Original: Fish Division ✓
cc: Division of Geology 6-1-43
Education-Game
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INSTITUTE FOR FISHERIES RESEARCH
DIVISION OF FISHERIES
MICHIGAN DEPARTMENT OF CONSERVATION
COOPERATING WITH THE
UNIVERSITY OF MICHIGAN

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UNIVERSITY MUSEUMS ANNEX
ANN ARBOR, MICHIGAN

May 26, 1943

REPORT NO. 871

THE NUMBER AND SIZE OF INLAND LAKES IN MICHIGAN

by

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How many lakes are there in Michigan? This question is asked many hundreds of times each year. In general, estimates range from 5,000 to 10,000. The revised Michigan Lakes and Streams Directory (1941) "lists 6,454 as being large enough to be lakes." This raises the question of, just what is a lake? Unfortunately all definitions of the term lake are couched in relative terms such as, "large enough," "of considerable extent," "with some windswept shoal," etc. Webster defines a lake as "a considerable inland body of water, also an expanded part of a river." This leaves us to define "considerable" which is no more specific than the word lake itself.

Many limnologists, treat as lakes, only those standing waters of sufficient size and character to have some windswept shoal. This distinction involves not only size but depth, location, shape of basin, type of bottom and shore protection. There are lakes as small as 10 acres which could qualify under this definition and others of several hundred acres which could not.

Certain workers in aquatic biology have used depth alone as the distinguishing characteristic between lakes and ponds while others have proposed temperature as a diagnostic feature. All of these definitions allow for individual opinion and it is little wonder that no uniformity exists as to the number of lakes in the state.

The writer favors the definition of Forel, the founder of modern limnology, who described a lake "as a body of standing water occupying a basin and lacking continuity with the sea." According to this definition all standing waters are lakes regardless of size, depth or origin. Ponds, bogs, swamps, reservoirs, etc. are just special kinds of lakes. This interpretation will be followed throughout this report.

Besides the confusion in the definition of lakes, no very accurate counts or measurements have been made of Michigan lakes. This has probably been due to the poor quality of existing maps. However, county maps have been greatly improved during the last few years, as a result of aerial survey and other improved methods. It is now possible to make reasonably accurate counts and to estimate areas. There is still much to be desired however and an accurate analysis will only be possible when all of the lakes in each county are mapped or areas determined from actual measurements. To date approximately 1,500 lakes have been mapped and practically all of the lakes in Washtenaw and Ogemaw counties have either been mapped or checked by field crews.

Methods

County Master plan maps of the Michigan Department of Conservation and the new polyconic projection maps of the Michigan State Highway Department were the chief sources of information for this report. Other county maps, U. S. Forest maps and corrected county maps in the Institute files were used to supplement the above.

Lakes were counted on the maps and their areas estimated by means of appropriate grids and tables. Actual acreages are available for most of the 1,500 lakes mapped. We satisfied ourselves that reasonable area estimates could be made by checking such estimates against the actual area of mapped lakes. The error of this method of determining area was further reduced by placing the lakes in various size categories.

In nearly all instances borderline (county line) lakes were arbitrarily assigned to the county having the greatest area of the lake within its boundary. Since the total area covered by lakes for each county was determined from these assignments there is considerable error in a few instances. This error, however, did not seem to justify the measurement of fractions of lakes for all counties. All lakes on the state line were credited to the county containing part of the lake. Areas were estimated for only that part of each lake which fell within the boundary of Michigan however.

An attempt has been made to separate the natural and artificial lakes. It was obvious from the outset that this would not be very accurate. Impoundments are in the process of being created most of the time and old lakes resulting from dams have no distinguishing characteristics discernible on our maps. It is estimated that there are between 700 and 800 impoundments in the state, i.e., those with dams 2 or more feet high. Then too, many lakes are semi-artificial in that outlet dams have been built to increase the size of once natural lakes. There is no great significance to the general category of artificial lakes from the fisheries point of view. However, impoundments in general are more subject to fluctuations and may therefore lack the carrying capacity for fish which exists in natural lakes of similar size. On the other hand certain impoundments are very productive.

The categories of "less than 200 acres" and "over 200 acres" were purely arbitrary (Table 1) although this division does separate the small from the large lakes.

The information on total areas of counties was secured from a publication by the U. S. Department of Commerce, Bureau of Census (1942), entitled "Areas of the United States 1940."

