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INSTITUTE FOR FISHERIES RESEARCH
UNIVERSITY MUSEUMS
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ANN ARBOR, MICHIGAN

REPORT NO. 354

April 29, 1936

ANALYSIS OF FISHING AND THE GAME FISH CATCH IN
BUDD LAKE, SUMMER OF 1935

Budd Lake is a long, narrow lake located in the village limits of Harrison on U. S. 27. A survey of this lake by Limar Braman shows that the lake has an area of 150 acres, and a maximum depth of slightly over 30 feet. A chemical and biological survey of this lake has not yet been made but it is anticipated that such a survey will be completed during the coming summer.

The census on Budd Lake was taken by a crew of men from Houghton Camp and was under the supervision of Camp Superintendent Harvey Dawson and Mr. Braman. Unfortunately the crew was not large enough to cover all fishing. The lake has an irregular shape, has extensive resort development and is accessible from a number of places. A relatively large crew would have been needed to thoroughly cover the lake. According to the census-takers the census covered 60% of all fishing. Unless otherwise indicated the figures given below are for those contacted only, consequently represent only about 60% of the fishing.

The census on Budd Lake was taken similar to the census on Fife and other lakes and details of the manner of taking it will not be repeated here.

This report covers only summer fishing which is here considered as extending from June 25th to September 30th inclusive. The data were compiled by the Institute assisted by the Sorting and Tabulating Division of the University of Michigan. The data are listed below. A copy of the census sheet used is also included.

CREEL CENSUS—Michigan Department of Conservation

Lake or Stream _____ Fisherman's Name _____
 Township _____ City or Town _____
 County _____ Sex? _____ Approximate Age? _____

SPECIES CAUGHT	LEGAL SIZE		UNDERSIZE	
	Number	Av. Lgth.	Number	Av. Lgth.
Brook Trout				
Rainbow Trout				
Brown Trout				
Large Mouth Bass				
Small Mouth Bass				
Bluegills				
Sunfish				
Yellow Perch				
Pike Perch (Walleyes)				
Northern (Grass) Pike				

Date _____ 193 _____

Kind of Fishing:

Ice? _____ Still Fishing? _____
 Boat? _____ Trolling? _____
 Shore? _____ Casting? _____
 No. of persons? _____ Total No. of lines? _____
Bait (Check if only one kind of bait used)
 How many fish caught with worms? _____
 Insects? _____ Minnows? _____ Spinner? _____
 Plug? _____ Artificial Fly? _____
 If taken with other bait, or by spear, dipnet or other means, state how _____
Weather: Clear? _____ Heavy Wind? _____ Cold? _____
 (Check) Cloudy? _____ Light Wind? _____ Mild? _____
 Rain? _____ Calm? _____ Warm? _____

(Enter other kinds taken on blank spaces above)

TIME FISHED	A.M. →	12	1	2	3	4	5	6	7	8	9	10	11	12
	P.M. →	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲

Draw line through hours and quarter hours fished; double line through indicated time when fishing was best. Make out report whether fish are caught or not.

Fig. 1. Blank used for recording creel census data

Number of fishermen (See Table 1). Census returns were obtained for a total of 2995 fisherman-days, 2495 for men, 493 for women, and 7 with sex not designated. A daily average of 31 persons were contacted. If this number represents 60% of the fishing, a total number of approximately 5000 fisherman-days were represented, averaging for the entire season about 50 fishermen (one per 3 acres) per day. On this basis, the fishing represents a total of approximately 33 fisherman-days per acre. In comparison with fishing on some other northern Michigan lakes for which census data are available, fishing on Budd Lake was relatively heavy.

