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INSTITUTE FOR FISHERIES RESEARCH

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A FISHERIES SURVEY OF CHRISTIANN LAKE,
CASS COUNTY

by

L. Edward Perry

Introduction

Location and drainage

Christiann (Christiana) Lake is located in south central Cass County (T8S, R14, 15W, Secs. 1, 6). It is one of three continuous lakes that are broadly joined to each other in Christiann Creek, St. Joseph drainage. The management of the other two lakes, Juno and Painter, is unavoidably linked with that of Christiann Lake, however, only Christiann will be discussed in this report since the other lakes have not yet been surveyed.

Good roads make these lakes easily accessible from Edwardsburg, 4 miles west, and Cassopolis, 7 miles north. An arterial highway, U. S. 112, passes within a mile of the south shore.

Acknowledgments

Christiann Lake was mapped and surveyed by a party of the Institute for Fisheries Research on July 20-24, 1938.*

Past and present use

Christiann Lake is not reported to have served any industrial use in the past. Its principal value is that of recreation, such as swimming, boating and fishing. At the time of the survey there were 38 cottages and 2 resorts located mostly along the east shore. Boats were obtainable at two liveryies.

*Personnel of party: R. C. Ball, leader; W. R. Crowe, P. Eschmeyer and A. Whitely, assistants.

The lake has been fished fairly heavily in both summer and winter.

Physical characteristics

Geological origin

No information is available on the geological origin of this lake.

Shape of basin and extent of drainage

Christiann Lake is roughly rectangular in shape, with the long axis extending nearly a mile in a northeast-southwest direction. The width is about one-third mile. The shoreline is fairly regular except for a large shallow bay on the west side and an intruding point or peninsula on the south which divides that end of the lake into two large bays. The shoreline is 1.6 times greater than that of a perfectly round lake of the same area. This is about average for lakes in southern Michigan and indicates fairly good protection from wave action. The lake had a surface area of 179 acres and a maximum depth of 43 feet when mapped. The deep area is near the center of the basin and directly east of the west bay.

The extent of shallow water is slight in Christiann Lake and is confined mostly to the north and east sides. Only about 10 per cent of the bottom is shallow enough to produce plants. The "drop-off" is rather steep and on the west side starts at the shoreline.

The drainage area of this lake is principally that of Christiann Creek which drains approximately 90 square miles of farm lands, marshes and wooded areas. About two-thirds of the immediate shore is marshy. The rest is dry and wooded.

Water fluctuation

No extreme fluctuation of water level has been reported. The water supply is derived mostly from Christiann Creek which flows through Painter, Juno and Christiann Lakes in that order. There are two connections between Juno and Christiann Lakes. The main one, about 600 feet wide and 6 or 7 feet deep, enters Christiann at the extreme north end. The other is small and of minor importance. It enters about 1,000 feet southwest of the main channel. The map shows a dam located in the outlet about a mile from the lake. No complaints have been received concerning the operation of this dam.

A summary of the physical data are presented in Table I.

Table I

Physical characters of Christiann Lake

Area (acres)	Maximum depth (feet)	Shore development	Dominant bottom types Shallows	Depths	Color of water	Transparency (Secchi disc in ft.)
179	43	1.6	marl, fibrous peat	Marl, muck	light brown	8½

Discussion of physical factors in relation to fisheries

The physical features of Christiann Lake resemble many other southern Michigan lakes. It is not very deep and has a highly organic bottom of pulpy peat which may contribute to depletion of the oxygen in the lower waters at certain times of the year. The amount of shallow water is not great but is sufficient around half of the lake to be of considerable value. Wave action is apparently not severe. The low transparency and the slight color of the water are indications of good productivity.

Temperature and chemical characteristics

Temperature

The warm surface water of Christiann Lake extended to a depth of about 15 feet at the time of the survey (July 20-24, 1938). Below this, the temperature dropped rather rapidly from 75° F. at 15 feet to 59° F. at 30 feet. From 30 feet to the bottom the temperature was more uniform and changed only three degrees in the last 9 feet (39 feet, 56° F.). The middle layer, the thermocline, acts as an insulator between the warm and cold water during most of the summer.

Chemical conditions

Oxygen was adequate at the surface (6.5 parts per million) but diminished rapidly toward the bottom. At 23 feet there were only 1.2 parts per million and at 28 feet, 0.3 parts per million. Below this, there was none. At least 3.5 parts per million are necessary to support normal fish life during summer months.

