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A FISHERIES SURVEY OF CRAIG, MORRISON, RANDALL'S, NORTH, CEMETERY,  
SOUTH AND MESSENGER LAKES, BRANCH COUNTY

By

Louis A. Krumholz

Introduction

Location and Drainage

This series of seven lakes is located in Girard and Coldwater townships in the north central part of Branch County near the city of Coldwater. The specific locations of these lakes in their north to south positions are as follows:

<u>Lake</u>	<u>Township</u>	<u>T.</u>	<u>R.</u>	<u>S.</u>
Craig	Girard	5 S.	6 W.	29, 32
Morrison	Girard and Coldwater	5-6 S.	6 W.	32, 5
Randall's	Coldwater	6 S.	6 W.	5, 8
North	Coldwater	6 S.	6 W.	8, 17
Cemetery	Coldwater	6 S.	6 W.	17
South	Coldwater	6 S.	6 W.	17, 20
Messenger	Coldwater	6 S.	6 W.	17, 19, 20

The Coldwater River enters South Lake, flows through it and the rest of the lakes in the chain and flows out of Craig Lake approximately eight miles above its outlet into the St. Joseph River at Union City. South Lake also receives a tributary from Marble Lake. This tributary is utilized by the city of Coldwater as a sewage canal. The drainage area is about 150 square miles.

Morrison and Craig Lakes are accessible by following Grand St., a good black-top road, north out of Coldwater for three and four miles respectively. This road passes within 100 yards of the east shore of these lakes. The west shore of Craig Lake is accessible by paying a small toll to the property owner. Randall's Lake may be reached by turning to the left from the Morrison Lake road at "The Narrows." This also affords access to North and Cemetery Lakes. The last three lakes may also be reached from U. S. Highway 112 at the west edge of Coldwater or from the gravel road along the west side of the lakes by permission of the property owners. South and Messenger Lakes are accessible from U. S. Highway 112 at the west edge of Coldwater.

### Acknowledgments

Craig, Randall's, North and Cemetery Lakes were mapped, sounded and biological inventories taken during the summer of 1938 by members of the Institute for Fisheries Research. Morrison, South and Messenger Lakes were mapped by a winter mapping party of the Institute for Fisheries Research in January, 1941. Fish collections were taken by a party from the Institute for Fisheries Research in May, 1941, and a biological inventory was made by a survey party from the Institute for Fisheries Research in July, 1941.

Preliminary surveys were conducted on Morrison, Randall's, North and South Lakes in May, 1927, by Messrs. Langlois and Bauer. They were assisted by Conservation officer C. G. Cole.

Many of the residents of nearby Coldwater have taken considerable interest in the fisheries of this series of lakes. The late Conservation officer C. G. Cole was quite active in these matters as were various members of the Craig Lake Club.

### Past and Present Use

For the past 45 years these lakes have provided a source of marl for the cement company located on the southern shore of South Lake. This industry has been supported by the deposits in this chain of lakes and at present there is no evidence of discontinuing the removal of such deposits. Needless to say, the dredging has had a profound effect upon the size and shape of the lakes. Barges are constantly towed back and forth from the present site of excavation in North Lake to the cement factory during the periods of open water.

Of the seven lakes under consideration, Morrison is by far the most highly developed for recreation. Due to the swampy terrain on the south and west sides of the lake, the development is confined to the high, wooded shores of the north and east sides. There are over 90 cottages and permanent homes in this area together with a store, gasoline station and boat livery. The other lakes are not so highly developed. On Craig Lake there are five cottages, two boat liveries and the Craig Lake Club. At the north end of Randall's Lake there is a resort development known as "The Narrows" which consists of about 15 cottages, a golf course and a boat livery. There is little resort

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▽ The mapping and survey party consisted of: Robert C. Ball, leader; Walter R. Crowe, Paul H. Eschmeyer and Arthur Whiteley, assistants.

▽ The mapping party consisted of: Lee Anderson, leader; Richard Wilson and Royal Howe, assistants.

▽ The party consisted of: W. C. Beckman, leader; Lee Anderson, Raymond Buller and Donald Thomas, assistants.

▽ The survey party consisted of: John Funk, leader; E. W. Roelofs and Stanley Lievens, assistants.

development on North and Cemetery Lakes although they are easily accessible from "The Narrows" and from the boat livery and Tourist park at the north end of South Lake. There are no cottages nor any resort development directly on South and Messenger Lakes. However, these two lakes, especially South Lake, are much used because they are just at the west edge of Coldwater and the tourist park and boat livery provide ready access. Many private owners tie their boats at the tourist park beach. The Great Lakes Greyhound Business have a depot in the large restaurant where U. S. Highway 112 crosses the Coldwater River. There is at least one other resort just west of the river from the bus depot. The Department of Conservation has purchased a public fishing site at the north end of Randall's Lake.

