Original: Fish Division
cc: Education-Game
Mr. Fortney 10-14-41

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October 9, 1941

REPORT NO. 688

FISHERIES SURVEY OF BUDD LAKE, CLARE COUNTY

by

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Budd Lake lies just east of U.S.-27, within the city limits of Harrison, Hayes Township, Clare County (T. 19 N., R. 4 W., Sec. 21, 28). While it has no inlet or outlet, it lies in the region of the headwaters of the Tobacco River, in the Tittabawassee River system.

The Institute for Fisheries Research* prepared a map and made the fisheries survey during June 11-15, 1938. The map shows the outline of the lake and includes the location of depth contours, weed beds, brush shelters, spawning areas, and various kinds of bottoms. The fisheries survey included a study of the water (temperature and chemical analyses), fish foods (bottom organisms and plankton), vegetation (kind, abundance, and distribution), and fish (kind and abundance).

Budd Lake has been a popular lake for many years because of its accessibility and the sizable catches of bass and bluegills. In June, 1931 there was a rather heavy fish mortality. Pollution was suspected by local

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* The party consisted of: George Moore, leader; W. C. Beckman, S. Baker, and F. Ames, assistants.

people as the cause, but investigation showed that the mortality was coincident with a heavy fungus growth on many of the fish in the lake. This mortality was not confined to Budd Lake but was rather widespread--similar reports coming from all parts of southern and middle Michigan. Mr. W. H. Krull, Fish Pathologist for the Institute for Fisheries Research at that time, reports that the fungus growth becomes prevalent during periods of low water level and high temperatures and occurs particularly during and following the spawning season. A theory advance for the fungus growth at this time is that spawning areas are limited by the low water level; fish trying to spawn under crowded conditions are injured; the fungus, which reproduces rapidly in shallow, warm waters, then occurs as a secondary infection (getting a start in an open sore or bruise) and spreads rapidly, eventually causing the death of the fish. A similar mortality but less severe occurred in June, 1932, but none has been reported since.

Budd Lake is a popular recreational spot. Wilson State Park is situated on the west side of the lake, where a modern swimming beach and a picnic ground have been developed. There are over 50 cottages on the lake. Summer fishing is heavy, while winter fishing is extremely light. A Creel census conducted during the winter of 1933-1934 showed that the lake was not visited by a single fisherman all winter.

Budd Lake occupies a rather long, narrow basin. Its long axis (approximately 1 1/2 miles) lies in a slightly northwest-southeast direction. Its width varies from 600 feet to 1600 feet; the maximum depth is 34 feet. There are two major depressions--one in the north end, the other occupying nearly the southern half of the lake. A rapid drop-off characterizes the west side, while the bottom slope around the remainder of the lake is more gradual. The entire shoreline, except for the two

small bays on the extreme southern end, is sandy and wooded. The two small bays have encroaching shorelines (plants are rapidly growing from the shore out into the open water, decreasing the size of the lake) composed of marshes and an alder bog. The bottom in these bays is marl while the rest of the lake has a sand bottom in the shallower water (0-5 feet) and pulpy peat in the deeper water. This explains how and why a lowering of the water level would decrease the suitable spawning area enormously, hard bottoms being required for bluegills, sunfish, and smallmouth bass.

The lake has no surface inlet or outlet; springs and seepage provide most of the water. Run-off water from the surrounding land is limited but enriched due to the wooded nature of the land. Tree growths decrease the amount of run-off, but the water that does run off is materially enriched by seeping through the partially decomposed ground litter. The soil is sandy but is held in place by the tree growth in spite of the hilly topography.

The water level is not subject to much annual fluctuation but has been dropping steadily for the last 10 or 12 years. This has been true of many lakes, but most of them began recovering in 1937 or 1938. Budd Lake, however, remained at a low level, the reason for which is unknown. In a lake with a limited shoal area, such as Budd Lake, this is serious because it definitely curtails the amount of shallow water suitable for spawning and limits the habitat of the fry and fingerling fish. It also decreases the extent of weed beds, which harbor an abundance of fish food organisms.