Number of fish, catch per hour, fish per fisherman, average size of all fish (See Table 2). The 2995 fisherman-days yielded a total of 14,221 fish having an average length of 7.5 inches and caught at the average rate of 1.5 fish per hour. The catch per hour and catch per fisherman varied considerably, while average size remained relatively the same for the entire season. Fishing was poorest during September. Poor fishing late in the season might be construed as indicating that the lake was "fished out." It is more probable that the chiefly caught species (bluegills) bite best when the water

Table 1. Number of fishermen
Budd Lake, summer of 1935

Date	Number of fishermen			Ave. per day
	Male	Female	Total	
June 25-30	216	39	255	42
July 1-7	301	74	375	54
July 8-14	188	30	218	31
July 15-21	157	36	193	28
July 22-28	205	35	240	34
July 29-Aug. 4	177	39	218**	31
Aug. 5-11	203	39	244**	35
Aug. 12-18	185	39	227**	32
Aug. 19-25	254	40	294	42
Aug. 26-Sept. 1	280	65	345	49
Sept. 2-8	144	36	180	26
Sept. 9-15	66	5	71	10
Sept. 16-22	71	10	81	12
Sept. 23-30	48	6	54	8
Total	2495	493	2995	31

* These data are for fishermen contacted. According to the census-takers about 60% of all fishermen were contacted.

** Include several for whom sex was not indicated.

Table 2. Number of fish taken, fish per hour, fish per fisherman (per day), and average size of all fish. Budd Lake, summer of 1935

Date	No. of fish taken	Fish per hour	Fish per angler	Average size of fish (in.)
June 25-30	1635	1.9	6.4	7.5
July 1-7	2318	1.9	6.2	7.3
July 8-14	1181	1.6	5.4	7.4
July 15-21	931	1.4	4.8	7.6
July 22-28	1261	1.7	5.3	7.4
July 29-Aug. 4	1044	1.7	4.8	7.5
Aug. 5-11	1269	1.7	5.2	7.6
Aug. 12-18	1306	1.9	5.8	7.3
Aug. 19-25	1044	1.1	3.6	7.4
Aug. 26-Sept. 1	1338	1.2	3.9	7.7
Sept. 2-8	402	0.8	2.2	7.5
Sept. 9-15	69	0.4	1.0	7.7
Sept. 16-22	179	0.7	2.2	7.9
Sept. 23-30	244	1.2	4.5	7.9
Total or Average	14,221	1.5	4.7	7.5

is relatively warm and therefore failed to bite well in September when the water was cooling. If the number of fish recorded represents 60% of all fish taken, the lake yielded a total of approximately 23,700 fish or a per acre catch of 158 fish. In comparison with production on other lakes for which census figures are available, Budd Lake was relatively quite productive.

Analysis of the catch by species (See Table 3). The species were, in the order of abundance in the catch: bluegills (Helioperca macrochira), sunfish (Eupomotis gibbosus), small-mouthed bass (Micropterus dolemieu), large-mouthed bass (Aplites salmoides), perch (Perca flavescens), rock bass (Ambloplites rupestris), bullheads (Ameiurus, either nebulosus or natalis, or both) and calico bass (Pomoxis sparoides).

The catch consisted primarily of bluegills and sunfish. These two species constituted 92% of all fish (approximately 77% and 16% respectively). The two species of black bass constituted 5% of the fish caught. The relation between predator and pan fish differs somewhat with the relation between the two for other northern lakes, the percentage of predator species being low in Budd Lake. Perch constituted a relatively small per cent of the fish caught; rock bass were even fewer than perch. Budd Lake is, apparently, a bluegill lake and seems to be a relatively productive one.

A decided decline in the per hour catch of bass, rock bass and perch is noted. While poor fishing in September might be regarded as due to a decrease in water temperature, the decline in August is hardly attributable to this cause. It appears that the fish other than bluegills and possibly sunfish were to a considerable degree "fished out" and that they bit poorly later in the season for that reason.

Total hours fished and average hours fished. The fishermen for whom records are available fished a total of 9551 $\frac{1}{4}$ hours, an average of 3.2 hours per fishing day. Obviously fishing on this lake did not occupy a majority of the fishermen's time. If the hours recorded represent 60% of the total hours fished on the lake, each acre was fished, on the average, about 100 hours.