The Number of Lakes

A total of 11,037 inland lakes were counted for Michigan. Only two counties, Sanilac and Saginaw, were completely without lakes. All of the counties in the thumb and Saginaw Bay area were poor in lakes. Arenac, Bay, Midland, Huron, St. Clair and Monroe each has less than 10 while Emmet, Macomb, Missaukee, Tuscola and Wayne counties each has between 10 and 25 lakes. Menominee and Ontonagon counties have fewer lakes than any other counties in the upper peninsula. Seven counties have more than 300 lakes. They are as follows: Marquette, 835; Luce, 571; Iron, 528; Gogebic, 488; Oakland, 447; Schoolcraft, 340; and Barry, 327. A summary of the number of lakes by counties is shown in table 1.

The Size of Lakes

Approximately one half of the lakes in Michigan are less than 10 acres in surface area and only 19 lakes have more than 5,000 acres while the average size for all lakes is about 66 acres. Of the 11,037 lakes in the entire state 10,403 are natural and 182 artificial which are less than 200 acres in area. There are 411 natural and 41 artificial lakes which have areas over 200 acres (Table 1).

A more adequate picture of the size distribution of the lakes in each county is given in table 2. Here 10 arbitrary divisions have been set up and the lakes classified accordingly. There is marked decrease in number as the size increases.

The total area of standing water in each county is shown in table 1. A greater percentage (10.1) of Antrim County is covered by inland lakes than in any other county; Charlevoix (9.9%) and Roscommon (9.2%) are not far behind. Marquette County, which has the largest number of lakes, has only 2.5% of its total area covered by lakes. This is only slightly greater than the average for all counties which is approximately 2%. This means that each section of land in the state could have a lake of about 13 acres if the total area of water were evenly distributed. Approximately one section in five would have a lake if the total number were evenly distributed. Actually the distribution of the inland lakes is very uneven. Many thousands of sections are without any lakes and on

Table 1. The number of natural and artificial lakes and their total areas by counties.

