Ave. hours per fisherman-day	Fishermen contacted		Fish caught		Catch per acre <sup>2</sup>	
					% <sup>1</sup>	No.	Total No.	Per hr. Ave. size (inches)		
<b>Fife</b>	Gr. Traverse & Kalkaska	800								
Summer 1934			98	2.6	93	2,399	10,656	1.7	8.3	13.3
Winter '33-'34			entire season <sup>3</sup>	4.5	100	444	260	0.1	16.9	0.3
Summer 1935			98	2.5	98	3,594	11,375	1.3	8.1	14.2
Winter '35-'36			entire season	5.3	98	191	136	0.1	12.0	0.2
<b>Budd</b>	Clare	150								
Summer 1935			98	3.2	60	2,995	14,221	1.5	7.5	94.8
Winter '35-'36			entire season	...	100	none	...	...	...	...
<b>Clear</b>	Ogemaw	330								
Summer 1934			83	3.0	75	739	1,817	0.8	8.1	4.8
Winter '33-'34			entire season	3.8	100	63	108	0.45	9.7	0.3
<b>Clear</b>	Montmorency	160								
Summer '34-'35 <sup>4</sup>			98	2.8	60	243	605	0.9	9.3	3.8
Winter '33-'34			entire season	4.0	100	28	164	1.5	7.4	1.0
Winter '34-'35			entire season	2.7	73	6	2	0.3	8.0	trace
<b>Bear</b>	Otsego	375								
Summer 1935			83	2.9	85	581	1,345	0.8	9.1	3.6
Winter '33-'34			entire season	1.5	100	6	...	...	...	...
<b>Pleasant<sup>5</sup></b>	Oakland	86								
Summer 1935			98	4.2	95	2,526	10,095	1.0	7.7	117.4
Winter '35-'36			entire season	3.1	98	161	63	0.1	19.6	0.7
<b>Ave. of total</b>										
Summer		2,751	94	3.0	81	13,077	50,114	1.1	8.3	36.0
Winter		2,911	entire season	3.6	96	899	733	0.4	12.3	0.3

<sup>1</sup> Approximate.  
<sup>2</sup> Catch per acre based on records for fishermen contacted only. The actual summer catch was considerably higher for some lakes.  
<sup>3</sup> Entire season includes entire period lake was ice-covered (about 120 days).  
<sup>4</sup> Summer data are for July 10-Sept. 30, 1934 and June 28-July 9, 1935.  
<sup>5</sup> Census on Pleasant Lake taken by National Park Service camp, all others by M.E.C.W.

and yellow perch dominate the catch in both winter and summer and fishing is legal throughout the year, there may be a logical argument for some closed period. Whether this should be done by eliminating winter fishing, as has been suggested by some, is open to question.

The percentage of the total catch for the entire year and for the winter as made up for each of the ten species of warm water fish most caught, in the various districts of Michigan, is shown in Table 4. It will be noted from this table that yellow perch, great northern pike and suckers are the species taken most consistently over the state in winter. Except in districts 1 and 2, bluegills are taken little or not at all in winter even though they make up a good share of the catch in all districts for the year as a whole. The fish caught in winter are mainly predacious species; so that it may be possible that in most lakes summer fishing actually benefits by the removal in winter of a certain number of the larger pike, walleyes, perch and crappies—which if not so taken, would presumably keep down the supply of bass, bluegills, and other pan fish which usually make up the bulk of the catch in summer.

*Average Size of Fish:* The general census for 1935 indicates an average length of 9.0 inches for fish caught in summer as compared with 9.5 inches for winter caught fish. The averages for the intensive census are 8.3 inches by summer fishing and 12.3 inches by winter fishing.

The majority of lakes which were covered by the intensive census contained great northern pike or walleyes, and since these made up a greater proportion of the catch in winter than in summer, the discrepancy between these figures for the general and for the intensive censuses seems to be accounted for.

*Catch per Hour:* The number of legal fish taken per hour is an index to the *quality* of the fishing but tells us little concerning the *quantity* of fish removed unless a complete record of the "take" is secured as in the intensive census. The general census indicates that the catch per hour is higher in winter than in summer for four districts, the reverse in two others and equal for the seventh; the average for the two seasons being almost equal (1.7 fish per hour in winter, 1.6 fish per hour in summer).

Over a period of seven years, Conservation Officer Thomas White secured a record by random sample of 67,759 hours of fishing on Houghton Lake, our largest and one of our most productive "pike lakes." As in the general state census for 1935, the catch per hour in summer and winter in this particular lake was practically the same (0.36).