The water in Christiann Lake was alkaline (pH 7.5-8.3) and hard (methyl orange alkalinity 165-198 parts per million), which is to be expected in a marl lake of this type. Generally, hard, alkaline waters are more productive than soft, acid waters.

Pollution

No signs of pollution were found or reported.

A summary of these temperature and chemical observations is given in Table II.

Table II

Temperature and chemical data of Christiann Lake,
July 23, 1938

Depth (feet)	Temperature (° F.)	Oxygen (parts per million)	M. O. Alkalinity (parts per million)	pH
0	77	6.5	168	8.3
12	76	6.5	167	8.2
15	75	---	---	---
18	70	3.5	165	7.8
21	66	---	---	---
23	---	1.2	168	7.8
24	64			
27	60			
28	---	0.3	185	7.6
30	59			
33	57			
36	57			
37	---	0.0	198	7.5
39	56			

Discussion of temperature and chemical factors in relation to fisheries

The temperature and chemical features of Christiann Lake are suitable only to warm-water fishes such as those now found in the lake. Although cold water was found below the thermocline there was not enough oxygen below 20 feet to support fish life, thus only the surface water was available to fish during the summer period. The temperature range of this upper zone was about 67-77° F. Again, in late winter there may be a similar condition of insufficient oxygen in the depths. The hardness and alkalinity of the water are favorable.

Biological characteristics

Vegetation

Twenty-eight species of aquatic plants were collected from Christiann Lake. Water milfoil was most abundant, however, others as waterweed, coontail, yellow and white water lilies, arrow arum, pickerel weed, several pondweeds and muskgrass were common and very important in maintaining the productivity of the lake. Water plants harbor small food organisms and provide shelter for fish. The plants in this lake were distributed around all shores to depths as great as 15 feet. The most extensive beds were found on the north and east sides.

A complete list of the plants collected is found in Table III, with notations on their abundance.

Table III

List of plants collected from Christiann Lake.

Common name	Scientific name	Relative abundance
Water weed	<u>Anacharis canadensis</u>	Common
Sedge	<u>Carex sp.</u>	Few
Coontail	<u>Ceratophyllum demersum</u>	Common
Water willow	<u>Decodon verticillatus</u>	Common
Water milfoil	<u>Myriophyllum sp.</u>	Abundant
Bushy pondweed	<u>Najas flexilis</u>	Few
White water lily	<u>Nymphaea odorata</u>	Few
Yellow water lily	<u>Nuphar variegatum</u>	Common
Arrow arum	<u>Peltandra virginica</u>	Common
Reed grass	<u>Phragmites maximus Berlandieri</u>	Few
Pickerel weed	<u>Pontederia cordata</u>	Common
Pondweed	<u>Potamogeton americanus</u>	Few
Pondweed	<u>P. lucens</u>	Few
Variable pondweed	<u>P. gramineus</u>	Few
Floating-leaf pondweed	<u>P. natans</u>	Few
Pondweed	<u>P. strictifolius</u>	Few
Sago pondweed	<u>P. pectinatus</u>	Common
Whitestem pondweed	<u>P. praelongus</u>	Few
Flat-stemmed pondweed	<u>P. zosteriformis</u>	Common
Three-square	<u>Scirpus americanus</u>	Few
Softstem bulrush	<u>S. validus</u>	Common
Bur reed	<u>Sparganium eurycarpum</u>	Few
Bur reed	<u>Sparganium sp.</u>	Few
Big duckweed	<u>Spirodela polyrhiza</u>	Rare
Common cattail	<u>Typha latifolia</u>	Few
Bladderwort	<u>Utricularia vulgaris americana</u>	Few
Wild celery	<u>Vallisneria</u>	Few
Musk grass	<u>Chara</u>	Common

Identifications by Betty Robertson Clarke.

Fish foods

Small free-floating organisms (plankton) were fairly abundant at the time of the survey. These observations, however, are only of general significance because of the great variability of plankton from time to time and place to place. Daphnia and small plants were the dominant organisms at the time of the survey. Plankton is an important source of food for both young and old of many species of fish.

Bottom food organisms were also fairly abundant in Christiann Lake. Midge larvae were predominant at all depths and Corethra (phantom midge) were second. Other insect larvae and scuds (fresh-water shrimps) were of lesser importance

but still rather abundant. Most organisms were found among the plant beds.

Forage fish were plentiful. Many schools of bluntnose minnows, golden shiners and common shiners were observed. Other species (Table IV) were found in lesser abundance.

In general, Christiann Lake has an abundant supply of food for fish of all sizes.