County	Number of lakes				Total number of lakes	Area of lakes				Total area of lakes		Total area of county	Percent of county covered by lakes
	Natural		Artificial			Natural		Artificial					
	Less than 200 acres	Over 200 acres	Less than 200 acres	Over 200 acres		Less than 200 acres	Over 200 acres	Less than 200 acres	Over 200 acres	Acres	Square miles	Square miles	
Alcona	88	2	0	1	91	1,660	9,650	0	950	12,260	19.2	694	2.8
Alger	243	9	0	1	253	6,306	4,142	0	1,700	12,148	19.0	934	2.0
Allegan	111	7	4	3	125	2,953	2,005	345	2,760	8,063	12.6	837	1.5
Alpena	25	4	3	2	34	534	7,195	225	1,820	9,774	15.3	590	2.6
Antrim	61	8	7	0	76	1,284	32,098	353	0	33,735	52.7	520	10.1
Arenac	1	0	0	0	1	50	0	0	0	50	0.1	369	0.0
Baraga	197	6	2	1	206	4,696	2,870	20	625	8,211	12.8	925	1.4
Barry	315	9	3	0	327	6,416	5,480	43	0	11,939	18.7	571	3.3
Bay	2	0	0	0	2	182	0	0	0	182	0.3	451	0.1
Benzie	48	8	2	1	59	1,322	15,000	13	300	16,635	26.0	342	7.6
Berrien	84	1	0	1	86	1,875	860	0	480	3,215	5.0	584	0.9
Branch	69	8	0	1	78	3,019	4,233	0	515	7,767	12.1	517	2.3
Calhoun	134	2	2	0	138	3,931	960	165	0	5,056	7.9	716	1.1
Cass	129	10	3	1	143	5,634	4,094	175	225	10,128	15.8	505	3.1
Charlevoix	32	6	3	0	41	1,347	21,041	82	0	22,470	35.1	451	7.8
Cheboygan	138	7	3	0	148	2,156	48,495	187	0	50,838	79.4	798	9.9
Chippewa	157	10	1	1	169	3,985	3,782	5	225	7,997	12.5	1,651	0.8
Clare	197	4	2	0	203	3,222	1,082	67	0	4,371	6.8	577	1.2
Clinton	48	0	0	0	48	752	0	0	0	752	1.2	573	0.2
Crawford	52	1	2	0	55	1,297	1,880	170	0	3,347	5.2	566	0.9
Delta	141	2	5	0	148	3,459	1,535	410	0	5,404	8.4	1,202	0.7
Dickinson	115	3	6	1	125	2,486	1,423	498	300	4,707	7.4	763	0.9
Eaton	34	0	0	0	34	755	0	0	0	755	1.2	572	0.2
Emmet	17	7	0	0	24	267	7,224	0	0	7,491	11.7	477	2.5
Genesee	86	4	3	1	94	2,382	1,975	137	335	4,829	7.5	649	1.2
Gladwin	38	2	1	3	44	871	1,025	6	3,032	4,934	7.7	512	1.5
Gogebic	465	21	1	1	488	10,929	24,555	125	350	35,959	56.2	1,146	4.9
Grand Traverse	172	11	3	0	186	2,669	11,731	330	0	14,730	23.0	490	4.7
Gratiot	3	0	3	0	6	183	0	510	0	693	1.1	566	0.2
Hillsdale	103	2	7	0	112	2,810	529	169	0	3,508	5.5	604	0.9
Houghton	184	6	7	0	197	2,273	14,132	248	0	16,653	26.0	1,047	2.5
Huron	2	1	0	0	3	80	1,350	0	0	1,430	2.2	824	0.3
Ingham	28	1	0	0	29	535	452	0	0	987	1.5	560	0.3
Ionia	41	2	5	1	49	520	692	425	600	2,237	3.5	578	0.6
Iosco	40	6	0	4	50	1,501	4,305	0	3,945	9,751	15.2	563	2.7
Iron	502	20	6	0	528	10,513	8,512	423	0	19,448	30.4	1,219	2.5
Isabella	50	3	2	0	55	1,065	719	193	0	1,977	3.1	573	0.5
Jackson	171	11	6	0	188	5,525	4,469	313	0	10,307	16.1	717	2.2
Kalamazoo	140	7	7	0	154	4,595	5,090	195	0	9,880	15.4	580	2.7