On many southern "bluegill" lakes the catch per hour at certain times in the winter may greatly exceed the catch per hour in summer. Conservation Officer C. G. Cole included six Branch County lakes in his general census returns for 1935. Records for these lakes indicated

TABLE 3. RESULTS OF INTENSIVE WINTER CENSUS ON EIGHTEEN ADDITIONAL LAKES

Lake	County	Area (acres) <sup>1</sup>	Period of census <sup>2</sup>	Ave. no. hrs. per fisherman-day	Fishermen contacted		Fish caught		Year		
					% <sup>3</sup>	No.	No.	per hr. ave. size		Catch per acre <sup>4</sup>	
Muskallonge	Montmorency	90	entire season	4.7	100	47	41	0.2	11.5	0.5	'33-'34
Hess	Newaygo	750	97 days	5.2	91.4	970	2,124	0.4	8.9	2.8	'33-'34
Round	Jackson	30	75 days	3.7	100	47	8	0.05	23.4	0.3	'33-'34
Wampplers	Jackson	800	75 days	5.5	96	716	402	0.1	19.2	0.5	'33-'34
Crescent	Oakland	150	69 days	3.0	100	335	162	0.2	10.6	1.1	'33-'34
Houghton	Roscommon	18,950	95 days	5.7	85	5,520	5,630	0.2	14.3	0.3	'35-'36
Lower Hamlin	Mason	3,100	59 days	3.9	75	377	420	0.3	11.0	0.1	'35-'36
Hubbard	Alcona	3,420 <sup>5</sup>	81 days	4.2	98	215	262	0.3	11.7	0.1	'35-'36
Grand	Presque Isle	5,000	81 days	4.9	90	98	211	0.5	10.9	0.04	'35-'36
Long	Presque Isle and Alpena	4,600 <sup>6</sup>	81 days	4.0	95	109	186	0.4	11.3	0.04	'35-'36
Oqueoc	Presque Isle	320	entire season	...	100	none	...	...	...	...	'35-'36
Manistee	Kalkaska	845	96 days	5.0	100	125	52	0.1	20.0	0.06	'35-'36
Pickarel	Kalkaska	133	96 days	5.7	100	58	86	0.4	11.8	0.65	'35-'36
Higgins	Roscommon	9,600	74 days	3.8	100	365	785	0.6	10.2	0.1	'35-'36
Margrethe	Crawford	1,640	81 days	5.3	100	792	345	0.1	22.5	0.2	'35-'36
W. Twin	Montmorency	1,000	70 days	2.9	100	300	3,287	3.8	7.8	3.3	'35-'36
N. Manistique	Luce	2,000	77 days	3.8	99	117	1,552	3.5	8.3	0.8	'35-'36
Independence	Marquette	1,848	108 days	4.4	99	487	437	0.2	21.0	0.2	'35-'36
Total or Average <sup>8</sup>	.....	57,187	.....	4.2	96	11,577	16,723	0.6	13.3	0.37	....

<sup>1</sup> Areas taken primarily from Michigan Lake and Stream Directory and are only approximate.

<sup>2</sup> Entire season includes entire period the lake was ice-covered.

<sup>3</sup> Approximate percentage.

<sup>4</sup> Based on fishermen contacted during census period. For most lakes this figure would be slightly higher if records for all fishing for the entire season were available.

<sup>5</sup> Half of lake covered by census, area given above is half the area of the lake.

<sup>6</sup> 90% of lake covered by census, area given above is 90% of the area of the lake.

<sup>7</sup> Weighted average, other averages unweighted.

<sup>8</sup> Includes data for winter fishing as given in Table 2.



an average of 6.1 fish per hour, over 99% of which were bluegills. In spite of the increased winter fishing in these lakes in past years, the catch per hour in summer for 1935 in District 1 is second highest in the state (Table 5) and no complaints of depleted fishing in this region are heard.

As a result of severe winter-killing, it was possible last spring to get rough estimates of the population of fish in several southern Michigan lakes. Mr. Gerald P. Cooper of the Institute staff found that one lake had contained approximately 1,125 fish per acre of an average size of about six inches; another contained approximately 1,200 fish per acre of an average size of about seven inches. Forage fish, obnoxious fish, the fish which survived (if any), the dead fish which were not floating, and the fingerling food and game fish are not included in the above estimates. These data are, of course, too few to justify generalization, but there seems little reason to assume that the rich southern Michigan lakes are being seriously depleted of fish despite relatively intensive fishing during both winter and summer.

Our six lakes which were checked at both seasons yielded an average of 1.1 fish per hour in summer but only 0.4 fish per hour in winter. The average catch per hour on all twenty-four lakes checked in winter was 0.6. It is felt that this is a more accurate comparison of the catch per hour than can be secured from the general census because records for complete seasons were obtained so that the poor days and poor catches are represented as well as the poorer lakes.

*Total Catch and Catch per Acre:* Probably the most significant comparison of summer and winter fishing which can be made is of the actual per acre and total catch in lakes in the two seasons.

Summer fishing on the six lakes checked resulted in a total catch of 50,114 fish. Winter fishing on these same lakes (plus an additional winter for Clear Lake, Montmorency County) yielded 733 fish. In other words, more than sixty-eight times as many fish were removed in summer as in winter.