All of these lakes are rather heavily fished and the fishing is considered to be moderately good. The winter fishing is considered very good in Craig, Randall's, North and Cemetery Lakes whereas the summer fishing on these lakes is considered to be only fair. People who have fished these lakes regularly say that the fishing has fallen off considerably in the past few years. Recently the local people have complained of the poor ice-fishing on Morrison Lake. These lakes are of potentially great importance as public fishing water as is shown by their past records.

### Physical Characteristics

#### Geological Origin

These lakes were probably formed as depressions in the outwash apron of the Tekonsha moraine of the Saginaw Lobe (Wisconsin stage).

#### Shape of Basin and Extent of Drainage

The chain of lakes extends in a direct north and south line for about five and one-half miles. As previously stated the Coldwater River enters at the south end of the chain and has its outlet at the north end leaving the impression that these lakes are merely widened out portions of the river. Morrison Lake is the largest of the chain and is irregular in outline. The other basins are oblong with their long axes in a north south direction. There are several small streams which enter the chain from the wooded slopes to the east. These streams afford drainage for about 15 square miles of country. To the west of the chain is fairly open country under cultivation. The large majority of the shoreline is swampy and brushy in character. This shoreline is interspersed with patches of higher solid ground. The shape of the basins of all of these lakes is more or less subject to change due to the dredging activities of the cement company.

#### Water Fluctuation

Inasmuch as the Coldwater River flows directly through these lakes and the channels between the lakes are wide and deep, there is little

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\*Institute Report No. 300. "A Brief Study of Winter Fishing with Hook and Line on Six Branch County Lakes." July 26, 1935. By R. W. Eschmeyer.

water fluctuation. The maximum fluctuation is probably not more than two feet even in extreme periods of drouth or flood.

There are numerous small springs and seven spring fed streams which enter the chain at various points. In addition to the Coldwater River, South Lake receives a tributary from Marble Lake. The only outlet is the Coldwater River into which Craig Lake empties about eight miles above the point the Coldwater River joins the St. Joseph River at Union City.

There are no dams or other obstructions in the Coldwater River.

Physical Data

Some physical characters of each of the seven lakes under discussion are given in Table I.

TABLE I

Some Physical Characters of Seven Branch County Lakes

Lake	Area (acres)	Maximum Depth (feet)	Shore Develop- ment	Dominant Bottom Types	Color of Water	Transparency (Secchi disc in feet)
Craig	122	25	2.9	fibrous peat and marl	light brown	5
Morrison	288	46	1.9	fibrous peat muck and marl	clear	10
Randall's	220	35	} 2.7	marl	brown	6
North	228	35		marl	brown	6
Cemetery	65	20		marl	brown	6
South	118	18	2.6	fibrous and pulpy peat and marl	brownish	5½
Messenger	54	16	1.5	marl	brownish	8

Shore development means the number of times the lake shoreline is longer than that of a circular lake of the same area. The relatively high shore-line development on these lakes is evidence of many bays and cover where productivity is greatest.

Wave and ice action have little damaging effect on the swampy shoreline. The Coldwater River keeps the channels between the lakes open the year round except in extremely cold weather.

Discussion of Physical Factors in Relation to Fisheries

The numerous bays and heavy vegetation in all of these lakes provide ample cover for fish. Although marl is abundant in all the lakes the weed beds are very dense and extensive. The shallower parts of the lakes, although

lacking in extensive sand and gravel beds, provide ample spawning grounds for all species of fishes in the lakes. Centrarchids have been seen spawning in all of the lakes and there are suitable spawning places for northern pike. Whereas the general physical characters of the lakes are adapted to all species of fish present, the turbidity, increased by the dredging operations, is definitely a limiting factor.

### Temperature and Chemical Characteristics

#### Temperature

The current set up by the Coldwater River more or less precludes the presence of a thermocline (the zone of rapid temperature change) in most of these lakes. The survey party found no thermocline in Messenger, South, Cemetery and North Lakes. In Randall's Lake the thermocline was present in the bottom eight feet of water in Randall's Cove (northwest bay) where the current of the river has little influence. The thermocline in Morrison Lake was present out in the middle of the lake at a depth of 20 to 32.5 feet. The current of the river probably also has little effect on the thermal stratification of Morrison Lake due to its size, depth and shape of the basin. In Craig Lake there was a thermocline present in the isolated southeast bay at a depth of 9-18 feet. No thermocline was present in that part of the lake affected by the main current of the river, although the water was deeper than in the bay.