Method of fishing and kind of bait (See Tables 4, 5 and 6). Almost 95% of the fishermen still-fished, relatively few fished by casting or trolling. Those who trolled took on the average relatively large fish and took almost as many per hour as those

Table 3. Analysis of the catch. Budd Lake, summer of 1935

Period	Largemouth bass			Smallmouth bass			Bluegill		
	No.	Ave.	Per	No.	Ave.	Per	No.	Ave.	Per
		size	hr.		size	hr.		size	hr.
June 25-30	56	11.1	.07	123	10.6	.15	938	7.0	1.12
July 1-7	44	11.4	.04	96	10.9	.08	1701	7.1	1.40
July 8-14	13	11.7	.02	102	10.8	.13	756	7.0	1.01
July 15-21	38	12.1	.06	52	11.1	.08	737	7.2	1.14
July 22-28	12	11.2	.02	75	11.2	.10	1001	7.1	1.34
July 29-Aug. 4	14	12.6	.02	16	10.8	.03	876	7.4	1.43
Aug. 5-11	5	10.6	.01	30	10.4	.04	1118	7.4	1.50
Aug. 12-18	6	12.3	.01	27	...	.04	1158	7.2	1.64
Aug. 19-25	11	11.5	.01	11	11.8	.01	915	7.3	.95
Aug. 26-Sept. 1	6	11.8	.01	8	11.7	.01	1087	7.6	.97
Sept. 2-8	2	10.5	tr.	...	...	...	368	7.5	.67
Sept. 9-15	2	15.7	.01	2	10.2	.01	50	7.4	.25
Sept. 16-22	6	11.1	.03	1	12.0	tr.	92	7.5	.37
Sept. 23-30	11	11.5	.05	...	...	...	113	7.4	.55
Total	226	11.6	.02	543	10.8	.06	10910	7.3	1.14

Period	Sunfish			Perch			Rock bass		
	No.	Ave.	Per	No.	Ave.	Per	No.	Ave.	Per
		size	hr.		size	hr.		size	hr.
June 25-30	406	7.0	.48	62	8.0	.07	50	7.5	.06
July 1-7	399	7.0	.33	38	8.4	.03	34	7.0	.03
July 8-14	275	7.0	.36	23	8.2	.03	12	8.9	.02
July 15-21	94	6.4	.15	10	11.4	.02	...	...	...
July 22-28	154	7.1	.18	14	9.6	.02	4	6.7	.01
July 29-Aug. 4	135	7.2	.22	3	12.0	tr.	...	...	...
Aug. 5-11	89	7.3	.12	22	11.6	.03	5	7.7	.01
Aug. 12-18	108	7.5	.15	6	9.7	.01	...	...	...
Aug. 19-25	102	7.3	.11	5	8.7	.01	...	...	...
Aug. 26-Sept. 1	224	7.6	.20	13	9.1	.01	...	...	...
Sept. 2-8	29	7.0	.05	2	6.1	tr.	...	...	...
Sept. 9-15	14	7.1	.07	1	7.0	.01	...	...	...
Sept. 16-22	76	7.8	.31	2	9.5	.01	...	...	...
Sept. 23-30	116	7.8	.55	4	12.0	.02	...	...	...
Total	2221	7.2	.23	205	9.0	.02	105	7.5	.01

A total of 5 walleyes, 5 bullheads, and 1 calico bass were also reported caught. The size given for the walleyes suggests that these were really perch and were inadvertently placed in the wrong column by the census-takers.