Considering the catch per acre for the average of these six lakes during these two seasons, the figures are even more impressive and probably more nearly correct. Summer fishing removed on the average 36.0 fish per acre; winter fishing 0.3 fish per acre. The effect of summer fishing was therefore 120 times as great as winter fishing. More fish were removed per acre during an average summer fishing day than were taken during the entire period of ice fishing. It is interesting to note (Table 3) that the average catch per acre for winter fishing of the twenty-four lakes checked was also 0.3 fish per acre, indicating that the six lakes compared directly for summer and winter fishing are quite representative in this important respect.

TABLE 4. PER CENT OF TOTAL FISH CATCH FOR WINTER AND FOR ENTIRE YEAR, FOR THE 10 MOST CAUGHT WARM-WATER FISH. GENERAL CENSUS, 1936, NON-TROUT WATERS ONLY. W=WINTER, Y=ENTIRE YEAR, TR.=TRACE.

District <sup>1</sup>	Largemouthed Bass		Smallmouthed Bass		Bluegills		Sunfish <sup>2</sup>		Perch		Walleyes		Northern Pike		Rock Bass		Sucker		Crappie <sup>3</sup>	
	W	Y	W	Y	W	Y	W	Y	W	Y	W	Y	W	Y	W	Y	W	Y	W	Y
1	tr. <sup>4</sup>	3	..	tr.	91	86	tr.	1	5	5	..	..	1	1	tr.	1	1	tr.	2	3
2	..	4	..	tr.	53	63	tr.	3	15	9	tr.	tr.	5	3	1	2	2	4	23	13
3	tr.	4	tr. <sup>4</sup>	1	3	43	tr.	3	86	29	tr.	1	3	1	tr.	7	1	1	6	9
4	tr.	2	..	2	4	18	1	12	75	34	4	5	12	8	tr.	16	4	1	..	1
5	..	1	..	3	..	7	tr.	6	93	49	1	11	5	9	..	13	1	1	..	..
6	..	7	..	2	..	39	..	4	..	16	..	tr.	5	4	..	10	95	3	..	17
8	..	10	..	20	..	13	..	3	43	23	13	13	43	7	..	3	..	1	..	..
Ave.	tr.	4	tr.	4	22	38	tr.	5	45	24	3	4	11	5	tr.	7	15	2	4	6

<sup>1</sup> District 7 omitted because of inadequate data.  
<sup>2</sup> Primarily common sunfish (*Eupomotis gibbosus*).  
<sup>3</sup> Mostly black crappie (*Pomoxis sparoides*).  
<sup>4</sup> Caught and returned. Illegal to take bass in winter.

**TABLE 5. COMPARISON OF HOURS FISHED, AVERAGE SIZE AND NUMBER OF FISH CAUGHT PER HOUR BY DISTRICTS. DATA FROM GENERAL CENSUS FOR 1935. (JANUARY, FEBRUARY, MARCH AND DECEMBER CONSIDERED WINTER FISHING; BALANCE SUMMER FISHING.)**

District No. <sup>1</sup>	Season	Hours fishing reported	Fish taken	Average Size in inches	Fish per hour
1	Winter	2,055	5,898	7.7	2.9
	Summer	1,812	3,487	8.0	1.9
2	Winter	2,099	3,398	9.0	1.6
	Summer	4,744	7,414	8.2	1.6
3	Winter	3,269	8,167	7.4	2.5
	Summer	13,170	28,738	7.7	2.2
4	Winter	2,924	4,724	9.8	1.6
	Summer	6,237	8,835	8.0	1.4
5	Winter	726	1,444	7.4	2.0
	Summer	780	1,402	10.9	1.8
6	Winter	95	73	12.2	0.9
	Summer	2,631	4,191	8.4	1.6
8	Winter	181	106	12.9	0.6
	Summer	2,313	1,771	11.9	0.8
Average	Winter	1,621	3,402	9.5	1.7
	Summer	4,534	7,977	9.0	1.6

<sup>1</sup> District 7 was omitted because of insufficient data.

#### SUMMARY AND CONCLUSIONS

The evidence from creel census data may be summarized as follows:

1. Relatively few lakes are fished in winter as compared with summer, particularly in the northern part of the state.
2. Lakes are fished more heavily in summer than in winter although the average fisherman-day is slightly longer in winter.
3. The species caught in winter are mainly limited to predacious fish such as pike, walleyes, perch and to coarse species represented by the suckers. Except in the extreme southern part of the state bluegills are not taken in numbers.
4. Winter fishing, especially by spear tends to remove the larger sizes of pike.
5. The number of fish taken per hour is much lower in winter than in summer on lakes where intensive census was carried on. The number of bluegills per hour may be higher in southern lakes on certain days in winter than in summer, but the general census does not indicate any decline in the catch per hour.
6. The total winter catch and catch per acre is much less than in summer.

On the basis of this evidence it is concluded that winter fishing is not generally harmful to summer fishing in Michigan. In "pike lakes" such as Houghton Lake a closed period to protect the great northern pike and walleyes during the spawning season seems more justifiable

than eliminating the sport of winter fishing. When sportsmanlike methods are employed, ice fishing may furnish fully as much and as valuable recreation as does summer fishing, and is deserving of equal consideration.