The lake has a surface area of 175 acres and a shoreline development of 2.31. This means that the shoreline is 2.31 times as long as the

circumference of a 175-acre circle. A high shoreline development, therefore, indicates an irregular shoreline, producing more bays, coves and shoal area. The width of the shoal varies from 50 to 300 feet, being considerably wider on the east side than on the west. The shoal area (0-10 feet) represents approximately 30 per cent of the lake.

The water is clear; the Secchi disc (a black and white circular metal disc) disappeared from view between 11 to 12 feet. Light penetration is important because it influences the distribution of plants--both the larger plants and the phytoplankton (microscopic and semi-microscopic plants).

The temperature and chemical analyses of the water as of June 14, 1938 are summarized in the following table.

Depth (feet)	Temperature °F.		Oxygen (ppm.)		CO_2 (ppm.)		M.O. Alk. (ppm.)		pH	
	ND*	SD**	ND	SD	ND	SD	ND	SD	ND	SD
0	67	67	8.6	10.1	0.0	0.0	115	113	8.1	8.0
15	66	67	...	9.64	...	0.0	...	111	...	8.0
20	...	...	6.85	...	0.0	...	109	...	7.8	...
22	65	...	...	...	...	...	...	...	...	...
26	58	...	...	...	...	...	...	...	...	...
30	...	62	...	4.34	...	15	...	85	...	7.4
32	...	61	...	...	...	...	...	...	...	...

* North depression

** South depression

The above data indicate that the water is very suitable for the warmer water game fish. There is an adequate supply of oxygen at all depths. The temperature, while only 67°F at the surface in June probably warms up considerably so that good growth of fish would result, providing food is adequate. The hardness and reaction are well within the range of high potential productivity.

There is evidence of a thermocline (zone of rapid change in temperature) near the bottom in the northern depression but not in the south. The existence of a thermocline on the very bottom in the early part of the summer is highly irregular and it is probable that the temperature recorded for the bottom was influenced by the colder bottom deposits. It is possible that a thermocline does not form since the lake is relatively shallow and the long axis of the lake is parallel to the direction of the prevailing winds. No data is available, however, to substantiate this.

The position of the thermocline in a lake is important in fisheries work because in middle and late summer the water below the thermocline stagnates and is depleted of oxygen, making it unsuitable for fish life.

The kinds and abundance of plants in Budd Lake are listed below.*

Common Name	Scientific Name	Abundance
Waterweed	Anacharis canadensis	Abundant
Musk grass	Chara sp.	Common
Spike rush	Eleocharis Smallii	Few
Mud plantain	Heteranthera dubia	Rare
Water milfoil	Myriophyllum sp.	Few
Yellow water lily	Nuphar variegatum	Rare
Pondweed	Potamogeton pusillus var. Tenuissimus	Few
Pondweed	Potamogeton strictifolius	Few
Flat-stem pondweed	Potamogeton zosteriformis	Rare
Duck potato	Sagittaria sp.	Rare
Cattail	Typha latifolia	Rare
Wild celery	Vallisneria americana	Rare

While most of the plants listed above are not very plentiful, the two most common ones (waterweed and musk grass) are of a type which provide an excellent environment for fish food organisms. The plants with larger scattered leaves offer cover for young fish but generally do not produce much in the way of fish food.

* Plants identified by Miss Betty Robertson, Botany Department, University of Michigan.

Bottom foods are not particularly abundant; midge larvae form the bulk of this type of food. The shoal areas are more productive than the deeper waters. Plankton samples taken during the survey indicate a rather low production of the smaller free-living plants and animals. The clarity of the water substantiates these findings. However, it is quite probable that later in the season, as the water becomes warmer, plankton algae populations would increase considerably.

Fishing done by the party discloses the presence of the following species. Stocking reports for 1936-1940 are included.

