Original: Fish Division
cc: Mr. Ruhl 2-6-40
Copies sent to Lansing for:
Mr. Whiteley - 2-6-40
Mr. J. Marks
Mr. J. McArthur (without recommendations) 2-6-40

INSTITUTE FOR FISHERIES RESEARCH
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ALBERT S. HAZZARD, PH.D.
DIRECTOR

ADDRESS
UNIVERSITY MUSEUMS
ANN ARBOR, MICHIGAN

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THE DOWAGIAC RIVER SYSTEM
ITS TROUT POSSIBILITIES

by

James W. Moffett

The drainage basin of Dowagiac River has been recognized by local sportsmen as potential trout water for many years. Through the efforts of these sportsmen and the State Conservation Department, certain streams of this drainage have been stocked with trout. It is largely due to their interest that an Institute for Fisheries Research survey party was sent to the area to determine the extent of trout water, possible means of improving the fishing and productivity in streams found suitable for these fish. This survey party worked on the drainage during the first fifteen days of August 1939. The party consisted of James W. Moffett, leader; L. D. Wesley and K. E. Goellner, biologists; and Frank Lydell, assistant.

The Dowagiac River valley drains into the St. Joseph River near Niles, Michigan. This valley is mostly swampy muck land underlain with sand and in places, gravel and marl. Extensive drainage projects have been completed and some are still underway to make this muck land tillable. Hence, most of the streams which were once meandering are now straight dredge cuts 5 to 10 feet below their former level. According to local

residents, the water table of the valley has been lowered considerably by these drains. Many springs, some large and constant in their flow, have been dried up or materially lessened in volume. However, water from some of the springs enters the dredge cuts as seepage or by drains from lateral ditches. Water in most of these dredged streams is cold and any warming due to exposure to the sun is usually overcome by springs or seepages along or in the stream bed.

Dredging operations were carried on vigorously up to about 1928. At present, this activity has almost ceased except for occasional cleaning in certain areas. Inquiries made of a number of land owners indicate that too much draining has been done. The upland farmers are especially provoked by the dry condition of their land and some of the muck farmers find their crops endangered in dry seasons because the lowered water table is out of contact with the muck soil and furnishes no moisture whatsoever to growing plants.

The survey party inspected the streams of the watershed and attempted to get information on all probable trout water. Their method of approach consisted of making observations from three general angles; namely: physical, chemical and biological. Physical observations included: temperature readings of both air and water; finding out the average width, depth, average current velocity and volume of water in the stream; recording shade conditions and amount of natural shelter; learning the kind of stream bottom, whether sand, muck, gravel, silt or clay and whether the stream had been dredged or not and if so, the approximate year this was done; finding how the stream was fed, how much its water level changed during an average year, sources of pollution, conditions of immediate shore and surrounding country, likely spawning grounds, whether the streams were open to public fishing, color and turbidity of the water; valuation of

pools on the basis of size, type and frequency. Chemical observations were limited to determining the oxygen content of the water, carbon-dioxide content, bicarbonate and carbonate content (hardness of the water) and the pH (i.e. intensity of acidity or alkalinity of the water). Biological observations included: fish food studies in which quantitative samples of the stream bottom were picked over to find the kind, number and volume of organisms living there; aquatic plant collections and notations on abundance of this vegetation; a study to determine the kinds, abundance, condition and rate of growth of fish in each stream.

Studies of the requirements and habits of trout have shown that these fish need certain things in their environment in order to survive and reproduce successfully. Yearly temperature fluctuation in waters which trout inhabit must be within certain limits. In most streams of Michigan the maximum limit in a safe temperature range is arbitrarily set at 75°F. Temperatures beyond this limit can be tolerated for a short time, but the success of toleration is dependent upon the amount of dissolved oxygen in the water. The higher water temperature goes, the more oxygen is needed for the life processes of fish, and it becomes increasingly difficult for natural waters to hold sufficient oxygen as the temperature rises. The minimum temperature limit is not sharply defined. Trout can remain alive in water almost at freezing point but they do not grow. For good growth, water should not remain below 55°F. for any length of time during summer.

There must be an adequate food supply from which trout can feed. The abundance of this food depends, for the most part, on the type of bottom in streams. Sand doesn't produce as much food per unit area as gravel or even muck. Oxygen must be dissolved in the water in rather large amounts (not below 3.0 parts per million). Trout require considerable oxygen in their breathing and that dissolved in the water is the only

available source. More oxygen is required as the water temperature rises. When spawning, trout seek gravel bars or riffles in which to construct their nests. Few, if any of them will use another kind of bottom for this purpose. Brook trout are most particular in this regard. Brook trout appear to spawn successfully only if these gravel areas are supplied with spring or seepage water. Trout are wary fish; they require places in which to hide, and seek shelter. The stream in which they live should offer them good pools in which to rest, and cover in both pools and riffles beneath which they can hide. It is self-evident to everyone who fishes for trout that these fish can't do well in very muddy water, industrial or domestic pollution and in streams with great fluctuations in water level. Trout are often unsuccessful in competition with some of the other kinds of fish. They don't do well when together with bluegills, sunfish, perch, pike or bass; however, in a small, cold stream the advantage is in their favor. Many environmental factors in an aquatic complex contribute to the productivity of that body of water. It was not within the scope of this survey to make tests for such substances as nitrates, phosphates and minerals in solution; neither could a detailed study be made of plankton, algae nor pollution. Even though these factors seem to have no direct influence on trout, they may be very important to the food supply or some other phase of trout life and hence should not be ignored.

The Dowagiac River system is composed of about 105 miles of stream. A rough map of the system accompanies this report and on it are indicated the points where observations were made by the survey party. A series of air and water temperatures was taken at various points on the streams. These temperatures are given in Table 1 and are indicated on the map by numbers. Tributaries to the main stream are designated by Roman numerals. The order of numbering corresponds with a progression from the mouth of the Dowagiac River to its source. This procedure was followed because,