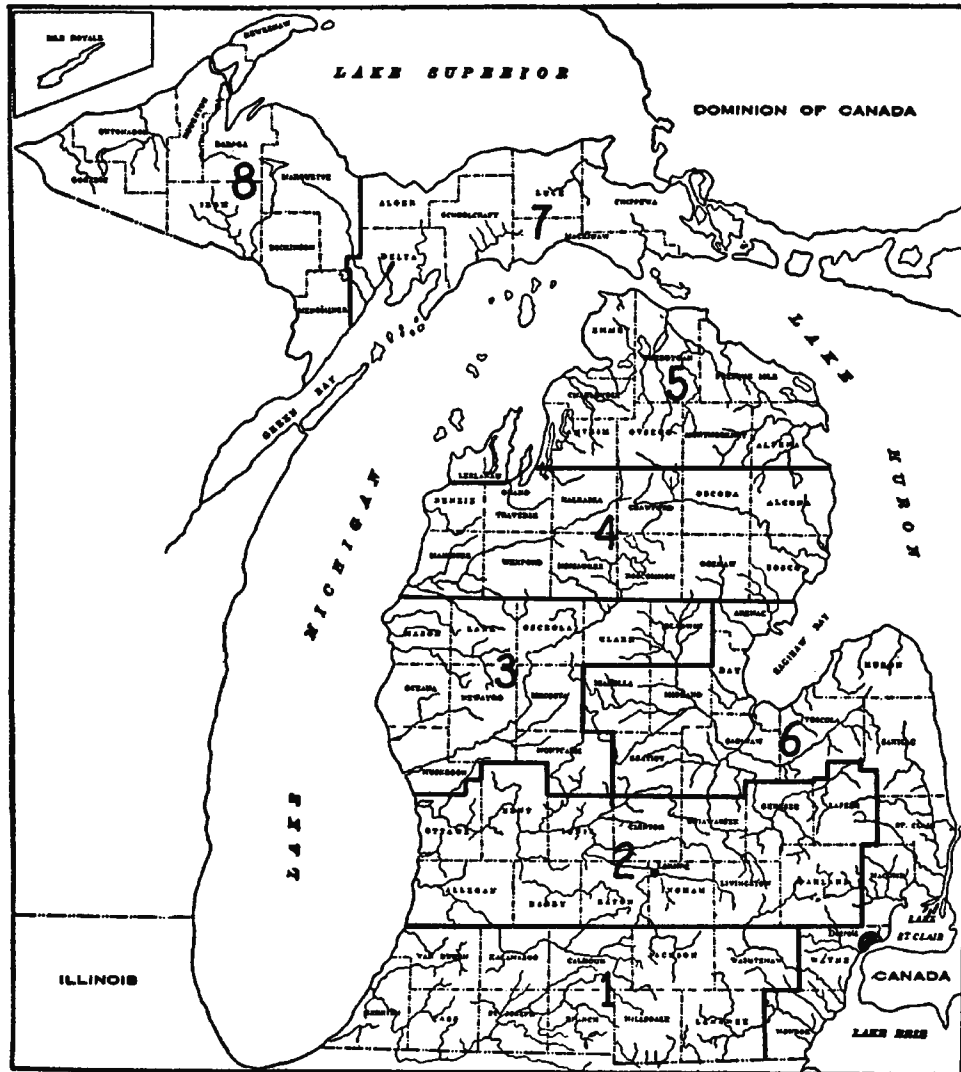


Figure 1. General census districts.

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August 13, 1936

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A. S. Hazzard and R. W. Eschmeyer

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Fishing in winter either by spear, tip-up or hand line has frequently been blamed for poor fishing during the summer season. In recent years certain states have enacted laws to prevent or curtail the take of fish through the ice. In the fall of 1935 in Michigan the number of ice lines permitted was reduced by Commission action from five to two. At the time this reduction was being considered the Institute was asked to advise concerning the wisdom of the proposed action. The facts which we had, indicated that winter fishing was not generally a factor in reducing the fish supply in lakes, but the evidence was not sufficient.

There are several good reasons for objection to winter fishing. At present there is no closed season on Great Northern Pike and Pikeperch (Walleyes) in certain Michigan lakes which have been designated as "pike lakes" nor in non-trout streams. Fishing for Bluegills, perch and other pan-fish is legal except from May 1 to June 25. It might well be argued that there is danger of overfishing and that the fish should be given a rest during the winter.