Kalkaska	119	3	4	0	126	2,612	1,393	56	0	4,061	6.3	573	1.1
Kent	261	5	3	1	270	5,136	1,557	348	300	7,341	11.5	868	1.3
Keweenaw	110	13	2	0	125	2,587	11,670	9	0	14,266	22.3	587	3.8
Lake	152	3	0	0	155	2,466	1,595	0	0	4,061	6.3	577	1.1
Lapeer	227	1	6	0	234	3,719	450	158	0	4,327	6.8	662	1.0
Leelanau	35	8	0	0	43	987	15,545	0	0	16,532	25.8	374	6.9
Lenawee	77	5	4	0	86	1,941	3,330	192	0	5,463	8.5	760	1.1
Livingston	236	4	6	0	246	6,653	1,157	496	0	8,306	13.0	583	2.2
Luce	554	4	13	0	571	6,624	4,100	76	0	10,800	16.9	929	1.8
Mackinac	173	14	0	0	187	4,082	25,573	0	0	29,655	46.3	1,081	4.3
Macomb	14	0	2	0	16	294	0	49	0	343	0.5	481	0.1
Manistee	83	3	0	1	87	1,662	3,840	0	1,280	6,782	10.6	568	1.9
Marquette	817	15	2	1	835	14,504	12,244	120	3,300	30,168	47.1	1,878	2.5
Mason	65	6	0	0	71	2,101	7,117	0	0	9,218	14.4	505	2.9
Mecosta	126	5	3	1	135	2,795	2,053	110	275	5,233	8.2	570	1.4
Menominee	46	3	1	0	50	1,287	1,054	108	0	2,449	3.8	1,044	0.4
Midland	0	0	0	1	1	0	0	0	2,300	2,300	3.6	523	0.7
Missaukee	19	3	0	0	22	995	2,675	0	0	3,670	5.7	572	1.0
Monroe	3	0	0	0	3	219	0	0	0	219	0.3	564	0.1
Montcalm	236	6	0	0	242	5,019	2,301	0	0	7,320	11.4	720	1.6
Montmorency	116	8	2	0	126	2,637	4,483	120	0	7,240	11.3	567	2.0
Muskegon	70	7	1	0	78	2,150	8,095	75	0	10,320	16.1	519	3.1
Newaygo	226	4	2	2	234	4,790	2,254	160	3,800	11,004	17.2	867	2.0
Oakland	425	21	1	0	447	10,762	8,388	66	0	19,216	30.0	899	3.3
Oceana	94	4	0	0	98	1,897	1,731	0	0	3,628	5.7	541	1.1
Ogemaw	174	4	1	0	179	4,327	1,474	15	0	5,816	9.1	580	1.6
Ontonagon	79	0	1	1	81	1,411	0	200	320	1,931	3.0	1,331	0.2
Osceola	121	1	1	0	123	2,410	370	75	0	2,855	4.5	585	0.8
Oscoda	123	2	2	1	128	2,448	430	81	560	3,519	5.5	568	1.0
Otsego	176	4	0	0	180	4,052	2,807	0	0	6,859	10.7	538	2.0
Ottawa	21	2	1	0	24	805	2,580	90	0	3,475	5.4	572	0.9
Presque Isle	80	6	5	0	91	2,876	6,517	155	0	9,548	14.9	678	2.2
Roscommon	87	5	1	0	93	1,037	32,824	5	0	33,866	52.9	573	9.2
Saginaw	0	0	0	0	0	0	0	0	0	0	0	814	0.0
St. Clair	2	0	0	0	2	32	0	0	0	32	0.1	751	0.0
St. Joseph	89	7	1	3	100	3,505	2,980	20	1,160	7,665	12.0	518	2.3
Sanilac	0	0	0	0	0	0	0	0	0	0	0	961	0.0
Schoolcraft	333	5	1	1	340	9,076	11,235	150	400	20,861	32.6	1,229	2.7
Shiawassee	42	0	1	0	43	384	0	65	0	449	0.7	540	0.1
Tuscola	21	0	0	0	21	426	0	0	0	426	0.7	820	0.1
Van Buren	121	7	1	0	129	4,431	1,714	25	0	6,170	9.6	615	1.6
Washtenaw	138	9	7	2	156	3,408	2,913	438	1,122	7,881	12.3	723	1.7
Wayne	3	1	8	1	13	25	400	308	1,250	1,983	3.1	625	0.5
Wexford	46	2	0	1	49	1,025	3,730	0	1,680	6,435	10.1	570	1.8
	10,403	411	182	41	11,037	235,647	447,164	9,602	35,909	728,322	1,137.6	58,438	