Table 1

Temperature Series of Waters in

the Dowagiac System*

Station Number	July 31, 1939				August 2, 1939			
	Time	Weather	Air	Water	Time	Weather	Air	Water
1	11:00 AM	Clear	77 F	77 F	...	...	...	...
2	11:25 AM	Clear	77	72	...	...	...	...
3	11:30 AM	Clear	77	69	2:15 PM	Cloudy	87 F	70 F
4	11:40 AM	Clear	77	63	...	...	...	...
5	11:50 AM	Clear	78	65	2:00 PM	Cloudy	87	71
6	12:00 M	Clear	...	63	1:45 PM	Cloudy	87	70
7	12:10 PM	Clear	78	63	1:40 PM	Cloudy	87	69
8	12:10 PM	Clear	...	63	...	...	...	...
9	12:30 PM	Clear	...	63	...	...	...	...
10	12:50 PM	Clear	75.5	63	1:30 PM	Cloudy	84	68
11	1:10 PM	Clear	...	72	...	...	...	...
12	1:10 PM	Clear	...	69	...	...	...	...
13	1:10 PM	Clear	...	77	...	...	...	...
14	3:00 PM	Clear	79	66	3:05 PM	Cloudy	79	68
15	3:00 PM	Clear	...	72.5	3:00 PM	Rain	75	73
16	3:10 PM	Clear	79	76	2:45 PM	Rain	82	79
17	3:40 PM	Clear	81	77	...	...	...	...
18	3:55 PM	Clear	...	66	...	...	...	...
19	4:00 PM	Clear	...	78	...	...	...	...
20	4:15 PM	Clear	...	71	...	...	...	...
21	4:30 PM	Clear	77	68	...	...	...	...
22	4:35 PM	Clear	...	66	...	...	...	...
23	4:45 PM	Clear	...	69	...	...	...	...
24	5:00 PM	Clear	...	73.5	10:15 AM	Clear	80	68
25	5:05 PM	Clear	...	63	10:10 AM	Clear	80	59
26	5:13 PM	Clear	76	69	10:00 AM	Clear	80	66
27	5:20 PM	Clear	...	76	9:45 AM	Clear	80	63
28	5:30 PM	Clear	...	70	9:15 AM	Clear	77	62
29	5:45 PM	Clear	...	69	8:45 AM	Clear	77	62
30	5:50 PM	Clear	75	68	8:45 AM	Clear	77	67
31	...	...	...	...	9:30 AM	Clear	80	62
32	...	...	...	...	10:30 AM	Clear	81	70
33	...	...	...	...	11:15 AM	Clear	81	68
33	...	...	...	...	12:10 PM	Clear	85	68
34	...	...	...	...	3:20 PM	Rain	82	68

* Refer to map for location of stations.

in certain instances, the names of tributaries were not known. Whenever the name of a tributary is known, that name accompanies the number on the map. In presenting the data on these streams, the main stream and each tributary will be discussed separately.

THE MAIN DOWAGIAC RIVER

Niles Pond. This pond is formed by a dam 21 feet high erected by the Niles Power Company. Water held by it is used to generate power for the city of Niles. The pond is about one mile long and as wide as the old river bed (50-300 feet). Originally it was as deep as the dam, but deposition of sand and silt by the river has filled it until now the maximum depth is about 13 feet. The dam has no fish-way and acts as a barrier to fish migration upstream. This is serious since rainbow trout runs from Lake Michigan are reported in the St. Joseph and lower Dowagiac Rivers. Water runs over the spill-way of this dam only during the spring run-off or on occasions of heavy flooding. Power operations fluctuate the level of the pond about 2 feet. During the summer this fluctuation is daily because there isn't enough water entering the pond to maintain a level when the generators are running 24 hours a day. Physically and chemically the waters of the pond are suitable for trout. The food supply is rather scarce, but there is plenty of shade and cover. There is no reason why trout should not inhabit the pond, although a 125-foot gill net caught no fish at all in 21 hours. Anglers and the power station attendant report that trout, mostly browns, are occasionally caught, especially in the early part of the trout season. At the time of the survey, only bullheads, sunfish, carp and suckers were being taken.

The main Dowagiac River is dredged throughout it s entire length (18.6 miles) with the exception of about 3/4 of a mile above Niles Pond. The dredge cut, made in 1926-1927, is practically straight and one can see down or upstream for considerable distances. Dredged material is piled high on each bank and although these piles are becoming overgrown with vegetation, there is a minimum of shade over the stream, especially in the lower three sections. In Section 4 shade is adequate. Very little cover is in the stream. Most of its bed is open and clean, just like a canal. Where bridges cross the channel, rock obstructions have been placed in the stream to protect the bridge foundations. Here, pools have been cut by current action and most of the fishing is done in these holes.

The stream bottom is almost exclusively shifting sand. Here and there where openings have been left in the dredged material to allow side streams from the original meandering channel to enter, gravel bars have been washed out into the stream. These bars are always occupied by minnows and some larger fish. Depressions resembling old fish nests were observed in almost every bar. Gravel is derived from the piled dredge banks and a layer beneath the muck which covers the lowland region. Some gravel is exposed in the banks of the stream, but the bottom of the dredge cut is below it. A cross-section of the stream bottom in the lower sections shows muck overlying gravel in the banks and shifting sand in the bottom. Very little gravel is exposed to the stream because the banks are almost vertical to the broad, smooth bottom. The upper section of this stream is devoid of gravel. The muck layer is in direct contact with clean sand. However, the current is somewhat slower and allows silt to accumulate. Where dredging has not been too recent, this silt is overgrown with plants which are good producers of food.

There are very few pools in the stream. When they occur, they are the direct result of obstructions placed in the stream bed to protect bridge abutments, or of gravel bars thrust into the stream from tributaries. The average number of pools is not over 2 per mile. Pools, as such, are usually mid-stream with little or no cover in them. One redeeming feature is their depth which may be from 4 to 8 feet. Good riffles are very scarce. They are present only in placed where gravel bars cross the stream. In a broad sense, the channel is one long, slow riffle of shifting sand, if dredged bottom can be considered as such.

Table 2 shows the physical and chemical data on this stream as taken by the survey party. Examination of this table reveals that the stream carries considerable volume of water which flows along at a rate sufficient to make improvement structures function well. The average widths and depths show that this stream is large enough to produce many fish if other factors were corrected.

The most important and best feature of this stream is the favorable water temperature which prevails throughout its length. Table 2 shows the temperatures of both air and water at stations worked. The water temperature is well below the maximum for trout and is ideal for good growth of these fish. References to Table 1, temperatures stations 1, 2, 3, and 4 shows the effect of springs in cooling this water and keeping it cool. As the water leaves Lake of the Woods, it is much too warm for trout, but after flowing less than a mile, it is cooled to well within the trout range. There is no question about the water of this stream being cold enough for trout.

Chemical features of this stream are ideal. There is the abundance of dissolved oxygen so characteristic of good trout streams (Table 2). Carbon-dioxide, a suffocating gas in high concentrations, is entirely absent, as is usually true in rapid, unpolluted waters. The water is just hard enough to give it that measure of alkalinity conducive to good