#### Chemical Conditions

At the time the lakes were surveyed there was a marked depletion of dissolved oxygen below a depth of 10-12 feet in all of the lakes except Morrison. In Morrison Lake there was ample dissolved oxygen to a depth of 20 feet. In the surface waters of all the lakes the samples showed from 8.8 to 11.3 parts per million of dissolved oxygen whereas at 10-12 feet the samples showed from 3.1 to 8.8 parts per million. Only Morrison and Messenger Lakes had sufficient oxygen available for fish life (4 p.p.m.) at 15 feet. At this depth the samples showed from 0 to 3.4 parts per million of dissolved oxygen in the other five lakes. This depletion of dissolved oxygen is probably due to the enormous deposits of peat in these lake beds. At the outlet of the tributary from Marble Lake, which is used as a sewage disposal canal, there were only 2.8 parts per million of dissolved oxygen.

All of these lakes are considered as "hard water lakes," the methyl orange alkalinity range is 155 to 231 parts per million. Only at one station (outlet of cement plant) was the water only moderately hard (M.O. alkalinity - 113 p.p.m.).

The hydrogen ion concentration (pH) was decidedly alkaline in all of the lakes (7.1-8.4). Generally moderately hard, alkaline lakes are more productive than soft, acid waters.

#### Pollution

The only evidence of pollution was in the tributary from Marble Lake which flows into South Lake. This stream is used in sewage disposal from

the city of Coldwater. At times the surface of the southern end of South Lake is covered with a film of oil and soot from the tug boats and smoke stacks of the cement plant. In addition there is a small drainage ditch from the cement plant into South Lake which at times carries considerable foreign matter of an unknown black mucky material.

Inasmuch as this relatively small amount of pollution has little deleterious effect on the aquatic life of the lake there is probably no need for control measures. If, however, the amount of sewage and industrial waste dumped into South Lake is increased due to wartime activities it might be necessary to institute control measures.

Discussion of Temperature and Chemical Factors in Relation to Fisheries

Table II indicates the chemical and temperature data from each of the seven lakes under consideration.

TABLE II

Lake	Date	Temperature		Oxygen		M.O.	pH
		Surface	Bottom	Surface	Bottom	Alkalinity range (p.p.m.)	range (p.p.m.)
Craig	6/28/38	73	66	9.5	3.1	162-222	8.4-8.0
Morrison	6/16/41	68	47	8.1	0.0	158-206	8.4-7.1
Randall's	7/9/38	79	58	9.5	0.0	170-231	8.4-7.8
North Cemetery	No specific data for North Lake						
	7/9/38	68	68	6.7	0.0	180-211	8.1-7.9
South	7/5/41	74	65	11.3	3.1	157-184	8.2-7.3
Messenger	7/5/41	76	60	9.9	9.2	155-156	8.4-7.8

\* Thermoclines in the lakes have been discussed previously.

\*\* There is no definite line of demarkation between Randall's, North and Cemetery Lakes.

All of the lakes in the chain are warm water lakes and the surface temperatures are not much greater than those in the deeper parts. This uniformity of temperature and consequent absence of thermoclines is probably due largely to the current of the Coldwater River as it flows through the chain. All of the lakes are "hard water lakes" and quite alkaline. These two characteristics are usually conducive to high productivity. From the above data it is evident that during the summer oxygen is only present in sufficient quantities to maintain fish in the upper layer of water. This condition along with the high temperatures limits the fish life to warm-water species. During the winter the current of the Coldwater River keeps all the channels between the lakes open and this constant aeration furnishes sufficient oxygen necessary for fish. The decomposition of the large amount of peat is probably the cause of the oxygen depletion in the deeper parts of the lakes.

Biological Characteristics

Vegetation

Table III shows the kinds and abundance of the various aquatic plants in each of the seven lakes under consideration.