Owners of summer cottages, resort operators and others dependent in whole or in part upon the tourist fishermen who vacation in Michigan fear that winter fishing may deplete their lakes of the next summer's harvest. Particularly is this

true if they are not local residents. They occasionally drive past their favorite lake in winter or see pictures of it in the newspapers and are alarmed at the number of ice shanties or fishermen that are in evidence. They do not stop to think that many of these shanties are only occupied on week ends or that the reason such pictures are published is often because they show an unusual concentration of fishermen. Nor do they remember that the species which furnish the most fishing in summer ("largemouth" bass, "smallmouth" bass, Rockbass and Sunfish) are protected or rarely caught in the winter. The large winter catches which they hear about are also those which stand out in the memory of the narrators as unusual. The long, cold hours with "nary a nibble" are as silent as the winter snow.

Opinions on this subject, in common with most wildlife problems, are numerous and varied; the facts, as revealed by Michigan's creel census are interesting and instructive. Both the general state census which has been carried on for the past eight years and the intensive or complete census of fish yield on certain lakes contribute to the solution of the problem. The former is a random sampling of the fishing carried on by the Conservation Officers. Fishermen are contacted in the regular pursuit of enforcement duties and are asked to report their catch for the day up to the time they are approached. Such a sampling yields valuable qualitative data but does not indicate the total number of fish taken from any one stream or lake. During the past two years complete or nearly complete records of the fishing for various seasons in certain lakes near C.C.C. camps have been secured through the cooperation of the M.E.C.W. and the States Division of the National Park Service. This year complete fish catch records on many additional lakes are being taken by the above agencies and in the Waterloo and Yankee Springs Projects of the Resettlement Administration. Methods employed in taking and analyzing these data were described by the junior author in a paper presented before this Society last year (Eschmeyer, 1936).

The figures used by us were taken from the general census for 1935 and from

other Institute reports of general census on Michigan lakes. Intensive census of winter fishing on twenty-three lakes and of summer fishing on six lakes contribute the most valuable comparison of the effect of these two types of angling on the fish population.

#### Comparison of Winter and Summer Fishing

Methods of fishing: The methods of fishing in summer are varied and well known. Winter fishing in Michigan is carried on in three ways: spearing (for Great Northern Pike, Muskallonge, suckers and other coarse fish) from January first to the last of February, ~~not including March first,~~ line fishing with a short, limber rod and by the use of tip-ups. Spearing in shanties with decoy minnows is popular sport on lakes containing pike. Table 1 shows that on six lakes where spearing and live fishing are practiced about half as many fish are taken by spearing, but their average size is more than twice as great as those caught by line. This suggests that if it is desired to protect large Northern Pike, spearing should be outlawed. Whether or not the protection of this predator in heavily fished lakes is desirable, is of course open to question. The number of fish taken per hour in winter in these lakes by either of these methods is only a fraction of the catch per hour for the state as a whole, but the average size is considerably larger.

Reports from various sections of the state indicate that the change from five to two ice lines has had two effects on fishing in lakes containing pike. The tip-up has been practically eliminated. Many former tip-up fishermen took up spearing and operated two ice lines inside their shanties in addition. Most complaints of the change in regulations came from fishermen frequenting lakes containing perch, pike and Walleyes since these are the species which were formerly taken by the tip-ups; especially perch and Walleyes since these could not be taken legally by spearing.

Number of lakes fished and number of fishermen: The number of lakes where winter fishing is practiced is small compared with the number fished in summer. Lakes not on the main travelled roads are seldom if ever visited by ice fishermen. Of twenty-eight lakes in the Waterlee Project area, winter fishing of any significance took place on only two. The great majority of lakes in northern Michigan which are popular with the summer tourist are little fished in winter.

The total number of fishermen contacted during the intensive winter census on twenty-three lakes was 11,416 or an average of .2 of a fisherman day per acre; in summer 13,077 or 4.8 fisherman days per acre, i. e. the lakes were subjected to twenty-four times as much fishing in summer as were the lakes which were checked during the winter.

Length of fishing days: The average number of hours spent on a lake by a fisherman seems to be inversely proportional to his luck. In winter when the catch per hour was low, fishermen spent, on the average, 4.2 hours; in summer the average "fisherman day" was 3.0 hours. This probably indicates that ice fishing is an all day sport rather than a pastime to be indulged in for a few hours before or after work. The longer fishing day, however, only slightly compensates in intensity of the fishing for the fewer number of anglers and the smaller catch per hour.

Species caught: In his papers on the fish catch in Fife Lake, the junior author (1936, 1937) has shown that most of the species which make up the bulk of the catch in summer, i. e., Rockbass, Bluegill, "smallmouth" bass, "large-mouth" bass, Walleyes, Common Sunfish and Bullheads were rarely if ever caught in winter in this lake. In a pike lake such as Houghton Lake where Pikeperch, Great Northern Pike and Yellow Perch dominate the catch in both seasons, there is a logical argument for shortening the fishing season. Whether this should be done by eliminating winter fishing, as has been suggested by some, is open to question.