Table 2

Physical and Chemical Features of Main Dowagiac Creek and its Tributaries

Sec. No.	Sta. No.	Date 1939	Time of Day	Air Temp. °F.	Water Temp. °F.	Weather	Oxygen ppm.	Carbon dioxide ppm.	Carbonates ppm.	Bicarbonates ppm.	pH	Ave. width ft.	Ave. depth ft.	Velocity ft./sec.	Volume c.f./s.
1	1	8/1	9:20A	75	65	Clear	7.9	0.0	4.0	170	8.0	55.0	2.3	2.27	258.7
	2	8/1	2:30P	83	67	Clear	8.1	0.0	4.0	169	...	...	...	...	...
2	1	8/2	11:00A	81	66	Clear	7.4	0.0	7.0	186	8.0	45.5	1.5	1.4	87.8
	2	8/2	2:30P	82	72	Rain	8.8	0.0	7.0	186	8.0	40.0	1.1	2.0	79.2
3	1	8/3	4:00P	82	73	Clear	8.5	0.0	9.0	173	8.0	34.5	2.0	2.3	123.1
	2	8/3	2:00P	73	69	Clear	7.9	0.0	6.0	192	8.0	30.0	1.2	1.7	55.0
4	1	8/4	9:00A	68	61	Clear	8.0	0.0	4.0	175	8.0	28.5	1.0	1.6	40.1
	2	8/4	11:00A	76	60	Clear	7.9	0.0	4.5	179	8.0	25.0	0.8	1.7	29.7
	3	8/4	1:00P	77	65	Clear	8.9	0.0	5.0	178	8.0	26.0	0.3	1.3	11.4
						Trib. #1, Kinzie Creek									
1	1	8/1	10:20A	76	63	Clear	9.0	0.0	14.0	182	8.0	16.6	0.4	3.1	15.0
	2	8/7	9:45A	74	59	Cloudy	8.3	0.0	7.0	176	8.0	17.3	0.4	1.8	10.2
	3	8/7	10:50A	79	59	Clear	...	...	...	...	...	15.3	0.5	1.6	10.0
2	1	8/7	1:10P	78	64	Cloudy	...	...	...	...	...	12.0	1.0	1.2	11.5
	2	8/7	3:00P	80	62	Cloudy	9.0	0.0	8.0	180	8.0	9.6	0.3	1.3	2.8
						Trib. #2, Pokagon Creek									
1	1	8/2	9:00A	75	67	Clear	8.6	0.0	8.0	211	8.0	24.5	0.7	0.6	9.5
	2	8/11	2:00P	83	61	Overcast	7.4	0.0	2.0	174	7.6	11.3	0.6	1.6	1.6
						Trib. #3, Peavine Creek									
1	1	8/2	1:00P	84	68	Cloudy	7.9	0.0	9.0	142	8.0	11.5	0.4	1.1	4.0
						Trib. #7, Indian Lake Outlet									
1	1	8/9	3:30P	73	73	Clear	6.2	0.0	1.0	123	7.6	12.0	0.3	0.7	2.3
						Trib. #8									
1	1	8/9	1:30P	73	68	Clear	6.3	0.0	1.0	194	7.8	8.5	0.8	1.1	6.7
						Trib. #9, Outlet of Magician Lake									
1	1	8/9	11:30A	70	68	Clear	6.7	0.0	1.0	127	7.6	19.0	0.6	1.3	13.3
						Trib. #10, Pine and Cook Lake Outlets									
1	1	8/9	9:45A	68	63	Clear	7.0	0.0	1.0	188	7.8	11.0	1.0	1.4	13.8
						Trib. #13, Wilson Creek									
1	1	8/8	11:30A	82	63	Cloudy	6.9	0.0	2.0	128	7.6	12.0	0.5	1.7	8.3
						Trib. #14									
1	1	8/8	1:30P	82	74	Cloudy	7.0	0.0	5.0	154	8.0	5.0	0.2	2.0	1.5
						Trib. #15, Glenwood Creek									
1	1	8/8	4:00P	77	65	Cloudy	6.9	0.0	2.0	188	7.6	7.0	0.5	1.3	4.1

~~to good~~ production of food and fish. This alkalinity is uniform throughout, as is shown by the pH reading of 8.0.

Biological features of the main Dowagiac River are presented in Tables 3 and 4. Aquatic plants are very scarce or entirely lacking in the lower three sections, but are common in the upper or fourth section. Although rooted aquatic plants are not absolutely necessary in trout streams, their presence offers food organisms a place of attachment and consequently they become excellent producers of fish food. Some organisms eat them as food. Their presence in this stream is especially important because of the poor bottom conditions.

Bottom organisms are almost lacking in the shifting sand bottom. Inspection of Table 3 shows this sand to be practically barren in the lower sections of the stream. However, farther upstream, where the current is not so strong and silt has a chance to accumulate, more organisms per unit area are present. Those few plots of gravel, mentioned previously, produce a fairly good supply of food organisms in contrast to the sand. Food conditions are not regarded as good in this stream as they exist at present, but could be greatly improved by installation of devices which would accumulate silt or expose gravel beds.

The fish population of Dowagiac River is shown in Table 4. The dominant fish are creek chubs and common shiners. Of the game fish, only rainbow and brown trout are abundant enough to be considered. Conversation with local sportsmen indicates that good catches of both kinds of trout are taken during the early season but that during mid-summer, fishing is not very good and therefore fishing is light. Fishing by members of the survey party substantiated these reports. Some very large brown trout are caught according to local anglers. Forage fish are present around gravelly and vegetation areas, but seining operations were not extensive enough to venture an estimate of their abundance.

Table 3

The Kinds and Abundance Per Square Foot of Bottom-inhabiting Fish Food Organisms Found in the Dowagiac River System

Name of Stream	Section No.	Station No.	Date 1939	Mayflies	Stoneflies	Midges	Oligochaeta	Other Diptera	Odonata	Beetles	Caddisflies	Shrimps (Amphipoda)	Water Mites	Dobson Flies	Mollusca	Leeches	Planaria	Volume in cc.	Bottom type
Dowagiac Creek	1	1	8/1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	None	Sand
		2	8/1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	None	Sand
	2	1	8/2	1.5	-	3	0.5	-	-	-	-	-	-	-	-	-	-	Trace	Sand
		2	8/2	0.5	-	1.5	-	0.5	-	-	-	-	-	-	-	-	-	Trace	Sand
	3	1	8/3	-	-	3	24	-	1	-	-	-	-	-	-	-	-	0.5	Sand
				7	1	7	-	-	-	5	59	1	1	-	-	-	-	0.5	Gravel
		2	8/3	-	-	3	-	-	-	-	-	-	-	-	-	-	-	Trace	Sand
	4	1	8/4	-	-	4	-	-	-	2	-	1	-	-	-	-	-	Trace	Sand
				8	-	3	-	-	-	4	7	7	-	1	-	-	-	0.9	Gravel
		2	8/4	-	-	1.5	-	-	-	-	-	-	-	-	-	-	-	Trace	Sand
		3	8/4	-	-	1	3	-	-	-	-	-	-	-	1	-	-	Trace	Sand
Kinzie Creek	1	1	8/1	-	-	3	3	-	-	-	-	1	-	-	-	-	-	Trace	Gravel
Trib. #1		2	8/7	3	1	2	-	4	-	1	44	1	-	-	-	1	-	0.2	Gravel
		3	8/7	2	3	13	-	9	-	3	-	2	-	-	-	-	-	0.1	Gravel
				6	9	6	-	13	-	9	5	1	-	-	-	1	-	0.1	Gravel
	2	1	8/7	-	-	16	1	18	-	1	1	-	-	-	-	1	-	0.1	Sand and gravel
		2	8/7	4	-	13	-	5	-	2	5	15	-	-	-	-	-	0.2	Sand and gravel
Pokagon Creek	1	1	8/2	-	0.5	1	1.5	-	-	-	-	5	-	-	-	-	-	Trace	Gravel
Trib. #2		2	8/11	2	-	-	-	-	-	-	2	4	-	-	1	-	2	Trace	Gravel
Peavine Creek Trib. #3	1	1	8/2	-	-	2	1	-	-	-	-	-	-	-	-	-	-	Trace	Sand and gravel
Indian Lake Outlet Trib. #7	1	1	8/9	-	-	1	21	-	-	-	-	-	-	-	-	2	-	0.6	Silt and sand
Trib. #8	1	1	8/9	-	-	94	2	3	-	3	4	13	-	-	1	-	-	0.1	Sand and silt
Magician Lake Outlet - Trib. #9	1	1	8/9	1	-	9	19	13	-	-	-	96	-	-	7	1	-	0.9	Silt and gravel
Trib. #10	1	1	8/9	-	-	13	2	3	-	2	-	-	-	-	-	-	-	0.2	Muck and sand
Trib. #13	1	1	8/8	0.5	-	0.5	0.5	2.5	-	-	3.5	2	-	-	-	-	-	0.05	Sand
Trib. #14	1	1	8/8	-	-	-	-	1	-	3	-	-	-	-	1	-	-	Trace	Sand
Trib. #15 Glenwood Creek	1	1	8/8	2	-	2	3	2	-	5	5	6	-	-	-	1	-	0.8	Silt and sand