TABLE III

## Relative Abundance of Vegetation in Each of Seven Branch County Lakes

Common Name	Scientific Name	Abundance						
		Craig	Morrison	Randall's	North	Cemetery	South	Messenger
Water plantain	<u>Alisma Plantago-aquatica</u>	-	-	-	-	-	R	-
Waterweed	<u>Anacharis canadensis</u>	F	F	-	C	-	A	A
Sedge	<u>Carex hystericina</u>	-	-	-	-	-	F	-
Sedge	" <u>Pseudo-Cyperus</u>	-	R	-	-	-	-	-
Sedge	" <u>stipata</u>	-	-	-	-	-	R	-
Sedge	" <u>sp.</u>	R	-	-	-	-	-	-
Coontail	<u>Ceratophyllum demersum</u>	A	A	A	A	A	A	A
Water Willow	<u>Decodon verticillatus</u>	F	F	-	-	-	C	C
Spike rush	<u>Eleocharis calva</u>	-	F	-	-	-	C	F
Spike rush	" <u>Smallii</u>	-	-	-	-	-	A	-
Spike rush	" <u>sp.</u>	-	-	C	-	-	A	-
Scouring rush	<u>Equisetum fluviatile</u>	-	-	-	-	-	R	-
Water star grass	<u>Heteranthera dubia</u>	-	R	-	-	-	F	-
Water pennywort	<u>Hydrocotyle umbellata</u>	-	-	R	-	-	-	-
Iris	<u>Iris versicolor</u>	C	-	-	-	-	-	-
Lesser Duckweed	<u>Lemna minor</u>	-	-	-	-	-	C	-
Water milfoil	<u>Myriophyllum exalbescens</u>	-	-	F	C	F	C	-
Water milfoil	" <u>heterophyllum</u>	-	-	-	-	-	-	C
Water milfoil	" <u>sp.</u>	C	C	-	-	-	A	-
Bushy pondweed	<u>Najas flexilis</u>	-	R	R	R	-	C	C
White water lily	<u>Nymphaea odorata</u>	A	A	C	C	C	C	C
Yellow water lily	<u>Nuphar advena</u>	A	C	C	A	A	A	A
Arrow Arum	<u>Peltandra virginica</u>	F	F	C	C	F	F	-
Reed grass	<u>Phragmites maximus</u>	-	-	-	-	R	R	-
Smartweed	<u>Polygonum coccineum</u>	F	-	C	C	C	R	F
Smartweed	" <u>natans f. genuinum</u>	-	-	-	-	-	R	R
Smartweed	" <u>sp.</u>	F	F	F	-	-	-	-
Reed canary grass	<u>Phalaris arundinacea</u>	-	-	-	-	-	R	R
Large-leaf pondweed	<u>Potamogeton amplifolius</u>	-	-	R	-	-	-	-
Pondweed	" <u>angustifolius</u>	R	R	-	-	-	-	-
Pondweed	" <u>Friesii</u>	-	C	C	A	A	A	A
Pondweed	" <u>longiligulatus</u>	C	-	-	-	-	-	-
Floating brownleaf	" <u>natans</u>	F	-	-	-	-	-	-
Sago pondweed	" <u>pectinatus</u>	C	C	A	A	A	A	A
Whitestem pondweed	" <u>praelongus</u>	-	-	-	-	-	-	-
Clasping-leaf pondweed	" <u>Richardsonii</u>	F	F	F	F	F	C	C
Flat-stemmed pondweed	" <u>zosteriformis</u>	F	F	F	-	-	-	-
Pondweed	" <u>lucens</u>	F	-	-	-	-	-	-
Stiff Water Crowfoot	<u>Ranunculus longirostris</u>	-	-	-	-	-	F	-
Crowfoot	" <u>sceleratus</u>	-	-	-	-	-	R	-
Swamp dock	<u>Rumex verticillatus</u>	-	-	-	-	-	R	R
Wapato	<u>Sagittaria latifolia</u>	R	R	R	-	-	R	R
Hardstem bulrush	<u>Scirpus acutus</u>	-	C	-	-	-	-	-
Three-square	" <u>americanus</u>	-	-	C	C	F	-	R
Softstem bulrush	" <u>validus</u>	-	F	-	-	-	F	F
Bulrush	" <u>sp.</u>	C	-	C	F	-	-	-
Bur Reed	<u>Sparganium eurycarpum</u>	-	F	-	-	-	F	F
Bur Reed	" <u>sp.</u>	-	-	F	F	-	F	-
Big Duckweed	<u>Spirodela polyrhiza</u>	F	C	C	C	C	C	C
Narrow-leaved Cattail	<u>Typha angustifolia</u>	-	-	-	-	-	F	-
Common Cattail	" <u>latifolia</u>	-	C	C	C	C	C	-
Bladderwort	<u>Utricularia vulgaris var.</u>							
	" <u>americana</u>	F	-	-	-	-	-	F
Bladderwort	" <u>purpurea</u>	-	-	-	F	-	-	-
Wild celery	<u>Vallisneria americana</u>	-	-	-	-	-	-	R
Musk grass	<u>Chara sp.</u>	A	A	A	A	C	C	C

A - abundant C - common F - few R - rare

Identifications by Betty Robertson Clarke.