Table 4. General data on methods of fishing*,
Budd 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	52	2	231	4.4	1.3	8.3	17	33
Casting	109	3	350	3.2	0.7	8.4	55	50
Still-fishing	2736	94	13245	4.8	1.5	7.4	978	36

* 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 5. General data on effectiveness of various kinds of bait used.
Budd 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.)
<u>Artificial:</u>						
Spinner	30	40	3.1	1.0	90	8.0
Plug	59	47	3.3	0.8	166	9.7
Art. fly	63	29	3.1	1.8	348	7.9
<u>Natural:</u>						
Minnows	176	33	2.6	0.9	428	9.3
Worms	1591	31	3.2	1.7	8640	7.3
Insects	548	39	3.2	1.5	2589	7.5

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

Table 6. Analysis of catch (by species) on various kinds of bait.
Budd Lake, summer of 1935

	All species	Largemouth bass	Smallmouth bass	Bluegills	Sunfish	Perch	Rock bass
ARTIFICIAL BAIT							
<u>Spinner:</u>							
Number caught	90	12	1	49	24	2	2
Average size	8.0	11.4	10.5	7.5	7.0	11.7	7.0
Catch per hr.	1.0	.13	.01	.52	.25	.02	.02
<u>Plug:</u>							
Number caught	166	31	56	49	21	1	8
Average size	9.7	13.5	11.5	6.8	7.0	12.0	7.0
Catch per hr.	0.8	.16	.29	.25	.11	.01	.04
<u>Artificial Fly:</u>							
Number caught	348	19	39	220	60	4	6
Average size	7.9	10.9	10.2	7.4	7.3	11.6	7.8
Catch per hr.	1.8	.10	.20	1.12	.31	.02	.03
NATURAL BAIT							
<u>Minnows:</u>							
Number caught	428	78	164	99	25	41	21
Average size	9.3	11.2	10.9	6.8	6.8	8.0	7.1
Catch per hr.	0.9	.17	.36	.20	.05	.09	.05
<u>Worms:</u>							
Number caught	8640	35	145	6582	1679	129	63
Average size	7.3	11.7	10.9	7.2	7.1	9.2	7.6
Catch per hr.	1.7	.01	.03	1.29	.33	.03	.01
<u>Insects:</u>							
Number caught	2589	6	29	2342	203	8	...
Average size	7.5	11.8	...	7.4	7.6	8.5	...
Catch per hr.	1.5	tr.	.02	1.34	.12	tr.	...

who still-fished. The method least used produced the best results. It is possible, of course, that those who trolled were, in general, more experienced anglers than those who still-fished. Casting produced the fewest fish (per hour) and, by a very small margin, the largest fish. Approximately a third of those who fished the lake got no fish at all. Details on the various methods used are shown in Table 4.

Six kinds of baits, 3 natural and 3 artificial, were listed. Of the artificial baits, flies were most used. They were more successful in taking fish than were any of the other five baits listed. Over half of the fishermen used worms, a method which took the smallest fish. Insects were used to a considerable extent and were relatively effective in taking fish. With the exception of data for artificial flies, there is a correlation between number of fish taken and size of fish taken, the kind of bait taking the largest fish taking also the fewest and visa versa. Details on kind of bait used are shown in Table 5.

Effectiveness of the various kinds of bait for taking each of the several species and small-mouth is shown in Table 6. It will be noted that large-mouthed bass bit best on minnows and on plugs, bluegills on insects, worms and artificial fly, sunfish on worms and artificial fly, perch on minnows and rock bass on minnows.

Relation between fishing and weather (See Table 7). The records indicate 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 usually checked except that on sheets used during the fore part of the season data with reference to roughness were not included. While a large number of combinations of the nine conditions are possible, the data were obtained only for each weather condition irrespective of the other conditions. These data are listed in Table 7.

Fish, in general, were best caught when the weather was warm, when there was a light wind and when the sky was clear. Whether fishing was best on a warm, clear day, with light wind, is not known since a 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.