Table 4

Fish Distribution and Stocking Records for the Dowagiac River System

Name of stream	Section No.	Station No.	Date 1939	Fish taken or reported: Rainbow trout	Brown trout	Brook trout	Bluegill	Mud pickerel	Sunfish	Common sucker	Yellow bullhead	Creek chub	Common shiner	Sand shiner	Blunt-nosed minnow	Johnny darter	Iowa darter	Black-sided darter	Muddler	Silversides	Carp	Yellow stone cat	Mud minnow	Stocking Records - Totals for year: 1934	1935	1936	1937	1938
Dowagiac Creek	1	1	8/1	x	x		x	x		x	x	x	x	x	x	x	x	x	x	x	x			No stocking in this section				
		2	8/1					No seining																				
	2	1	8/2	x	x			x	x	x		x				x			x		x							
		2	8/2					No seining																1000B*	3000B	...	2600B	1200B 2500R
	3	1	8/3					No seining																3900B	5400B	26442B		2400B
		2	8/3	x	x							x	x									x		500R			1000R	4000R
	4	1	8/4	x	x			No seining																4000B	2900B	24000B	3600B	1500B
		2	8/4	x	x			No seining																500R			1500R	2000R
		3	8/4	x	x			No seining																				
Kinzie Creek Trib. #1	1	1	8/1	x	x					x		x				x			x					500B	1500B	1000B	1200B	750B
		2	8/7	x	x					x		x	x											1450R			1000R	2000R
		3	8/7	x	x			No seining																				
	2	1	8/7	x	x							x												-	-	8000B	-	750B
		2	8/7	x	x			No seining																				
Pokagon Creek	1	1	8/2	x	x	x																		1000B	3000B	11000B	2000B	1500B
Trib. #2		2	8/11					No seining																2000Br	1000Br	2400Br 1000R	1400Br	1000Br
Peavine Creek																												
Trib. #3								No seining																No stocking in this stream				
Trib. #7								No seining																No stocking in this stream				
Trib. #8								No seining																No stocking in this stream				
Trib. #9								No seining																No stocking in this stream				
Trib. #10						x		No seining																1000Br	5000Br	600Br	-	-
Trib. #13								No seining																No stocking in this stream				
Trib. #14								No seining																No stocking in this stream				
Trib. #15 Glenwood Creek	1	1	8/8	x		x																x		1500Br	1000Br	1100Br	1200Br	2000Br

B = Brown trout; R = Rainbow trout; Br = Brook trout.

Stocking records for the last five years are included in Table 4. Some of the trout planted were only 4-months old, but the age of the majority was between 7 months and 1 year.

All the land along Dowagiac River is privately owned. That property immediately adjoining the stream is put to no use in most instances because of the dredge piles. Some areas are pastured, but these are very limited. According to local sportsmen, there is no objection by property owners to public fishing on this stream. Should improvements in the stream better the fishing and thus attract more fishermen who are not so considerate of other people's property, the problem of free accessibility to the public will surely become acute as it has in other areas.

In summarizing the data on Dowagiac River, there can be no question as to its suitability for trout, especially browns and rainbows when one considers the temperature and chemical features of the water. It is remarkable that a stream so far south in the state maintains such ideal water temperatures. This feature alone offers good promise that, with judicious improvement, Dowagiac River can be made much more productive than at present. In its present condition, this water is poorly suited to the successful culture of any fish. Growing trout in Dowagiac Creek is like trying to raise a good agricultural crop in the Sahara Desert. Except for the few holes and gravel riffles, which might be compared to oases, the remainder of the creek is almost useless in its present condition.

Improvements can be made in the stream with very little effort. In fact, any improvement devices placed in the stream would better its condition. In most places, material for improvement structures is plentiful but permission for its use and for installation must be secured from riparian owners. Conversation with Commissioner Whiteley, Mr. Joe McArthur, and other sportsmen in Dowagiac, left no doubt that

they are anxious to have a project started and are willing to cooperate whole-heartedly in arranging for such work to be done. Mr. McArthur reports that some property owners along the stream have been contacted and nearly all of them have expressed their willingness to allow such a project to be carried out on their parts of the stream. It is advised that structures placed in the stream be of a sort which will not cause bank erosion. Structures which best accomplish digging with a minimum of bank erosion are V deflectors, Y deflectors, underpass deflectors, rock or log dams and small A type or isolated boulder deflectors. Wing deflectors projecting a short ways from the bank do considerable digging and do not erode the banks to any great extent. These structures are described in "Methods for the Improvement of Michigan Trout Streams," by Carl L. Hubbs, John R. Greeley and Clarence M. Tarzwell, Bulletin No. 1, Institute for Fisheries Research, University of Michigan Press. V and Y type deflectors concentrate the water in the middle of the stream causing a central hole with bars on each side to be formed. Underpass deflectors force the stream current under them and cause digging from the bottom. Rock or log dams create a hole below them with quiet water above. Small A type deflectors and isolated boulders create holes at each side of them and a small bar downstream. Cover logs and bank covers described in the bulletin should accompany these current-modifying structures to give some protection to trout occyping the holes formed and to assist in preventing bank erosion.

Obstructions placed in the stream must be strong enough to withstand a water level fluctuation of 4-5 feet. Gravel, which is generally abundant on the dredge banks, should be put back into the stream wherever possible to improve both food production and spawning places. Any program of

stream improvement undertaken should include construction of stiles over all fences. The ideal solution to the problem of property rights would be for the state to acquire the land immediately adjacent to the stream either by long-term leases or by outright purchase. Complete acquisition might involve too much money, but at least control of parts of the stream should be bought by the state. One source of pollution should be removed. It is the unsanitary method of sewage disposal employed by the Methodist Outdoor Camp (T. 6 S., R. 16 W., Sec. 30). The outhouses of this institution empty directly into the creek. Several hundred people are in the camp while it is in session.