Such an abundance of plants is considered a criterion of high productivity. Certainly these plants furnish ample support and food for fish food organisms and also sufficient spawning facilities as well as shelter for the young fish.

### Fish Foods

Collections of plankton (very small free-floating organisms) indicated that this form of fish food was abundant in all lakes at the time of sampling. Such a few collections, however, do not give a reliable picture for the lake as a whole because of great fluctuations in the number and distribution of such organisms. These minute animals and plants constitute most of the food of the young fishes and of the larger fish-food organisms. Even certain adult fish, viz bluegills, use them to a considerable degree.

The bottom fauna (organisms which inhabit the lake bottom) were moderately abundant in all of the lake at the time of collection. However, in these lakes, when there is a dearth of dissolved oxygen at depths greater than fifteen feet, the bottom dwelling organisms would be more or less unavailable to the fishes especially during the warmer months of the year. It must be remembered, however, that these bottom organisms are probably also present in the regions where there is sufficient oxygen for fish life and thus constitute an important part of the food supply. The most abundant bottom organisms in these lakes were amphipods (scuds) and chironomids (midge larvae).

Forage fish are present in abundance in all of the lakes. These are listed in Table IV along with the other fishes.

### Fish Present

A list of the kinds of fishes collected by the survey parties and their relative abundance is given in Table IV. The stocking records embrace all fish planted from 1933 to 1941 inclusive.

There is no doubt that the bluegill is the most abundant game fish, as well as the most sought after by anglers, in the entire chain of lakes. The perch is probably the next most abundant game fish. Other common game fishes in the lakes are the rock bass, black crappie, largemouth bass, and northern pike.

Bullheads, both brown and yellow, are the most abundant of the coarse fishes taken by anglers. The chub sucker and the common sucker are fairly common and there are a few redhorse (mullet).

Short-nosed gars and dogfish are the two most abundant of the obnoxious fishes although there are also a few long-nosed gar and carp present.

Since 1933 a total of 1,371,200 fish have been planted in the chain of lakes under discussion. Of these there were 80,000 perch, 12,000 smallmouth black bass, 55,200 largemouth black bass and 1,224,000 bluegills.



TABLE IV

Kinds and Abundance of Fishes Taken in Collections at Seven Branch County Lakes

Kind of Fish	CRAIG		MORRISON		RANDALL'S		NORTH		CEMETERY		SOUTH		MESSENGER	
	Abundance	Stocking	Abundance	Stocking	Abundance	Stocking	Abundance	Stocking	Abundance	Stocking	Abundance	Stocking	Abundance	Stocking
<b>GAME FISH</b>														
Northern Pike	C		C		C		C		-		C		C	
Perch	A	20,000	C	20,000	A	20,000	C		F	20,000	C		C	
Smallmouth Bass	-		-	4,500	-	5,500	-	1,000	-		-	1,000	-	
Largemouth Bass	A	5,050	A	17,600	A	15,550	F	10,000	A	500	C	5,000	F	1,500
Bluegill	A	225,000	A	257,000	A	240,000	-	187,000	A	185,000	A	130,000	A	
Pumpkinseed	C		F		C		-		F		A		C	
Rock Bass	F		-		F		-		-		-		R	
Black Crappie	A		A		A		-		C		A		F	
Sunfish Hybrids	F		F		F		-		F		F		F	
<b>COARSE FISH</b>														
Common Sucker	-		-		-		-		-		C		C	
Chub Sucker	F		F		-		F		-		A		A	
Mullet	-		-		-		-		-		F		F	
Brown Bullhead	A		C		F		F		-		A		C	
Yellow Bullhead	C		A		C		-		-		C		C	
Warmouth Bass	C		C		F		-		F		C		A	
Green Sunfish	-		F		-		-		-		-		F	
Long-eared Sunfish	C		-		C		-		-		-		-	
<b>OBNOXIOUS FISHES</b>														
Mud Pickerel	C		F		F		-		-		-		F	
Short-nosed Gar	C		F		F		-		-		C		F	
Long-nosed Gar	-		F		-		-		-		-		-	
Dogfish	C		F		F		-		-		C		F	
Carp	R		-		-		-		-		-		-	
<b>FORAGE FISHES</b>														
Pug-nosed Shiner	C		C		F		-		-		-		-	
Black-nosed Shiner	C		-		-		-		-		-		-	
Black-chin Shiner	C		C		-		-		-		-		-	
Spot-tail Shiner	-		-		R		-		-		-		-	
Common Shiner	F		-		F		-		-		F		F	
Golden Shiner	F		C		C		-		-		C		C	
Blunt-nose Minnow	-		F		C		-		-		-		-	
Mud Minnow	C		-		-		-		-		-		-	
Menona Killifish	-		F		-		-		-		-		-	
Starhead Top-minnow	F		-		-		-		-		-		-	
Log Perch	R		R		C		-		-		-		-	
Johnny Darter	-		R		F		-		-		-		-	
Iowa Darter	C		F		F		-		-		-		-	
Silverside	C		-		F		-		-		-		-	
Brook Stickleback	-		F		-		-		-		-		-	