The percentage of the total catch and catch for the winter made up by each of the ten most caught warm water fish in the various districts of Michigan is shown in Table 4. It will be noted from this that Yellow Perch, Great Northern Pike and suckers are the fish taken most consistently over the state in winter. Except in districts 1 and 2, Bluegills are taken little or not at all in winter even though they make up a good share in the catch of other districts for the year as a whole. The fish caught in winter are mainly predacious species so that it may be that summer fishing actually benefits by the removal of a certain number of the larger Pike, Pikeperch, perch and Crappies.

Average Size of Fish: The general census for 1935 indicates an average length of 9.5 inches for fish caught in winter as compared with 9.0 inches for summer caught fish. The averages for the intensive censuses are 13.6 inches by winter fishing and 8.3 inches by summer fishing.

The majority of lakes which were covered by the intensive census contained Great Northern Pike or Walleyes, and since these made up a greater proportion of the catch in winter than in summer, the discrepancy between these figures for the general and for the intensive censuses is explained. Conclusions reached from the intensive census do not apply to the "bluegill lakes" of southern Michigan.

Catch per Hour: The number of legal fish taken per hour is an index to the quality of the fishing but tells us little concerning the quantity of fish removed unless a complete record of the fishing is secured as in the intensive census. The general census indicates that the catch per hour is higher in winter than in summer for three districts, the reverse in three others and equal for the seventh; the average for the two seasons being equal (1.7 fish per hour). Over a period of seven years, Conservation Officer Thomas White secured a record by random sample of 67,759 hours of fishing on Houghton Lake. As in the general census for 1935 the catch per hour in winter and summer was practically the same (0.36).

Whether these figures from the general census present an accurate comparison may be questioned. In winter fishermen tend to concentrate on the few lakes where fishing is good and go there only to fish, whereas in summer the place a man fishes is frequently determined for other reasons by members of his family. Census secured by the Conservation Officers naturally reflect these distributions.

On southern "bluegill" lakes the catch per hour in winter may greatly exceed the catch per hour in summer. Conservation Officer C. G. Cole included six Branch County lakes in his general census returns for 1935. Records for these lakes indicated an average of 6.1 fish per hour, over 99% of which were Bluegills. In spite of the increased winter fishing in these lakes in past years, the catch per hour in summer for 1935 in District One is second highest in the state (Table 5) and no complaints of the fishing in this region are heard. As a result of severe winter-killing in a few southern Michigan lakes it was possible last spring to get a rough estimate of the population of fish in several of these lakes. Mr. G. P. Cooper of the Institute staff found that one lake had contained approximately 1,125 fish per acre of an average size of about 6 inches, another contained approximately 1,200 fish per acre of an average size of about 7 inches. Forage fish, obnoxious fish, the fish which survived, the dead fish which were not floating, and the fingerling food and game fish are not included in the above estimate. These data are, of course, too few to permit generalization, but there is reason to believe that the rich southern Michigan lakes are far from being depleted of fish despite relatively intensive fishing.

Intensive winter census on twenty-three lakes gave an average of .55 fish per hour; complete records of the summer catch on six lakes yielded an average of 1.1 fish per hour. It is felt that this is a more accurate comparison of fishing than can be secured from the general census because records for complete seasons were obtained and the poor days and poor catches are represented as well as the poorer lakes.

Total Catch and Catch per Acre: Probably the most significant comparison which can be made is of the actual catch per acre and total catch in lakes in summer and in winter. In his comparison of winter and summer fishing in Pige Lake (1936, 1937) the junior author gives the following figures for 1934: catch per acre in winter .36 fish, total winter catch 286; catch per acre in summer 14.3 fish, total summer catch 11,460. In 1935 136 fish or .17 per acre were taken in winter as compared with 11,666 fish or 14.6 per acre in summer.

Intensive winter census on twenty-three lakes indicates a total catch of 16,689 fish on 576 acres, or an average of less than .3 fish per acre; summer fishing on six lakes yielded 80,114 fish for 2,741 acres, an average of 18.3 fish per acre. In other words, summer fishing resulted in the removal of sixty one times as many fish per acre of water fished as did winter fishing.

#### Conclusion

It must be concluded, on the basis of evidence now available, that in general, in Michigan, winter fishing is not deleterious to summer fishing, and that those lakes in which winter fishing might adversely effect the summer fishing are the exception rather than the rule. It is believed that, except for the possible curtailment of winter fishing on a few lakes where evidence may definitely indicate the need for greater restriction, winter fishing in Michigan is justified, not only because it has failed in general to prove objectionable to summer fishing, but because farmers, resort operators and other local residents whose work in summer is of such a nature that it does not allow them to take time for fishing at that season are entitled to enjoy this form of recreation. It appears, on the basis of evidence now available, that in general those who strongly object to winter fishing in Michigan are prejudiced or misinformed.

#### Literature Cited

Eschmeyer, R. W.

1936. Analysis of the game-fish catch in a Michigan lake. Trans. Amer. Fish.

See. 65, 207-223.

1937. Analysis of the game-fish catch in a Michigan lake--second season. Trans Amer. Fish. Soc. 66, 600-600.

Table 1. Comparison of line fishing and spearing, intensive winter census on six lakes.