Fish present

A list of fish and the stocking since 1933 is given in Table IV.

Table IV

A list of fish collected or reported from Christiann Lake and stocking from 1933 to 1941.

Name	Stocking
Game fishes:	
Northern pike	
Yellow perch	20,000 fingerlings
Walleyes (reported)	
Smallmouth bass (reported)	
Largemouth bass	5,900 fingerlings
	750 yearlings
Bluegill	213,200 fingerlings
	750 yearlings
Common sunfish	
Rock bass	
Black crappie	
Longear sunfish	
Coarse fishes:	
Warmouth	
Lake chub-sucker	
Brown bullhead	
Yellow bullhead	
Obnoxious fishes:	
Mud pickerel (reported)	
Longnosed gar	
Shortnosed gar	
Dogfish	
Carp (reported)	
Forage fishes:	
Black-chinned shiner	
Mimic shiner	
Sand shiner	
Common shiner	
Golden shiner	
Bluntnose shiner	
Menona Killifish	
Blackstripe topminnow	
Log-perch	
Iowadarter	
Brook stickleback	

Bluegills were by far the most abundant game fish in Christiann Lake. Black crappies and yellow perch were next. The occurrence of walleyes and smallmouth bass is known only through reported catches by anglers.

Several species of "coarse" and "obnoxious" fishes were found. The most important of these were gars and dogfish which were fairly abundant. These voracious fish have a bad reputation among sportsmen because of their feeding habits, however, there is very little evidence that they will seriously harm a lake. In Christiann Lake the forage fish were abundant and there was little evidence to substantiate the belief that gars and dogfish are damaging the fishing in the lake.

Creel census

Christiann Lake was the subject of an intensive creel census from the fall of 1938 to the fall of 1940. The results are given by O. H. Clark in three Institute reports: Nos. 540, 588 and 661, the latter being a summary of the whole. Harold Bowditch acted as census clerk. Other records of a more general nature have been made by various conservation officers since 1928. Tables V and VI review some of the data obtained by the intensive census and show the trends of fishing in recent years. The information was obtained from Institute Report No. 661.

Table V

Summary of creel census of Christiann Lake,
1938-40, from Report No. 661.

Date	Number of Fishermen	Percentage taking no fish	Number of legal fish caught	Number of illegal fish caught	Catch per hour	Catch per fisherman	Average size of all fish caught (ins.)
Winter 1938-39	1,295	44	3,537	3,586	0.8	2.7	8.1
Summer 1939	3,540	48	6,373	3,258	0.6	1.6	8.7
Winter 1939-40	632	33	3,228	884	1.4	5.1	8.4
Summer 1940	3,214	48	6,969	3,524	0.7	2.2	8.4

Table VI

The principal components of the catch in percentages of
total number, from Report No. 661.

Species	Winter 1938-39	Summer 1939	Winter 1939-40	Summer 1940
Bluegills	84	41	88	44
Perch	2	21	*	13
Crappies	3	11	4	28
Warmouth	9	1	3	*
Largemouth bass	*	8	*	7
Rock bass	*	5	*	2
Sunfish	*	3	1	3

*Less than one per cent.

Fishing in Christiann Lake, based on catch per hour, was above the average of eleven southern Michigan lakes during the winter of 1939-40, but below average during the remainder of the two years under consideration. The number of fishermen per acre of water was less than average in winter and more than average in summer, however, the difference was not great and the fishing intensity may be considered about average. Another interesting point brought out by the creel census is the average size of fish caught. The average size was greater from Christiann Lake during three of the four periods censused (exception was summer of 1940) than from any other of the five lakes intensively studied. The smallest average size was from Craig Lake where the catch per hour was high.

These results bring out a very interesting point. A low catch per hour does not necessarily mean poor fishing. In the case of Christiann Lake it means fewer but larger fish. The catch in pounds per acre gave the lake a much better representation than the catch in number of fish per acre. As a possible explanation gars and dogfish in the lake may have been influential in keeping the number of game fish down so that competition is reduced, more food is available and a faster growth rate is the result. If these predators were removed the results might be more fish but of a smaller average size.

Growth rate of fishes

Ages of all fish except bluegills were determined from scale samples collected by the survey party. Scales from bluegills were collected during the winter census and for this reason their ages cannot be compared directly with the corresponding age of other species or the state average (Table VII). They were just beginning a years growth when collected and the other fish had already been growing for a half year. Thus, a two-year-old bluegill of the collection is a half-year younger than a two-year-old of the state average and should not be as long. This compensation must be made when comparing the growth of the bluegills in Table VII.