Fish	Abundance	Total Number Planted 1936-1940
Game Fish		
Yellow perch	Abundant	7,500
Largemouth bass	Common	4,400
Green sunfish	Common	
Bluegill	Common	117,000
Pumpkinseed	Common	
Rock bass	Few	
Black crappie	Few	
Bluegill x green sunfish	Rare	
Green sunfish x pumpkinseed	Rare	
Coarse Fish		
Common sucker	Few	
Forage Fish		
Black-chin shiner	Few	
Black-nosed shiner	Few	
Mimic shiner	Abundant	
Blunt nosed minnow	Abundant	
Iowa darter	Common	

There seems to be a goodly supply of perch, bass, and bluegills. To maintain this population, there is an abundance of forage fish as well as crayfish. No obnoxious fish were observed or reported.

Scale samples were taken from all the game fish for the purpose of determining the growth rate. (Scales were not taken from all of the perch since so many more fish were taken than are necessary for a suitable growth study.) Additional collections were made by W. C. Beckman during 1939 and

1940. These growth studies are included. The average size of each age group of each species is given in the following table.

Fish	Age Group	Number of Specimens	Average Total Length (In.)	Average Weight (oz.)	Number of Specimens [*]
Yellow perch	I	29	3.3	0.2	(29)
	II	34	6.2	1.7	(30)
	III	28	8.0	5.3	(12)
	IV	21	10.3	9.0	(7)
	V	8	11.3	9.5	(7)
	VI	2	11.5	9.8	(2)
	VII	10	11.9	12.8	(7)
	VIII	3	11.8	8.5	(2)
	IX	1	13.2	19.2	(1)
	X	1	12.7	11.0	(1)
Largemouth bass	I	8	3.6	0.3	(7)
	II	9	7.7	3.7	(5)
	III	8	10.2	8.3	(5)
	IV	5	11.5	12.1	(2)
	V	3	12.7	18.0	(1)
	VI	1	13.6	21.2	(1)
	VII	1	17.1	43.0	(1)
	VIII	1	15.0	...	...
Bluegill	I	2	2.0	...	...
	II	15	3.5	0.5	(14)
	III	70	4.8	1.2	(37)
	IV	15	6.2	7.4	(1)
	VI	1	9.3	9.7	(1)
	VII	1	9.0	8.5	(1)
Green sunfish	III	1	5.2	1.5	(1)
	IV	2	5.8	1.7	(1)
	V	1	5.6	...	...
Pumpkinseed	I	1	2.2	0.1	(1)
	II	39	2.7	0.2	(42)
	III	48	4.1	0.9	(38)
	IV	18	5.2	2.2	(10)
	V	3	5.9	...	...
	VI	2	6.1	6.8	(2)
	VII	2	8.6	8.3	(1)
	VIII	1	8.6	8.2	(1)
	IX	1	8.8	8.9	(1)
	X	1	8.8	10.5	(1)
Great northern pike	VII	1	30.6	6 lb. 15 oz.	(1)
Black crappie	I	2	4.1	...	...
	II	4	6.8	2.9	(2)

[*] Number of specimens weighed.

Fish	Age Group	Number of Specimens	Average Total Length (In.)	Average Weight (Oz.)	Number of Specimens
Rock Bass	I	5	3.8	0.6	(5)
	II	9	4.4	...	...
	III	18	5.8	...	...
	IV	1	7.8	6.6	(1)
Pumpkinseed x bluegill	II	2	3.6	0.4	(2)
Pumpkinseed x green sunfish	II	1	2.8	0.2	(1)
	III	2	5.2	1.7	(2)
	IV	4	5.4	1.9	(4)
	V	2	5.4	2.3	(2)

The growth studies indicate that the bluegills are not growing as fast as the state average as calculated by W. C. Beckman*; they reach legal size nearly a year later. The pumpkinseeds are growing still slower, reaching legal size at least a year later than the bluegills. The slow growth of these fish can be attributed in part to a population which is too large for the limited food supply. These fish are largely insect and plankton feeders. Bottom foods are not plentiful and plankton, at the time of the survey, was limited. The dense vegetation along the west side of the lake (waterweed is dense from 6 to 20 feet deep; Chara is common in shallower waters -- 1 to 6 feet) should harbor considerable insect life, but the vegetation around the rest of the lake probably does not support adequate food for the fish.