Lake	County	No. of fishermen		Hours fished		Catch per hour		Ave. size of fish caught	
		Line	Spear	Line	Spear	Line	Spear	Line	Spear
Houghton	Roscommon	3,169	1,024	17,973	5,965	.22	.11	12.0	21.2
Fife	Gr. Traverse and Kalkaska	142	332	715	1,383	.21	.09	11.8	22.6
Crescent	Oakland	266	69	767	247	.20	.06	9.1	23.9
Round	Jackson, Washten- aw and Lenawee	4	43	8	169	.27	.05	8.0	28.6
Manitowish	Jackson and Lenawee	98	650	529	3,591	.18	.08	11.1	21.8
Hess	Newaygo	947	18	4,890	96	.43	.19	8.9	19.5
Tot. or Ave.		4,626	2,136	24,873	11,451	.25	.10	10.3	24.6

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Table 2. Data on winter fishing on twenty-three Michigan lakes, intensive census.

Lake	County	Area (acres) <sup>1</sup>	Period of census <sup>2</sup>	Ave.No.Mrs. per fisher- man-day	Fishermen Contacted		Fish Caught			Catch per Acre <sup>3</sup>	Year
					% <sup>4</sup>	No.	No.	per hr.	ave. size		
Hess	Benzie	750	97 days	5.2	91.4	970	2,123	0.4	8.9	2.8	'33-'34
Pife	Gr. Traverse and Kalkaska	800	116 days	4.5	100	444	280	0.1	16.9	0.3	"
Bear	Otsego	350	entire season	1.5	100	6	none	—	—	—	"
Clear	Ogemaw	330	" "	3.8	100	63	108	0.45	9.7	0.35	"
Budd	Clare	150	" "	—	100	none	none	—	—	—	"
Mushallonge	Montmorency	90	" "	4.7	100	47	41	0.2	11.5	0.5	"
Clear	Montmorency	180	" "	4.0	100	28	164	1.5	7.4	1.0	"
Clear	Montmorency	180	" "	2.7	over 50	6	2	0.3	9.3	trace	'34-'35
Round	Jackson	30	75 days	3.7	100	47	8	0.05	23.4	0.3	"
Waukena	Jackson	800	75 days	5.5	96	716	402	0.1	19.2	0.5	"
Crescent	Oakland	180	69 days	3.0	100	338	182	0.2	10.8	1.1	"
Houghton	Roseman	18,950	95 days	5.7	88	8,530	5,630	0.2	14.3	0.3	'35-'36
Lower Hamlin	Mason	3,100	57 days	3.9	78	577	420	0.3	11.0	0.1	"
Hubbard	Alcona	3,430 <sup>5</sup>	51 days	4.2	96	215	262	0.3	11.7	0.1	"
Grand	Presque Isle	5,000	81 days	4.8	90	98	211	0.3	10.9	0.04	"
Long	Presque Isle and Alpena	4,600 <sup>6</sup>	81 days	4.0	95	109	186	0.4	11.3	0.04	"

Hubbard	Aleona	3,420 <sup>5</sup>	81 days	4.2	96	215	282	0.3	11.7	0.1	"
Grand	Presque Isle	5,000	81 days	4.9	90	98	211	0.6	10.9	0.04	"
Long	Presque Isle and Alpena	4,600 <sup>6</sup>	81 days	4.0	95	109	186	0.4	11.3	0.04	"
Oquessoc	Presque Isle	320	entire season	4	100	none	—	—	—	—	"
Hanistee	Kalkaska	845	96 days	5.0	100	125	52	0.1	20.0	0.06	"
Pickorel	Kalkaska	135	96 days	5.7	100	58	96	0.4	11.6	0.06	"
Higgins	Hosocomon	9,600	74 days	3.8	100	365	785	0.6	10.2	0.1	"
Margrethe	Crawford	1,640	81 days	5.3	100	792	345	0.1	22.5	0.2	"
N. Twin	Montmorency	1,000	70 days	2.9	100	300	3,287	3.8	7.8	3.2	"
Fife	St. Traverce and Kalkaska	800	entire season	5.3	98	191	136	0.1	12.0	0.2	"
M. Hanistique	Luce	2,000	77 days	3.8	99	117	1,552	3.5	6.3	0.6	"
Independence	Marquette	1,848	108 days	4.4	99	487	457	0.2	21.0	0.2	"
Tot. or Ave.	—	57,078	—	4.2	—	11,418	16,659	.55	13.2	0.3 <sup>7</sup>	—

<sup>1</sup> Census taken primarily from Michigan Lake and Stream Directory. Areas for most lakes are only approximate.

<sup>2</sup> Entire season includes entire period the lake was ice-covered.

<sup>3</sup> Approximate percentage.

<sup>4</sup> Based on fishermen contacted during census period. For most lakes this figure would be slightly higher if records for all fishing for the entire season were available.

<sup>5</sup> Half of lake covered by census, area given above is half the area of the lake.