The collections taken by the survey parties in Cemetery, Randall's, Morrison and Craig Lakes were augmented by netting operations for population and marking studies in May and June, 1941.

A - abundant, C - common, F - few, R - rare.

Fish Movement

There is considerable movement of the fish from one lake to another in this chain. In 1940 and 1941 fish of various species were tagged in conjunction with population studies. The return of these tags from fish caught by anglers indicates that fish move freely from one lake to another. The channels connecting the lakes are wide and deep enough to allow free movement back and forth between the lakes. There does not seem to be either a definite upstream or downstream movement. The data on these tag recoveries will be included in another report.

The population studies indicate that there is movement of fish in and out of Craig Lake. Although there has been a heavy winter fishing pressure on this lake for many years the numbers of fish large enough to be caught by the net decreased from 48,500 in June, 1940 to 32,500 in November, 1940. Our creel census records for Craig Lake for the summer of 1940 show only 6,140 fish taken from June 25 to October 15. These data on population studies will also be included in a later report.

Creel Census

General creel census records taken on each of the seven lakes are abundant enough to be of considerable value as an indication of the quality of fishing in these waters. All of these records were taken by the late C. G. Cole who was Conservation officer for Branch County for many years prior to his death in 1942. The fishing in these Branch County lakes as shown by the creel census is much higher than the average for the state. Table V gives a summary of the creel census on each of these lakes since 1930.

TABLE V

Summary of General Creel Census for Seven Branch County Lakes  
1930 to 1941 inclusive

Name of Lake	No. of Anglers	Total Hours Fished	Legal Fish Caught	Catch per Hour	Percentage of Bluegills in Catch
Craig	333	1,047.50	2,768	2.6	89.5
Morrison	569	1,417.25	4,134	2.9	88.8
Randall's	221	786.00	2,041	2.6	82.0
North	599	2,268.75	7,381	3.3	85.0
Cemetery	299	1,145.25	3,932	3.4	82.4
South and Messenger	227	836.50	2,247	2.7	86.7
Total or Average	2,248	7,501.25	22,503	3.0	85.7

In the general census reports for 1940 and 1941 the average catch has been 1 fish per hour for all waters. However, in District 9, which includes Branch County, the catch has been 1.3 fish per hour for both 1940 and 1941

as shown by the general census. In an earlier Institute report<sup>✓</sup> on the winter fishing in six Branch County lakes, the fishermen on Craig, North and Cemetery Lakes experienced a catch of 6.7, 6.5 and 7.2 fish per hour respectively. In another report<sup>✓</sup> the data shows that on Craig Lake alone 2,478 fishermen caught a total of 22,215 fish during the entire winter fishing season, an average of 2.6 fish per hour.

An intensive creel census was in operation on Craig Lake for three years. Also, there have been studies on the population of the legal-sized fish through netting operations<sup>\*\*\*</sup> carried on at Craig Lake and all of these data so gathered will constitute the material for a separate report.

#### Growth Rate of Game Species

Table VI shows the age, length and weights of game fishes collected at various times in the seven lakes under consideration. The collections made by the survey parties were augmented by the netting operations in May-June 1941. Because of this extensive netting the material for growth studies is especially good for most species particularly for Craig Lake.

From this table it is evident that most of the fishes in the chain of lakes grow only slightly slower than the average for the state. This is in line with the findings<sup>\*\*\*\*</sup> in an earlier report on the growth of bluegills in Craig Lake.

