SPECIES COMPOSITION AND DISTRIBUTION OF FISH OF THE RED CEDAR RIVER SYSTEM WITH DETAILED DESCRIPTIONS OF COLLECTING STATIONS

Thesis for the Degree of M. S.
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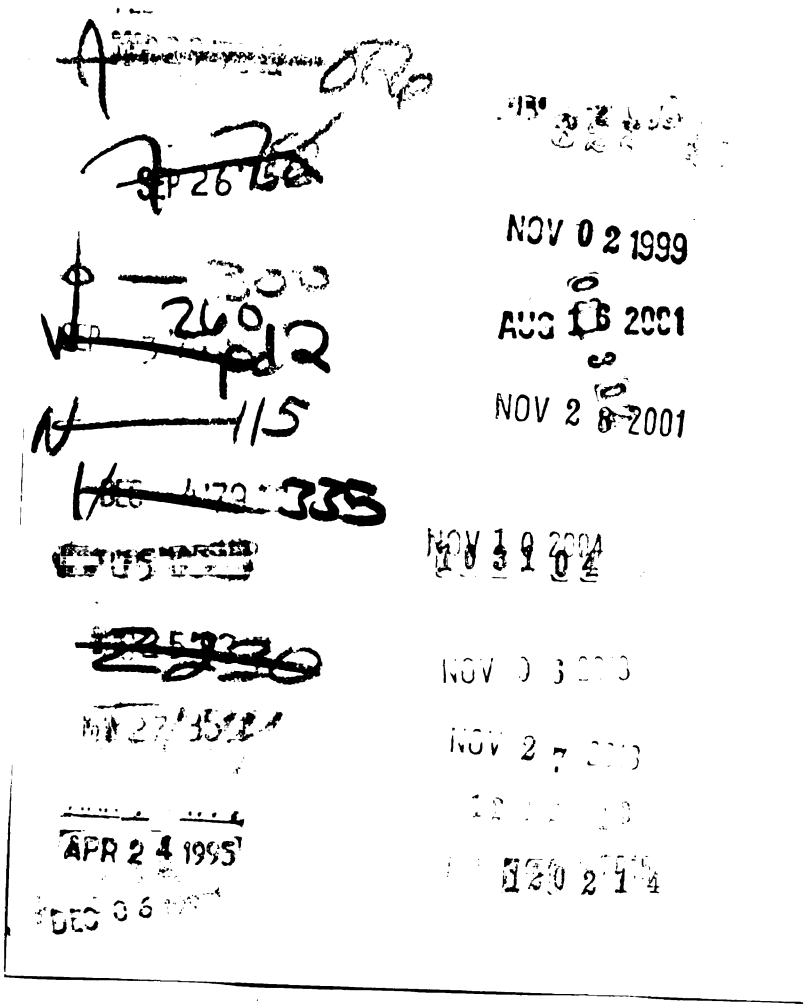
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ABSTRACT

SPECIES COMPOSITION AND DISTRIBUTION OF FISH OF
THE RED CEDAR RIVER SYSTEM WITH
DETAILED DESCRIPTIONS OF COLLECTING STATIONS

by William M. Horton

Collections of fish were made throughout the entire Red Cedar River drainage system in order to determine species composition and distribution. D.C. shocking gear was used and proved to be the most effective means for collecting nearly all species of fish. Gill nets, hook and line and drag seines were also employed.

The Red Cedar River was divided into seven regions each of which consists of several collecting stations (42 stations in all). Each of the 42 stations was carefully studied and described by using the following characteristics: bottom types; length of station; average and range of depth, width, and current; type and abundance of aquatic vegetation; shoreline; water temperature; amount of cover in the stream and turbidity of the water.

Collected fish numbered 22,440 representing 54 species (including two sub-species), 32 genera and 12 families. The greatest diversity of species was found in the mainstream (48 species, 31 genera, 12 families), with less diversity in the tributaries (39 species, 26 genera, 10 families) and lakes (21 species, 15 genera, 7 families).

The minnow family (Cyprinidae) was the most abundant making up more than 37% of the total fish collected from the entire drainage system. The five most abundant fish, in order of their abundance (percentage of the total number of fish collected), were as follows: the northern

common shiner, Notropis cornutus frontalis (19.53%); the rock bass, Ambloplites rupestris (10.89%); the white sucker, Catostomus commersoni (9.41%); the pumpkinseed, Lepomis gibbosus (5.30%) and the bluntnose minnow, Pimephales notatus (4.27%).