<sup>6</sup> 90% of lake covered by census, area given above is 90% of the area of the lake.

<sup>7</sup> Weighted average, other averages unweighted.

Table 3. Data on summer fishing (June 25th to September 30th), intensive census.

Lake	County	Approx. Area in Acres	Period of Census Days	Ave. No. of Hrs. per Fisherman-day	Fishermen Contacted		Catch			Year	
					% <sup>1</sup>	No.	Tot. per Hr.	Ave. Size	Per Acre <sup>2</sup>		
Fife	Gr. Traverse and Kalkaska	800	98	2.6	93	2,399	10,656	1.7	8.3	13.3	'34
Fife	Gr. Traverse and Kalkaska	800	98	2.5	98	3,594	11,578	1.3	8.1	14.2	'35
Budd	Clare	150	98	3.2	60	2,995	14,221	1.5	7.5	94.8	'35
Clear	Ogemaw	380 <sup>3</sup>	98	3.0	75	739	1,817	0.8	8.1	4.8	'34
Clear	Montmorency	180 <sup>3</sup>	98	2.7	60	243	605	0.9	9.3	4.0	'34-'35
Pleasant <sup>4</sup>	Oakland	88	98	4.2	95	2,526	10,095	1.0	7.7	117.4	'35
Bear	Otsego	375	83	2.9	85	581	1,345	0.8	9.1	3.6	'35
Tot. or Ave.	—	2,741	97	3.0	81	13,077	50,114	1.1	8.3	36.0	—

<sup>1</sup> Approximate.

<sup>2</sup> Based on data for fishermen contacted only. The actual catch was considerably higher for some lakes. For Budd Lake, for instance, the total catch was approximately 160 fish per acre.

<sup>3</sup> Areas approximate.

<sup>4</sup> Census taken by National Parks Service Camp, all others by M.E.C.W.



Table 4. Percent of total fish catch for winter and for entire year, for the ten most caught warm-water fish. General census, 1935, non-trout waters only.

w, winter, y, entire year, tr., trace.

District <sup>1</sup>	"Largemouth" Bass		"Smallmouth" Bass		Bluegills		Sunfish <sup>2</sup>		Perch		Walleyes		Northern Pike		Rock Bass		Sucker		Crappie <sup>3</sup>	
	w	y	w	y	w	y	w	y	w	y	w	y	w	y	w	y	w	y	w	y
1	tr. <sup>4</sup>	3	—	tr.	91	86	tr.	1	5	5	—	—	1	1	tr.	1	1	tr.	2	3
2	—	4	—	tr.	53	63	tr.	3	15	9	tr.	tr.	5	3	1	2	2	4	23	13
3	tr.	4	tr. <sup>4</sup>	1	3	43	tr.	3	66	29	tr.	1	3	1	tr.	7	1	1	6	9
4	tr.	2	—	2	4	13	1	12	75	34	4	5	12	8	tr.	16	4	1	—	1
5	—	1	—	3	—	7	tr.	6	93	49	1	11	8	8	—	13	1	1	—	—
6	—	7	—	2	—	39	—	4	—	16	—	tr.	5	4	—	10	96	3	—	17
8	—	10	—	20	—	13	—	3	43	23	13	13	43	7	—	3	—	7	—	—
Ave.	tr.	4	tr.	4	22	38	tr.	5	45	34	3	4	11	5	tr.	3	15	2	4	6

<sup>1</sup>District 7 omitted because of inadequate data.

<sup>2</sup>All or nearly all common sunfish (Lepomis gibbosus) and, in some counties, also Bluegills.

<sup>3</sup>Mostly black crappie (Pomoxis sparoides).

<sup>4</sup>Caught and returned. Illegal to take bass in winter.

<sup>5</sup>Unweighted average.

Table 5. Comparison of hours fished, ave. size and number of fish caught per hour by districts. Data from general census for 1935.

(Jan., Feb., March and Dec. considered winter fishing, balance summer fishing).

District <sup>1</sup>	Season	Hours Fishing Reported	Fish Taken	Ave. Size in Inches	Fish per Hour
1	Winter	2,055	5,898	7.7	2.9
	Summer	1,812	3,487	8.0	1.9
2	Winter	2,099	3,398	9.0	1.6
	Summer	3,939	7,414	8.2	1.9
3	Winter	3,269	8,167	7.4	2.5
	Summer	13,170	28,753	7.7	2.2
4	Winter	1,673	2,407	10.0	1.4
	Summer	6,287	8,835	8.0	1.4
5	Winter	726	1,444	7.4	2.0
	Summer	780	1,402	10.9	1.8
6	Winter	95	73	12.2	0.9
	Summer	2,631	4,191	8.4	1.6
8	Winter	181	106	12.9	0.6
	Summer	2,313	1,771	11.9	0.8
Average	Winter	1,569	3,070	9.5	1.7
	Summer	4,419	7,977	9.0	1.7

<sup>1</sup>District 7 was omitted because of insufficient data.