The largemouth bass and perch are growing at a suitable rate. This would be expected since forage fish are plentiful.

A limited amount of summer creel census records from Budd Lake are available and are summarized in the following table. An intensive census was conducted during the summer of 1935, while in other years no effort was made to contact all fishermen. The percentage of the total which each species represents is given for each year as well as for the 9-year period.

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* Beckman, W. C. Meet Mr. Bluegill. Mich. Cons., June, 1941, Vol. X, No. 7, pp. 6-7, 11.

Fish	1929		1930		1932		1933		1934		1935		1937		1939		1940		Nine years
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	%
Smallmouth bass	11	8.5	42	14.7	1	3.8	24	1.6	59	1.8	543	3.8	15	10.2	2	5.3	14	8.6	3.6
Largemouth bass	11	8.5	33	11.6	...	...	18	1.2	25	0.8	226	1.6	...	...	14	36.8	27	16.7	1.8
Bluegill	64	49.6	190	66.7	...	...	1259	84.0	2531	77.4	10910	76.8	97	66.0	17	44.7	57	35.2	76.5
Pumpkinseed	19	14.7	3	1.1	25	96.2	178	11.9	442	13.5	2221	15.6	23	15.6	2	5.3	38	23.5	14.9
Rock bass	...	...	2	0.7	...	...	...	...	32	1.0	105	0.7	1	0.7	3	7.9	16	9.9	0.8
Perch	20	15.5	4	1.4	...	...	19	1.2	179	5.5	205	1.4	11	7.5	...	...	10	6.2	2.3
G. northern pike	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...
Bullhead	4	3.1	11	3.9	...	...	...	...	...	...	5	...	...	...	...	...	...	...	0.1
Walleye	...	...	...	...	...	...	...	...	...	...	5	...	...	...	...	...	...	...	...
Total	129	...	285	...	26	...	1498	...	3269	...	14220	...	147	...	38	...	162	...	
*Fish caught per hour	0.54	...	3.03	...	3.71	...	2.35	...	3.74	...	1.49	...	1.50	...	1.27	...	1.59	...	

*These figures are based on the catch for which the corresponding time is known; this catch is usually slightly less than the total catch reported.

If these figures represent the actual conditions in Budd Lake, the bluegill composed three-fourths of the total catch for the 9-year period. However, the trend of the bluegill take has been downward in the last few years--decreasing from a maximum of 84 per cent in 1933 to 35.2 per cent in 1940. During this period the smallmouth bass and largemouth bass have become more prominent. The last two years show a marked increase in the take of rock bass, although the take is relatively small. The take of perch has been small and the figures are probably not significant. These data indicate a swing from the insect-feeding bluegill toward the fish-eating small- and largemouth bass. This is undoubtedly due to food conditions, which seem to favor the growth of bass.

Management Suggestions

Budd Lake has adequate spawning facilities on the sandy shoal area. Cover for the young fish is found in the vegetation around most of the margin and in about 30 brush shelters constructed and placed by the CCC in 1933.

Food is adequate for bass and perch; but food studies and growth studies on bluegills indicate a larger population than the food supply can support. However, the increase of bass, as indicated by creel census records, may result in a heavier feeding on bluegills, reducing their population to a point where food is adequate.

The lake should remain in the class of "all other" lakes. Since the lake provides adequate facilities for maintaining a balanced fish population, stocking of all fish should be discontinued for the time being and further improvements are considered unnecessary.

Predators and parasites are not important in Budd Lake and require no control.

The declining water level is hazardous but since the lake has no inlet or outlet, there is little or nothing that can be done to relieve the condition.

Cover is believed to be adequate; the effect of the scarcity of vegetation along the east side is off-set by the brush shelters.

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