#### Natural Propagation

The adult fish in the seven lakes being discussed have ample spawning facilities in each of the lakes. This is borne out by the presence of large numbers of young of the year fish of all species seen and collected during the summer months. There are not, however, spawning areas which can be utilized by the smallmouth black bass, whose introduction has been attempted several times.

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<sup>✓</sup>"A Brief Study of Winter Fishing with Hook and Line on Six Branch County Lakes." Institute for Fisheries Research Report No. 300. By R. W. Eschmeyer.

<sup>✓</sup>"Report on the Intensive Winter Census on Eight Lakes in Southern Michigan, 1938-1939." Institute for Fisheries Research Report No. 540. By O. H. Clark.

<sup>\*\*\*</sup>The netting crew consisted of R. D. Van Deusen, in charge; Ralph Curl and Donald Curl, net operators.

<sup>\*\*\*\*</sup>"The Age and Growth of the Bluegill from Six Michigan Lakes." Institute for Fisheries Research Report No. 649. By William C. Beckman.

TABLE VI

Age, Length and Weight of Game Fish Collected in Seven Branch County Lakes

Kind of Fish	Age	CRAIG LAKE			MORRISON LAKE			RANDALL'S, NORTH AND CELETERY LAKES			SOUTH LAKE			MESSENGER LAKE			MICHIGAN AVERAGE
		Number	Average Length (inches)	Average Weight (ounces)	Number	Average Length (inches)	Average Weight (ounces)	Number	Average Length (inches)	Average Weight (ounces)	Number	Average Length (inches)	Average Weight (ounces)	Number	Average Length (inches)	Average Weight (ounces)	
Northern Pike	I	5	19.3	23.2							2	17.8	19.0	3	14.9	10.3	
	II	23	21.8	34.9							21	22.8	42.0	8	23.2	26.7	
	III	9	27.8	65.6							4	27.3	82.0	2	25.3	62.0	
	IV	4	30.3	75.0	2	25.0	49.9				1	31.7	108.0	1	27.8	72.0	
	V	2	31.0	-	3	26.9	63.0										
	VI				2	27.6	74.4										
	VII	1	40.5	256.0	3	32.2	130.8										
	VIII				2	33.4	157.7										
Perch	I	7	4.1	0.7	23	3.2	0.2	2	3.7	0.4							4.7
	II	35	5.9	1.6	40	5.4	1.0	14	5.8	1.5	8	5.6	1.1	4	5.6	1.1	6.2
	III	22	7.0	3.0	27	6.4	1.8	4	8.0	3.6	7	6.3	1.4	11	6.7	2.1	7.1
	IV	5	8.3	3.9	10	7.1	2.5	4	8.9	5.5	4	8.3	3.6	4	7.6	2.5	7.8
	V	3	9.6	-	7	7.6	2.8	1	9.9	6.9							9.4
	VI	2	8.6	4.4	2	9.0	5.2										10.2
	VII				2	9.7	6.2										10.4
	VIII				1	10.7	9.5										11.3
Largemouth Bass	I	7	4.9	0.9	11	3.8	0.4	2	4.7	0.9							5.5
	II	6	9.0	6.1	3	6.6	2.0	3	7.6	3.3				1	5.8	1.3	8.4
	III	39	10.7	10.6	3	10.1	8.3	4	10.6	8.7	8	10.7	10.1	3	8.1	4.0	10.8
	IV	87	12.2	16.0	1	12.8	15.5	2	11.6	11.6	2	11.9	13.9				12.1
	V	87	13.0	19.4	1	13.9	23.0										13.3
	VI	24	13.8	23.8				2	17.3	79.5	1	13.8	25.0				14.4
	VII	13	15.5	33.3													16.8
	VIII	7	16.1	38.2													-
	IX	3	15.2	32.0													-
	X	1	16.8	-													-
Bluegill	I				26	2.1	0.1							3	2.0	-	3.0
	II	30	5.3	1.8	36	3.6	0.6	6	3.8	0.6	11	3.3	0.4	9	3.5	0.4	4.3
	III	107	5.9	2.7	10	5.8	2.5	1	5.7	2.1	31	5.0	1.4	9	4.7	1.0	5.6
	IV	214	6.7	3.9				6	6.8	3.6	10	7.0	4.0	3	6.1	2.8	6.7
	V	224	7.3	5.3	3	7.9	6.6	1	7.1	3.7	5	7.2	4.6	1	8.5	8.6	7.4
	VI	152	7.6	5.9	2	8.4	6.9	1	7.9	6.0				2	8.6	8.4	7.8
	VII	43	8.0	7.1	3	8.4	6.9	1	7.7	4.8							7.9
	VIII	19	8.4	7.3													8.3
	IX	1	8.9	8.1													8.5
Pumpkinseed	I				3	2.2	0.1	1	2.2	0.2							2.7
	II	8	4.6	1.4	10	4.5	1.2	9	4.3	1.1	4	4.3	1.0	2	3.7	0.5	4.4
	III	30	5.8	2.8	6	5.8	2.6	2	6.1	3.0	33	6.0	3.2	23	4.9	1.7	5.8
	IV	11	6.1	3.0	1	5.8	2.7	1	6.0	3.0	4	6.3	3.5	5	5.7	2.8	6.4
	V	4	6.2	3.5				1	6.6	3.9				2	7.8	7.0	6.8
Rook Bass	I	5	2.2	0.1													3.2
	II	8	4.2	1.0													4.3
	III	11	6.2	3.2													4.9
	IV																5.6
	V													1	6.5	3.0	6.6
	VI	1	8.1	6.3				1	8.1	5.8							8.3
	VII	1	9.7	12.9													8.7
Black Crappie	I	9	3.8	0.4	4	2.8	0.2										5.3
	II	9	6.1	1.9	21	5.9	1.7										5.9
	III	54	7.9	4.4	6	8.2	4.5				26	5.1	1.1	2	5.1	1.0	8.7
	IV	72	9.1	6.3	10	9.5	7.7				8	7.8	3.9	2	6.8	2.3	9.2
	V	17	10.0	10.1	5	9.4	7.2				15	8.4	4.9				9.7
	VI	10	9.5	7.4	3	9.5	7.8				5	9.8	8.0				10.1
	VII	5	11.0	11.5	1	11.2	12.7				1	10.9	12.6	4	10.9	10.6	10.7
	VIII	3	11.6	11.5										2	11.8	14.8	-
	IX	1	11.3	-	1	12.0	16.2										-
	X	1	11.2	-													-