Table 7. Number of fishermen, catch per hour for all fish and for each species, under various weather conditions. Budd Lake, summer of 1935

Weather	No. of fishermen	Total no. of fish taken	Hours fished	Catch per hr., all fish	Catch per hour: 1. For weather listed; 2. For entire season*											
					Largemouth Bass		Smallmouth Bass		Bluegills		Sunfish		Perch		Rock Bass	
					1	2	1	2	1	2	1	2	1	2	1	2
Cold	61	124	185 3/4	.70	.01	.02	...	.06	.58	1.14	.08	.23	.01	.02	...	.01
Mild	1168	4588	3694 1/2	1.24	.02	"	.05	"	.90	"	.23	"	.02	"	.02	"
Warm	1651	8741	5323	1.64	.03	"	.06	"	1.27	"	.25	"	.02	"	.01	"
Heavy Wind**	117	394	395 3/4	1.00	.02	.02	.01	.06	.79	1.14	.17	.23	.01	.02	...	.01
Light Wind**	1385	5669	4430	1.28	.02	"	.04	"	1.02	"	.19	"	.01	"	tr.	"
Calm**	267	1016	806	1.26	.02	"	.05	"	.96	"	.23	"	.01	"	tr.	"
Clear	1680	7955	5259 1/2	1.51	.02	.02	.05	.06	1.13	1.14	.28	.23	.02	.02	.01	.01
Cloudy	1245	5977	4073 1/2	1.47	.03	"	.06	"	1.16	"	.18	"	.03	"	.01	"
Rain	67	277	209 1/2	1.32	.10	"	.13	"	.94	"	.13	"	.01	"	tr.	"

* Irrespective of weather

** Sheets used during the early part of the season when fishing was best did not include these three items.

The weather conditions under which each species bit best were:

Large-mouthed Bass: warm weather, rain.

Small-mouthed Bass: warm, calm, rain.

Bluegill: warm, light wind, cloudy

Sunfish: warm, calm, clear

Perch: cloudy

Rock Bass: too few taken to permit comparison.

It should be understood that the estimates of temperature are with respect to general summer temperature, not to annual temperature. A "cool" day is cool with reference to normal temperature for the period.

Comparison of men and women as fishermen (See Table 8). For the season as a whole men and women caught fish of the same average size. The women however caught fewer fish per hour than men (men took three fish for each two caught by women). This condition differs considerably from that in Fife Lake where women caught more fish per hour than men. The comparative catch and size of fish caught are shown for each week in Table 8.

Relation between fishing by residents and non-residents (See table 9). Fishing by residents and non-residents were almost identical for the season as a whole, with reference to catch per hour and average size of fish caught by each. Figures for both varied considerably from week to week; residents may have had a relatively good week when non-residents had a relatively poor week and visa versa.

Of the fishermen contacted 23% were non-residents. The states represented, and number and per cent of fishermen from each state were:

State	Non-Residents	
	No.	% of non-residents
Illinois	22	3
Indiana	70	10
Iowa	2	tr.
Missouri	2	tr.
Ohio	575	84
Pennsylvania	10	1.5
West Virginia	4	0.5
Total	685	99

Table 8. Comparison of men and women in catch per hour and average size of fish*

Period	Male		Female	
	Catch per hour	Average size	Catch per hour	Average size
June 25-30	2.1	7.5	1.1	7.6
July 1-7	2.0	7.4	1.6	7.1
July 8-14	1.6	7.4	1.1	7.6
July 15-21	1.4	7.6	1.5	7.5
July 22-28	1.8	7.4	1.1	7.5
July 29-Aug. 4	1.9	7.5	0.9	7.6
Aug. 5-11	1.8	7.6	1.3	7.5
Aug. 12-18	1.9	7.3	1.6	7.3
Aug. 19-25	1.1	7.4	1.0	7.5
Aug. 26-Sept. 1	1.2	7.7	1.0	7.8
Sept. 2-8	0.8	7.5	0.5	7.5
Sept. 9-15	0.3	7.6	0.4	8.0
Sept. 16-22	0.9	7.9	0.0	...
Sept. 23-30	1.3	7.9	0.1	7.0
Average	1.6	7.5	1.0	7.4

* Not including data for 7 fishermen for whom sex was not given.