Table VII

Growth of game fish in Christiann Lake.

Species	Age*	Number of individuals	Average total length (inches)	Average weight (lbs.)	(oz.)	Tentative Michigan Average* (length in inches)
Northern pike	II	1	21.1	1	13.6	---
	VI	1	29.8	5	9.0	
Yellow perch	I	7	4.5		0.7	4.7
	II	7	6.0		1.6	6.2
	III	1	7.9		2.9	7.1
	IV	1	8.7		4.2	7.8
	V	2	7.3		2.6	9.4
Largemouth bass	II	3	10.9		9.0	8.4
	IV	1	13.6	1	6.1	12.1
	VIII	1	19.1		----	---
Bluegills**	II	15	4.6		----	4.3
	III	121	6.9		3.0	5.6
	IV	93	7.7		5.8	6.7
	V	87	8.2		7.8	7.4
	VI	85	8.9		9.4	7.8
	VII	29	9.3		10.4	7.9
	VIII	9	9.4		9.7	8.3
	IX	3	9.4		11.4	8.5
	Black crappie	I	4	4.5		0.7
II		2	7.5		3.8	5.9
III		3	8.9		9.1	8.7
V		2	10.2		9.8	9.7
Pumpkinseed	II	3	5.3		1.9	4.4
	IV	1	7.2		6	6.4
Rock bass	I	1	3.5		0.5	3.2
	II	3	5.5		2.1	4.3
Long-eared sunfish	II	2	3.6		0.7	

*Determined by W. C. Beckman

** Taken from Institute Report No. 649, based on winter collections.

The growth of all game species in Christiann Lake was above average. The bluegills grew as much as two and three years faster than average, that is, the average four-year-old was the same size as the state average for a six-year-old and the average five-year-old was the same as the state average for an eight-year-old. The difference was not so great among other species, but it was significant.

Bluegills of this lake were also above average weight for their length. A six-inch bluegill from Christiann Lake is heavier than the state average for the same length fish. None of the fish were underweight.

The rapid growth rate of these fish shown by scale study is another point possibly in favor of the predacious gars and dogfish. They undoubtedly aid in preventing an overcrowded condition in the lake which would cause stunted growth, however, it also must be considered that Christiann Lake has a good supply of food which permits good growth. It is also possible that the relatively heavy fishing here both winter and summer may at least partly account for the rapid growth - that is by keeping the population level low there is more food available per fish.

Natural propagation

Spawning facilities in Christiann Lake are not the best for bluegills and bass but it is known that these species will spawn adequately in less favorable conditions. At the time of the survey many beds of bluegills were seen in the marl and shell bottom of the shallows. Natural propagation of all species in the lake appears to be adequate.

Management proposals

Designation of lake

Christiann Lake is in the "all other lakes" classification. This designation seems proper in view of the findings of this survey.

Stocking

Stocking of all fish in Christiann Lake should be discontinued. Spawning facilities are adequate for the species in the lake to maintain their present condition which is suitable. It is believed that the few bluegills, perch and largemouth bass that have been planted from year to year are of little or no value in increasing the fish population beyond the possibilities of natural spawning, however, in the future if it is found by subsequent investigation that these plantings are necessary, they can be resumed.

Predators and parasites

Turtles, bitterns and water snakes were found by the survey party, however, the effect of these predators is not known to be serious. The only important predation is caused by gars and dogfish and there is no evidence that they do any harm to the lake, in fact, they may be beneficial in controlling the size

of the fish population. No control measures are recommended.

Tapeworms were found on the ovaries of one largemouth bass. Other infestations were not noticed and it is believed that parasitism is slight. There is no satisfactory control of the bass tapeworm.

Shelter

Vegetation provides sufficient shelter in Christiann Lake.

Regulation of water level

No additional regulation is believed necessary.

Improvement of spawning facilities

Spawning conditions are not the best for bluegills and other centrarchids but it is known that they will utilize less favorable conditions sufficiently to meet needs. No improvement is believed necessary.

Other recommendations

Considering the close connection of Juno and Painter Lakes with Christiann, proper management of one of this group cannot be determined definitely without considering the other. All of the lakes in the chain should have been surveyed at the same time but this was not possible when Christiann Lake was studied. However, nothing is known concerning this chain which would cause any doubt as to the validity of the recommendation made in the report. When possible the survey of this chain should be completed.

INSTITUTE FOR FISHERIES RESEARCH

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