## Management Proposals

### Designation of Lake

These lakes are now in the "all other lakes" group and there is no apparent reason why this designation should be changed.

### Stocking

In the light of the data found on these seven Branch County lakes it is evident that further stocking of any species is of little or no value. The fact that the fish already present in the lake grow at a slightly slower rate than the average for the species throughout the state indicates, from the point of view of present fisheries management, that further stocking may only aggravate this situation. Attempts to establish smallmouth black bass have been unsuccessful in these waters as evidenced by the fact that there have been no reports of this species by hook and line fishermen. All plantings of this species should be discontinued. The available spawning areas throughout the chain of lakes affords ample opportunity for replacement of fish removed by hook-and-line fishing. Also it does not appear desirable to introduce any new species considering the great variety of game and forage fish now present.

### Predators and Parasites

Very few parasites were reported by the survey parties. A few cases of infestation by trematodes and flukes were reported but the infestation is not of sufficient severity to be important.

While terns, great blue herons, kingfishers, snapping turtles, soft-shell turtles, dogfish and gars are known to be present, there is no need of control at the present time. The status of these predators in fish economy is not clearly understood but we suspect they may do more good than harm under most circumstances by removing sick and diseased fish and by controlling the number of small panfish.

### Shelter

Ample shelter is present in all the lakes in the form of submerged and emergent aquatic plants and there is no need for any improvement along this line.

### Regulation of Water Level

Inasmuch as these lakes are more or less widened portions of the Coldwater River the water level is fairly constant. There is no need for control or regulation of water level.

### Improvement of Spawning Facilities

There is ample spawning area for all species native to the chain of lakes and no improvement is necessary.

Other Suggestions

On January 1, 1940 these lakes were closed to out-of-state anglers during the winter time. There is no biological basis for this regulation and our intensive creel census studies have shown that Craig Lake has withstood considerable winter fishing pressure year after year. If the fish are cropped in the winter time, and we harvest most of our other crops in the fall of the year, it will provide more room and food for the fish which will come into being the following spring. We know that some lakes are better winter fishing lakes than others and these lakes have very good reputations for ice fishing. With the cut in travel, due to the war effort, and the probable scarcity of meat in the diet, these lakes might afford both food and recreation for non-resident as well as the resident fishermen.

Following the cessation of stocking of all species of fish in the lakes further collections should be made at intervals to obtain a series of lengths, weights and scale samples to ascertain whether or not the growth-rates of the fish have come up to the state average. Population counts and creel census on Craig Lake would also be desirable at the end of the first five year period of no stocking as a check on this management practice.

INSTITUTE FOR FISHERIES RESEARCH

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