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Kinzie Creek, Tributary #1 in the Dowagiac River system, is about 9.5 miles long. It enters Dowagiac River on the line between Berrien and Cass counties in the southwest corner of Section 6, Howard Township, Cass County. It is fed by springs, seepage and overflow from a small mud lake. The lower section of this stream has not been dredged. It meanders through gravelly areas and is shaded very well throughout most of its course. Cover in the lower section is almost ideal. Projecting branches, roots and overhanging banks offer protection in the pools. Large stones and occasional logs form small retreats in the riffles. The stream bottom is composed of gravel which is interspersed here and there with silt bars. Some muck is found in the deeper holes. Pools are fairly large and well protected. At the bends of this meandering lower section almost perfect pools for trout occur. The frequency of pools per mile is approximately 30-40. Riffles between the pools are gravelly without exception. The upper section of Kinzie Creek has been dredged. Although this dredging was done about 1915, the stream is still straight and trench-like. Some filling has occurred and logs, clods from the bank and miscellaneous accumulations of debris offer some cover to trout. Shade and cover, as a whole, are not sufficient. Bottom materials are mostly sand, but a few

isolated gravelly stretches are present. The condition of both pools and riffles is generally poor due to the dredging. There are plenty of gravel beds suitable for spawning.

The stream flows about 15 cubic feet per second at its mouth. The average current velocity is 1.8 feet per second. Reference to Table 2 will show the average widths and depths of the stream at points where stations were set up. This table and Table 1 show the water temperatures recorded during the survey. It can readily be seen that the water is cold enough to maintain trout successfully. Chemical characteristics of the water offer no objectionable features. There is plenty of oxygen dissolved in the water, no carbon-dioxide, and the alkalinity of the water should be about right for good production.

Kinzie Creek is in fair condition biologically as examination of Table 3 will reveal. Even in August, which is usually the poorest month of the year in the production of fish food because of earlier insect hatches, the food supply is sufficient to maintain trout. Aquatic plants are very scarce in the lower section of this stream but their lack is offset by good gravel riffles. In the upper section, where dredging has removed most of the gravel, aquatic plants are quite abundant and produce enough food to make up for the lack of good riffles. This creek is populated with an abundance of creek chubs and common shiners (Table 4). Brown trout are more plentiful in the lower section of this stream than in any other water of the Dowagiac system, according to angler's reports and results of fishing by survey party members. Table 5 showing growth-rate data is made up entirely of fish taken from Kinzie Creek with the single exception of one rainbow trout caught in the main Dowagiac River. This table shows that trout grow well in Kinzie Creek, although the data presented are complicated by records of stocked trout which presumably grew faster in the hatchery than those fish resulting from natural reproduction

Table 5

Growth-rate Data on Trout Taken From the

Dowagiac River System

Catalog Number	Species	Annuli	Standard length	Total length (inches)	Weight in grams	Name of stream
23855	Brown trout	1	132 mm.	6.25	42.6	Kinzie Creek
23856	Brown trout	1	143	6.62	50.0	Kinzie Creek
23857	Brown trout	2	154	7.00	56.4	Kinzie Creek
23858	Brown trout	2	155	7.10	59.3	Kinzie Creek
23859	Brown trout	2	149	7.20	54.2	Kinzie Creek
23860	Brown trout	2	153	7.20	53.6	Kinzie Creek
23861	Brown trout	2	158	7.30	61.3	Kinzie Creek
23862	Brown trout	3	185	7.80	110.6	Kinzie Creek
23863	Brown trout	2	168	7.90	77.9	Kinzie Creek
23864	Brown trout	2	212	9.90	152.9	Kinzie Creek
23865	Brown trout	2	241	11.30	187.0	Kinzie Creek
23866	Brown trout	3?	265	12.40	298.1	Kinzie Creek
23867	Brown trout	1	125	6.00	35.0	Kinzie Creek
23868	Brown trout	1	138	6.40	46.5	Kinzie Creek
23869	Brown trout	1	139	6.60	50.0	Kinzie Creek
23870	Brown trout	1	149	7.00	53.0	Kinzie Creek
23871	Brown trout	2	155	7.10	68.0	Kinzie Creek
23872	Brown trout	1	170	8.00	73.5	Kinzie Creek
23873	Brown trout	1	170	8.10	81.7	Kinzie Creek
23874	Brown trout	3	172	8.30	82.5	Kinzie Creek
23875	Brown trout	2	175	8.30	82.5	Kinzie Creek
23876	Brown trout	3	204	9.50	143.4	Kinzie Creek
23877	Rainbow trout	2	248	11.80	280.0	Dowagiac Creek

did in the stream. This is to be expected (though not true in all cases) since confinement and heavy feeding in the hatchery cause fish to grow faster than they normally would in nature. Records of fish stocked in Kinzie Creek for the past five years are given in Table 4. Considering the approximate fishing demands and the present population of trout, one is impressed by the apparent success of these plantings, especially in the case of brown trout.

All property adjoining this stream is privately owned. As on Dowagiac River, no problem of accessibility is yet apparent. Fishermen use the stream freely and no objections are raised by the land owners. Conversations with owners in certain areas indicate that they are beginning to resent some of the inconsiderate tricks pulled by some careless sportsmen. Fence cutting, neglecting to close gates, molesting farm animals and in some cases firing of muck land by careless tossing of lighted cigarettes are among the complaints held against the sportsmen. The question of access to this stream will become a problem if such impositions continue.

There is no question about the suitability of this stream for trout. The lower three miles of stream offer the best and most dependable fishing in the whole watershed largely because of the good shelter and food afforded. Certain parts of this section could be improved but action may be inadvisable in a program of management until the main Dowagiac River has been worked into passable condition. The upper portions of Kinzie Creek, having been dredged, are in need of some improvement. However, this part of the stream is not entirely uninhabitable for trout. It is believed that there are sufficient gravel areas for spawning activities despite the dredging, and as previously stated, the food has recovered fairly well in the intervening years.

Pokagon Creek, Tributary #2, is about 22 miles long if all its tributaries are included. It drains a region similar to that of Kinzie Creek. It enters Dowagiac River close to the little town of Sumnerville. Four tributaries feed the main creek and these are fairly good trout water. One tributary which enters the creek in section 3, Howard Township, cannot be considered significant because of recent dredging operations which opened the channel and allowed the small flow of water to become too warm (No. 27, Table 1). The other tributaries, although dredged in places, are in good condition. Pokagon Creek has been dredged over part of its length, but this dredging is being rapidly nullified by erosion and by re-establishment of a normal stream channel.