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Table 2. The number of lakes and size distribution for each county in Michigan.

County	Area in acres 0-10	11-25	26-50	51-100	101-200	201-500	501-1,000	1,001-5,000	5,001-10,000	10,001-	Total
Alcona	52	18	9	7	2	-	2	-	1	-	91
Alger	98	66	41	30	8	6	3	1	-	-	253
Allegan	40	37	23	10	5	8	1	1	-	-	125
Alpena	13	9	2	1	3	2	3	-	1	-	34
Antrim	37	11	11	7	2	3	2	1	1	1	76
Arenac	-	-	1	-	-	-	-	-	-	-	1
Baraga	109	39	21	20	10	3	4	-	-	-	206
Barry	183	86	21	14	14	7	1	1	-	-	327
Bay	-	1	-	-	1	-	-	-	-	-	2
Benzie	19	15	10	4	2	6	1	1	1	-	59
Berrien	36	27	12	7	2	1	1	-	-	-	86
Branch	14	17	17	13	8	5	3	1	-	-	78
Calhoun	56	39	16	14	11	1	1	-	-	-	138
Cass	27	35	26	30	14	10	1	-	-	-	143
Charlevoix	10	7	9	4	5	4	-	1	-	1	41
Cheboygan	87	31	14	6	3	2	1	1	-	3	148
Chippewa	64	53	21	14	6	8	3	-	-	-	169
Clare	138	29	20	5	7	4	-	-	-	-	203
Clinton	31	12	3	1	1	-	-	-	-	-	48
Crawford	23	14	8	4	5	-	-	1	-	-	55
Delta	56	46	23	13	8	1	-	1	-	-	148
Dickinson	57	33	14	13	4	3	1	-	-	-	125
Eaton	13	12	5	3	1	-	-	-	-	-	34
Emmet	8	6	3	-	-	1	3	3	-	-	24
Genesee	28	36	13	8	4	3	2	-	-	-	94
Gladwin	19	10	6	2	2	2	2	1	-	-	44
Gogebic	213	141	56	42	14	15	4	2	-	1	488
Grand Traverse	106	39	22	2	6	5	2	4	-	-	186
Gratiot	-	1	1	-	4	-	-	-	-	-	6
Hillsdale	39	37	19	11	4	2	-	-	-	-	112
Houghton	139	32	10	6	4	2	2	1	1	-	197
Huron	-	-	2	-	-	-	-	1	-	-	3
Ingham	11	10	6	1	-	1	-	-	-	-	29
Ionia	29	9	2	4	2	2	1	-	-	-	49
Iosco	14	11	5	6	4	5	1	4	-	-	50
Iron	293	105	50	36	24	14	5	1	-	-	528
Isabella	22	18	7	2	3	3	-	-	-	-	55
Jackson	49	70	25	19	14	10	1	-	-	-	188
Kalamazoo	50	45	27	15	10	4	1	2	-	-	154
Kalkaska	61	32	14	10	6	2	1	-	-	-	126
Kent	147	67	25	15	10	6	-	-	-	-	270
Keweenaw	64	18	16	8	6	7	2	4	-	-	125
Lake	86	38	17	10	1	2	1	-	-	-	155
Lapeer	141	62	14	10	6	1	-	-	-	-	234
Leelanau	13	12	3	5	2	4	1	1	2	-	43
Lenawee	31	30	12	5	3	2	2	1	-	-	86
Livingston	107	62	30	25	18	4	-	-	-	-	246
Luce	400	119	26	14	8	1	1	2	-	-	571
Mackinac	76	51	29	9	8	6	3	4	-	1	187
Macomb	3	7	6	-	-	-	-	-	-	-	16
Manistee	48	22	6	2	5	-	-	4	-	-	87
Marquette	507	165	77	47	23	10	2	4	-	-	835
Mason	32	8	11	9	5	2	3	1	-	-	71
Mecosta	70	34	10	8	7	5	1	-	-	-	135
Menominee	14	15	11	5	2	3	-	-	-	-	50
Midland	-	-	-	-	-	-	-	1	-	-	1
Missaukee	2	7	4	2	4	2	-	1	-	-	22
Monroe	-	1	1	-	1	-	-	-	-	-	3
Montcalm	121	58	33	17	7	5	1	-	-	-	242
Montmorency	60	33	11	7	7	5	2	1	-	-	126
Muskegon	22	23	13	10	3	4	1	2	-	-	78
Newaygo	123	52	32	12	9	2	2	2	-	-	234
Oakland	174	129	70	38	15	17	3	1	-	-	447
Oceana	48	31	8	3	4	3	1	-	-	-	98
Ogemaw	94	41	17	13	10	3	1	-	-	-	179
Ontonagon	41	26	5	6	2	1	-	-	-	-	81
Osceola	80	15	11	12	4	1	-	-	-	-	123
Oscoda	74	26	15	5	5	2	1	-	-	-	128
Otsego	83	47	27	11	8	3	-	1	-	-	180
Ottawa	7	5	3	6	1	-	1	1	-	-	24
Presque Isle	31	15	20	12	7	4	1	1	-	-	91
Roscommon	63	19	2	2	2	2	-	1	1	1	93
Saginaw	-	-	-	-	-	-	-	-	-	-	-
St. Clair	1	-	1	-	-	-	-	-	-	-	2
St. Joseph	23	24	22	12	9	7	3	-	-	-	100
Sanilac	-	-	-	-	-	-	-	-	-	-	-
Schoolcraft	166	83	32	22	31	3	1	1	1	-	340
Shiawassee	32	6	3	2	-	-	-	-	-	-	43
Tuscola	10	6	4	-	1	-	-	-	-	-	21
Van Buren	36	34	26	15	11	7	-	-	-	-	129
Washtenaw	77	31	14	15	8	8	3	-	-	-	156
Wayne	5	3	1	2	-	1	-	1	-	-	13
Wexford	29	9	2	4	2	-	-	3	-	-	49
	5,385	2,673	1,265	784	478	278	90	67	9	8	11,037

the other hand some townships and many sections are entirely covered by lakes. One section in Luce County has all or part of twenty-two lakes within its boundaries.

The significance of number and sizes of lakes from the fisheries viewpoint is exceedingly interesting and important. Fish production depends upon the quantity of water but also upon the quality or biological productivity. Too much emphasis cannot be placed on the significance of the small lakes in Michigan. Acre for acre they will produce a much greater quantity of fish than large lakes. The distribution of these small bodies of water is practically state-wide except for a few counties already mentioned. They serve the local folk with fishing to a much greater extent than often realized. The writer has knowledge of several small lakes (less than 10 acres) each of which provide fishing for a dozen or more fishermen year in and year out. In the purchase of lake frontage consideration should be given these productive little lakes many of which are unknown to the tourist but which furnish the home folk much food and recreation.

INSTITUTE FOR FISHERIES RESEARCH

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