Table 9. Number of residents and non-residents, catch per hour and average size of fish caught by each

Period	Residents			Non-residents		
	No. of records	Catch per hr.	Ave. size	No. of records	Catch per hr.	Ave. size
June 25-30	226	1.9	7.5	29	2.0	7.4
July 1-7	254	1.9	7.4	121	2.0	7.3
July 8-14	189	1.6	7.5	29	1.4	6.9
July 15-21	137	1.3	7.4	56	1.8	7.7
July 22-28	189	1.9	7.4	51	1.0	7.3
July 29-Aug. 4	176	1.5	7.4	42	2.6	7.9
Aug. 5-11	204	1.9	7.5	40	1.0	7.7
Aug. 12-18	178	1.9	7.4	49	1.7	7.2
Aug. 19-25	189	1.3	7.3	105	0.7	7.6
Aug. 26-Sept. 1	262	1.3	7.6	83	0.8	7.9
Sept. 2-8	147	0.8	7.6	33	0.4	7.0
Sept. 9-15	60	0.4	7.6	11	0.1	8.0
Sept. 16-22	57	1.1	7.8	24	0.2	8.3
Sept. 23-30	42	1.2	7.8	12	1.1	8.1
Total or Average	2310	1.5	7.5	685	1.3	7.5

It will be noted that most of the non-residents were from Ohio.

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

<u>Residents</u> Distance from Budd Lake (air-line)	<u>No. of Records</u>
0-25	502
25-50	347
50-75	232
75-100	643
100-125	202
125-150	326
150-175	21
175-200	2
300-325	4
No answer	30
Not determined	1
Total	<u>2310</u>

Six zones (0-150 miles) were well-represented. There were more fishing days by those who came 75 to 100 miles than by local residents. A list of the communities and number of fishermen from each locality follows:


Adrian 1, Albion 2, Alma 78, Ann Arbor 8, Auburn 6, Bath 1, Battle Creek 20, Bay City 54, Bellevue 2, Birmingham 1, Breckenridge 8, Camden 1, Carrolton 1, Chapin 4, Charlotte 68, Clare 85, Clarkston 1, Clawson 5, Coldwater 1, Coleman 2, Columbus 2, Corona 2, Dearborn 5, Deerfield 4, Detroit 243, East Lansing 3, Eaton Rapids 9, Ecorse 3, Essexville 2, Ferndale 11, Flint 145, Flushing 1, Foster City 1, Fowler 2, Fowlerville 21, Fremont 1, Gladwin 3, Grand Rapids 27, Grass Lake 2, Greenville 2, Harrison 400, Haslett 3, Hemlock 1, Henderson 2, Highland 1, Holt 5, Houghton Lake 3, Hudson 5, Inkster 12, Ionia 4, Ironwood 4, Ithaca 9, Jackson 124, Jonesville 1, Kalamazoo 6, Lansing 291, Lincoln Park 2, Loretto 1, Manchester 1, Marion 1, Marlette 2, Marshall 1, Martin 4, Mason 5, Marrill 1, Midland 44, Monroe 3, Montgomery 5, Mt. Clemens 3, Mt. Morris 3, Mt. Pleasant 76, Olivet 3, Ovid 1, Owosso 35, Parma 2, Petoskey 1, Plymouth 1, Pontiac 24, Potterville 23, Riverdale 1, River Rouge 2, Rosebush 8, Royal Oak 6, Saginaw 115, St. Johns 43, St. Louis 54, Saline 2, Shepherd 13, Standish 1, Stockbridge 1, Sturgis 1, Troy 2, Vernon 1, Waldron 6, Waltz 1, Warren 2, Wayne 4, Wheeler 56, Williamston 6, Wyandotte 2, Ypsilanti 1.

It appears desirable that census on this lake be resumed during the 1936 season in order that comparative figures for the several summers may be available. Should the census be resumed, a somewhat larger crew of census-takers should be used.

Another report comparing fishing between Budd Lake and other lakes for which census figures are available will probably be prepared later.

INSTITUTE FOR FISHERIES RESEARCH

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