Cover and shade are abundant enough throughout the stream's length. In dredged areas, shade conditions have not been changed but the cover has been removed to the extent that its absence is a problem. The stream bottom is mostly gravel and sand. Even in the dredged parts there is enough gravel in the stream to support fish food and allow spawning. Pools are not as large as they could be, but they do form good places of hiding for trout. There are about 30-35 pools per mile of stream in the undisturbed stream bed. Riffles between these pools are long and somewhat shallow. Their productivity could not be accurately estimated because a flood resulting from heavy rains had recently scoured the stream bottom. The stream flowed about 10 cubic feet per second at the time of survey. Current velocity averages around 1.5 feet per second. Pokagon Creek fluctuates tremendously on occasions of heavy rainfall. It is fed by seepage and run-off, and since its drainage area is quite large and exposed, heavy rains cause it to rise 4-5 feet above normal, overflow its banks and spread considerably in the region of its mouth. Temperature of the water is low enough (see Tables 1 and 2) to maintain trout successfully. Only in the lower portion, from the entrance of the first tributary to the mouth, does

the water temperature rise to a point where it is dangerous or perhaps would kill trout if they remained there. Reports by local fishermen indicate that the water does get too warm. Survey records show temperatures which are borderline but not too high. Despite the question of temperature in the lower end of this stream, the headwaters are cold enough to easily carry trout through the hottest months of summer and it is likely that trout would move upstream to these colder sections at such times. The results of chemical analyses of the water in this creek (given in Table 2) show that there is no question as to the suitability of the chemical nature of this water for trout.

Aquatic plants, with the exception of algae, are not abundant in Pokagon Creek. Some cress and narrow-leaved Potamogeton beds occur in the headwaters. These support great numbers of fresh-water shrimps which are excellent trout food. An accurate estimation of abundance of bottom food organisms could not be made for this stream. Abnormally high water had scoured the bottom and removed the population almost entirely. Good early season fishing is reported for the lower part of this stream. Some trout are taken from the headwaters throughout the summer. The stream is populated with creek chubs and common shiners, which are good forage fish for the larger trout but which compete with them directly for food and shelter. Stocking records for this stream are given in Table 4. The brook trout were planted in a tributary called Kimmerlee Creek. This creek is good brook trout water. According to reports, good catches of brooks are taken each season. The brown and rainbow trout were planted farther downstream in the main Pokagon.

All property on Pokagon Creek is privately owned but free use of the stream is allowed fishermen. The tributary, Kimmerlee Creek, is closed to fishermen by the property owners, gentlemen farmers, of whom, one intends restoring an old mill dam, to make a private fish pond out of the

best stretch on the stream. Should his plans work out, there will be formed about a 20 acre pond. Here he wants to fish himself, sell fishing rights to the public and build water wheels. He wanted to plant bluegills in water which seldom gets above 63°F. Another party upstream from him is cooperating by closing the water on his property. The tendency to buy these choice places and make them private in fact is becoming more and more pronounced in this region.

A program of improvement for Pokagon Creek should await the completion of improvement work on Dowagiac River. Pokagon Creek, at present, is in fair condition and needs little, if any, serious improvement which cannot wait until the rest of the drainage has been bettered. If possible, something should be done to curb the construction of that dam on Kimmerlee Creek. It will hamper, if not completely stop, fish migration and spoil a very nice section of stream. It is also likely that impoundment would raise the temperature in the stream below to a point where trout would be unable to live during the warmer months.

Peavine Creek, tributary #3, is about 3.5 miles long and enters Dowagiac River in Section 17 of Pokagon Township. Its general drainage is gravelly and morainic. Springs, seepage and run-off feed it. The water level fluctuates about four feet seasonally and during the heavy rainstorm described previously it was over its banks, spread over lowland meadows and very silty. This stream has never been dredged, hence, pools and riffles are in good condition. Most of the bottom material is gravel. Suitable areas for spawning are common. Although this stream is short, it flows about 4 cubic feet per second. The water is well suited for trout both thermally and chemically (see Tables 1 and 2). Bottom organisms were not too abundant before the heavy flood (Table 3) and after it no evaluation of fish food conditions could be made. The stream has not been stocked during the past five years, but still some good catches are reported

in it early in the trout season. Presumably fish migrate from the main river into this tributary. Stocking this stream with rainbow or brown trout would probably be a good thing since it would act as a feeder to the main river. Property along Peavine Creek is privately owned but free access is allowed. The stream needs no improvement at present except that stiles should be built over the fences which cross the stream.

Tributaries #4 and #5 were considered unimportant because both are very small and intermittent. No survey data were obtained from them, hence they will not be discussed further except to state that the back waters at their mouths produce great numbers of minnows which find their way into the main river as food for larger fish there.

Tributary #6, called Dowagiac Creek, is the east branch of Dowagiac River and joins with the north branch just west of the town of Dowagiac. It carries almost as much water as the north branch but is quite warm (77°F. at an air temperature of 81°F.). Numerous lakes, through which it flows, retard the water long enough to allow warming to a point considerably above the trout range of temperatures. Since the stream was too warm for trout, no further investigative work was done on it. It is interesting to note the effect water flowing from this east branch into the north branch has on the temperature of the main river. Just above the junction, water in the north branch had a temperature of 66°F. while below the junction the water temperature was 71°F. This warming effect is soon overcome as is shown by a water temperature of 68°F. taken one-half mile below the junction on the same day and almost at the same time. In addition to the warming effect of this tributary, some sewage is carried by it. The influence of the pollution appeared minimal. The east branch is highly productive and is probably used by trout in the early season of the year for spawning and again in the fall. Very little can be done to alter the temperature of this stream. Lakes are too large and numerous

to by-pass if this were desirable.

Tributary #7, Indian Lake Outlet, enters the Dowagiac River from the west in the southeast corner of Section 33, Silver Creek Township. It is approximately 2 miles long, meanders through low-lying meadows and is definitely too warm for trout. Like the east branch of Dowagiac River, it is invaded by trout in early spring and late fall. It is not suited to spawning since the bottom of it is almost exclusively sandy. Because of high water temperature this stream is not considered further as possible water for trout. A study was made of it to determine its probable value as a feeder stream. Bottom conditions and food supply were found to be poor (see Table 3). No shade nor cover protect the stream and since it is fed from the warm surface water of Indian Lake, it is inadvisable to attempt measures to cool the water.

Tributary #8. This is another rather insignificant flowage which enters the north branch of Dowagiac River in Section 23 of Silver Creek Township. It is about 2 miles long, flows about 6.7 cubic feet per second and is on an average 8.5 feet wide and 0.8 feet deep. Dredged throughout its length, this stream is shaded but has no cover. The stream bottom is sandy and produces quite a few food organisms (see Table 3). Productivity of this bottom is due to its stability. Sand when not shifting and when covered by a thin layer of silt is quite productive. Water temperatures (Tables 1 and 2) indicate that it is marginal trout water at best. The stream has never been stocked and no reports of trout catches from it could be obtained. No recommendations are made regarding it because it is hardly worth working on at this time when such a great amount of work has to be done on the main river.

Tributary #9, outlet of Magician Lake, is 4.6 miles long. It flows about 13 cubic feet per second through a meandering channel which is well shaded and has never been dredged. The stream bottom is a conglomerate

of silt, sand and gravel. The productivity of the bottom is good as a glance at Table 3 will show. Since this stream is fed directly from the surface water of Magician Lake (700 acres), it is warm and a poor risk for trout. Trout may utilize it in early spring and late fall but in summer they are not present in the stream. Table 2 gives a summary of chemical and physical data taken on this stream. Tributary #9 is not considered a good trout stream. It has never been stocked and no catches have been reported from it.

Tributary #10, Pine and Cook Lake outlets, empties into Dowagiac River in Section 24 in Silver Creek Township. It flows about 14 cubic feet per second and is 4.6 miles long. The stream's course has been dredged up to Pine Lake. The Cook Lake branch has not been dredged. Both lakes and the streams issuing from them are spring and seepage fed. Reference to Tables 1 and 2 shows this stream to be borderline for trout. Water temperatures indicate that it might become too warm because of the influence of Pine Lake outlet. Biologically, the stream is lacking in several important respects. Pools and riffles have been consolidated into one long trench by dredging. Bottom materials tend toward sand, although there is some muck intermixed in them. Shade and cover are afforded by overhanging banks only. Productivity of the bottom appears to be about average for dredged streams in the section--0.2 cc. per square foot. Plants in the form of cress beds and water plantain masses produce large numbers of fresh-water shrimps and other trout foods. This tributary has been stocked and records of the plantings are given in Table 4. Only brook trout have been placed in the stream. It is believed that perhaps the main stream and Cook Lake branch might support these fish, but Pine Lake branch certainly will not. Rainbow or brown trout would survive there if any trout could, and the risk of loss due to high water temperatures would be reduced since these fish can tolerate higher temperatures than brook trout.

Property adjoining this stream is private, but no objection is raised to fishing. Stiles should be built over fences. An improvement program is not recommended at present but should include planting of willows along the stream margins for additional shade.

Tributaries #11 and #12 are too small and inaccessible to be considered as possible trout water. They have been dredged and are intermittent during years of average precipitation.

Wilson Creek, Tributary #13, also called Osborne drain, enters Dowagiac River in Section 9 of Wayne Township. It flows approximately two miles through a swampy area at first and then a hilly, gravel area as it reaches the river. Its volume is about 8 cubic feet per second. For the average width, depth and current velocity, see Table 2. One tributary enters this stream from Pitcher Lake and is intermittent. Wilson Creek has been dredged its entire length but due to the rapid fall of its basin it has rehabilitated itself in the 25 years since it was dredged. The surrounding country is generally low and swampy. Muck farms border the stream in its upper reaches. The stream bottom is mostly sand, but gravel riffles are plentiful. Shade and cover are abundant in most places. Pools are far apart and small, but cover in them makes up for some of their objectionable features. Riffles are long and in nearly every case composed of gravel. Sand riffles are bound down by vegetation. Water temperatures in Wilson Creek are believed to be low enough to safely accommodate brook trout as reference to Tables 1 and 2 will show. It is noted from Table 2 that chemical conditions are not adverse to trout habitation.

Throughout most of this stream, aquatic plants are lacking, but occasional beds of cress line the banks and silt bars. Some plants occur in the sandy riffles. Bottom productivity (Table 3) is slightly below average. Interpretation of data on bottom conditions should be conditioned

by the fact that a heavy storm increased the volume of water in the stream about three times normal. Some of the organisms, normally present, would be washed away by this increased flow. Reports from local sportsmen indicate that this stream yields some good catches of rainbow and brook trout. A search of the stocking records for Cass and Van Buren counties showed no fish planted in this stream during the past five years.

That this stream is suitable for trout is very apparent. Fish occurring there have migrated in and appear to be holding their population level. Fishing is not heavy, being confined to the early part of the season. Property along the stream is private but free access is allowed. It is suggested that this stream be stocked with brook and rainbow trout. No improvements need be made at present, but the stream could be helped by the construction of deflectors where it has not recovered from the effects of dredging itself.

Tributary #14 is a small unnamed creek which enters Dowagiac River from the east in Section 9 of Wayne Township. It flows about 1.5 cubic feet per second and courses for 0.75 of a mile from a small lake through muck land to the river. It is brushy, hard to traverse and dredged for half its length on the lower end. During dry seasons it becomes intermittent. The volume cited above was taken following a heavy rain and represents twice the normal flow. The water temperature as shown in Table 2 is near the upper limit of trout toleration. Considering its size, intermittent flowage and temperature along with the scant food supply as shown in Table 3, this stream is not worth stocking or maintaining as trout water.

Tributary #15, Glenwood Creek, is a spring-fed brook which enters Dowagiac River in Section 3 of Wayne Township. It arises in some rather scattered springs south of the town of Glenwood and flows as a meandering stream carrying around 4 cubic feet of water per second through mucky lowland for 1.6 miles to its mouth. Tables 1 and 2 show it to be suited

for trout both chemically and thermally. Since it has not been dredged, pools are plentiful and of a fairly good size. Plenty of cover is in the stream but shade is almost lacking. Some shade is afforded by undercut and grassy banks. The upper reaches of this creek afford gravel riffles which appear to be fair brook trout spawning beds. The bottom in the lower is sandy silt and produces ample food organisms (Table 3). In addition, cress beds augment the food supply considerably with their production of fresh-water shrimps. Fishing is good in Glenwood Creek early in the season where brook trout are taken almost exclusively. A record of stocking and fish seined from the stream is given in Table 4.

Improvement of this stream will be difficult because materials are not readily available. There need be no structures erected to establish pools since these are numerous enough. Cover is good but some willows might be started along the stream to make some shade. All property along the stream is private, but no problem exists in connection with accessibility at present.

Tributary #16 is a small spring-fed stream one mile long. It starts from a big spring just west of the road that runs north and south one mile east of the town of Glenwood. At present, it is dammed at this road by a man named Kemp, who is flooding some old carp rearing ponds abandoned some 30 years ago. He intends to raise trout. Very little water was running down the stream bed, hence, it was decided not to attempt a survey of it.

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Suggestions for a Demonstration and Experimental Area On Dowagiac Creek

The original channel of Dowagiac River was very meandering. It coursed back and forth almost touching itself in the middle of some of its bends. Woods and brush bordered this original stream and, here and there, grassy, open areas were located between the trees. When the river was

dredged, no attention was given to the course of the river and a straight cut was made down through the center of the basin. By such a transect, oxbows, in the lower portion of the river, were isolated on either side of the cut. From several of these large oxbows, small streams reach the present channel through portals in the piles of earth thrown up by the dredge. Most of these streams are warm, but in two instances where springs feed these semi-ponds, the water is ideal for trout. The two areas are located on the map and designated as rearing pond sites. However, their precise location is given below. Both ponds are on the west side of the river. The lower one is located in Section 31 of Pokagon Township (T. 6 S., R. 16 W., Sec. 31), about 1/2 mile below Sumnerville bridge. The upper one is located in section 30 of Pokagon Township (T. 6 S., R. 16 W., Sec. 30) and runs north and south across the road in the northeast corner of the section.

The lower pond is about 500 feet long and varies in width from 10 to 50 feet. It is densely shaded on both sides, but in the center it is open and great beds of duck weed and water cress have taken advantage of the sunshine available. The bottom is gravel, but it is covered with a thin layer of muck and silt. Water temperatures in the pond never go above 72°F., even when high water backs up into the pond from the river. The west side of the pond is bordered by a high gravel bank from which springs run. This bank is covered by a dense but well kept wood lot. This woods extends to a road about 1/5 of a mile to the west. A small passable auto trail winds through the trees from this road to the very edge of the pond. Some fallen logs and other debris lie in the pond and willows have encroached upon it in certain places. It would be necessary to build a dam at the lower end to control water level. This and other suggested sites should be examined by fish culturists and any action toward development must have their approval.

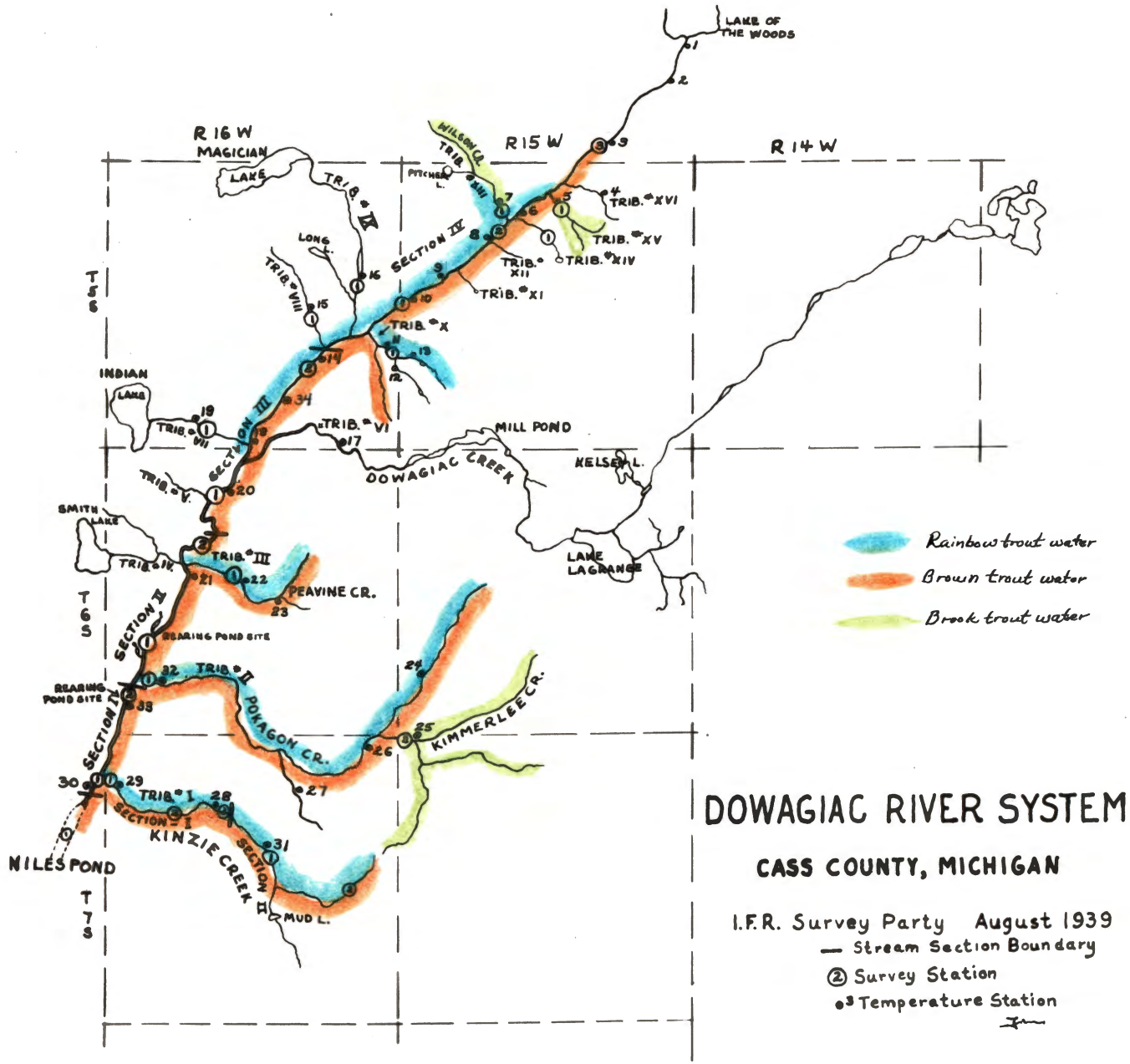
The upper pond is about 1/2 mile long and 10-50 feet wide. It was estimated that about 1.5 cubic feet of water per second runs out. It has the same water temperature as the lower pond and springs along a high bank to the west keep the water cooled. There is not as much shade here as in the lower pond. In places, considerable current is noticeable and some good gravel riffles occur. The land surrounding this area is pastured and partially wooded. One site south of the road mentioned above is a grassy, almost level continuation of the high bank to the west. This pond-like stream would need cleaning only. A screen placed at the lower end might be used to retain all fish. The nice thing about this pond is its natural setting.

In connection with these ponds an experimental and demonstration area could be constructed. The river would illustrate methods and results of stream improvement structures and attract many fishermen. It is suggested that the area around the ponds be made into a "park" and the main stream in that region be converted into a fenced and controlled public fishing area where restrictions on baits, kill and catch would be applied on an experimental basis. Persons possessing a fishing license would be allowed to fish a certain number of times per season. The section of stream would be stocked and fishing restricted solely to the use of flies with barbless hooks. A fisherman would be allowed to catch a certain number of fish but only keep two or three. Size limits for fish kept from this section would be raised to 10 inches. Statistics could be kept on the number of fishermen visiting the project, fish caught and fish killed by checking each fisherman out of the gates. Weights, lengths and scales could be taken from the fish killed for information on growth-rate and condition. This plan would attract many sportsmen and would serve as a good means of bringing to public attention fundamentals of fish conservation policies and some of the problems their conservation department has to meet. An

expert on fly fishing and lure making could be maintained to instruct novices in the art of using such lures. The larger of the two ponds could be used as a fishing ground for women only, while men and women could fish the main river. Many other worthwhile developments would naturally grow out of such a project.

To accomplish such aims as have been outlined, purchase of the lands around the ponds would be necessary. Some development work would be required, but this need not be prohibitive. Purchase or long-term leasing of the land bordering Dowagiac River in this section and the lower portions of Kinzie Creek and Pokagon Creek should be considered. Should the cost of the entire area be prohibitive, the minimum requirements for this program would only need to involve the purchase of lands around the ponds, immediate banks on both sides of Dowagiac River from the center of Section 12, Niles Township, Berrien County to the center of Section 20, Pokagon Township, Cass County and the land bordering Kinzie Creek. This land being rather infertilie is poorly developed agriculturally and should be acquired at a reasonable figure.

INSTITUTE FOR FISHERIES RESEARCH



DOWAGIAC RIVER SYSTEM

CASS COUNTY, MICHIGAN

I.F.R. Survey Party August 1939

— Stream Section Boundary

② Survey Station

•³ Temperature Station