SPECIES COMPOSITION AND DISTRIBUTION OF FISH OF THE RED CEDAR RIVER SYSTEM WITH DETAILED DESCRIPTIONS OF COLLECTING STATIONS

A Thesis

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the Department of Fisheries and Wildlife

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by

William Murray Horton

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INTRODUCTION

The purpose of this study was to determine the species composition and distribution of fish in the Red Cedar River system. Habitat preferences for each species were also to be investigated.

This study may prove to be beneficial in two ways: 1) A project similar to this on the same river in years hence will indicate changes in species composition as the stream undergoes modifications resulting from urban and industrial change and changing agricultural practices; 2) Habitat preference studies substantiate and/or indicate ways of improving streams to maintain or introduce a particular desirable species of fish.

DESCRIPTION OF THE RED CEDAR DRAINAGE SYSTEM

The Red Cedar River is a warm water river originating in Cedar Lake in Livingston County. It flows northwesterly through Livingston and Ingham Counties for approximately 60 miles and empties into the Grand River in Lansing. The river valley is in its mature stage of development with meandering common in the lower regions. The drainage pattern as seen in Figure I consists of trellis and dendritic types. Twelve major tributaries enter the stream. The river drains about 475 square miles of land and has an average gradient of 2.51 ft. per mile. Water level is the highest in the spring, often reaching the flood stage. During this period of time the water is very turbid. In the late fall the water is at its lowest level. In the lower stretches of the river it rises rapidly and becomes very turbid after heavy rains. Three impoundments are found in the river. In Williamston there is a dam 13 ft. high, the

backwaters of which extend approximately two miles upstream. A second dam constructed of loose rocks is found in the Okemos picnic area. This dam is approximately 2 ft. high. The dam on the Michigan State University campus is approximately 8 ft. high.

PROCEDURES AND METHODS

Forty-two different collecting stations were chosen. Twenty-three locations were on the main stream, seventeen were tributary locations (the data from one is combined with a joining locality on the mainstream) and three localities were on three different lakes. The sampled tributaries entering from the north were Lake Lansing Outlet (Pine Lake Outlet), an unnamed creek, Coon Creek, Squaw Creek, Sullivan Creek and Wolf Creek. The sampled tributaries entering from the south were Sycamore Creek, Herron Creek, an unnamed drain, Sloan Creek, Button Drain, Deer Creek, Doan Creek, Dietz Creek, Kalamink Creek, West Branch Cedar River and Middle Branch Cedar River. The lakes sampled were Lake Lansing, Dobie Lake and Cedar Lake.

Collections were made frequently throughout the summer and fall of 1962 after the water level had subsided in order to cover as much of the river system as possible. This was done knowing that the more extensive and comprehensive the collecting the better the chances of collecting more species.

Location Numbering System

The main stream of the river is divided into seven regions:

0. mouth to campus dam below Farm Lane

I. campus dam to Okemos Rd.

II. Okemos Rd. to Zimmer Rd.

III. Zimmer Rd. to Williamston dam

IV. Williamston dam to Dietz Rd.

V. Dietz Rd. to Van Buren Rd.

VI. Van Buren Rd. to Cedar Lake

The first region was given the numeral 0 because regions I through V correspond to the numerals used for the regions studied by previous investigators. Regions 0 and VI are regions in addition to those previously studied. Each collecting locality, whether it be on the main stream or on a tributary, is numbered according to the region in which it occurs or into which it empties. For example, a station in section I or on a tributary emptying into section I is designated as I.A or I.B or I.C, etc. Figure I shows the regions and collecting stations.

Specific Locations of Collecting Stations

0.A Ingham County, Lansing Township, western region of Section 22, from under Pennsylvania Avenue bridge to 300 ft. upstream.

0.B Ingham County, Lansing Township, central east area of Section 34, Sycamore Creek, 25 ft. below to 700 ft. above Cavanaugh Rd. bridge.

0.C Ingham County, Lansing Township, central area of Section 13, between 0 and 400 ft. downstream from foot bridge behind Kellogg Center, M.S.U. campus.

0.D Ingham County, Meridian Township, southwest corner of Section 18, between M.S.U. campus dam and foot bridge (approximately 500 ft. downstream from dam).

I.A Ingham County, Meridian Township, southwest corner of Section 18 just above M.S.U. campus dam.

I.B Ingham County, Alaiedon Township, northwest corner of Section 5, Herron Creek, between 10 ft. downstream and 50 ft. upstream from Jolly Rd. bridge.

I.C Ingham County, Meridian Township, northeast corner of Section 10, Lake Lansing (southwest shoreline).

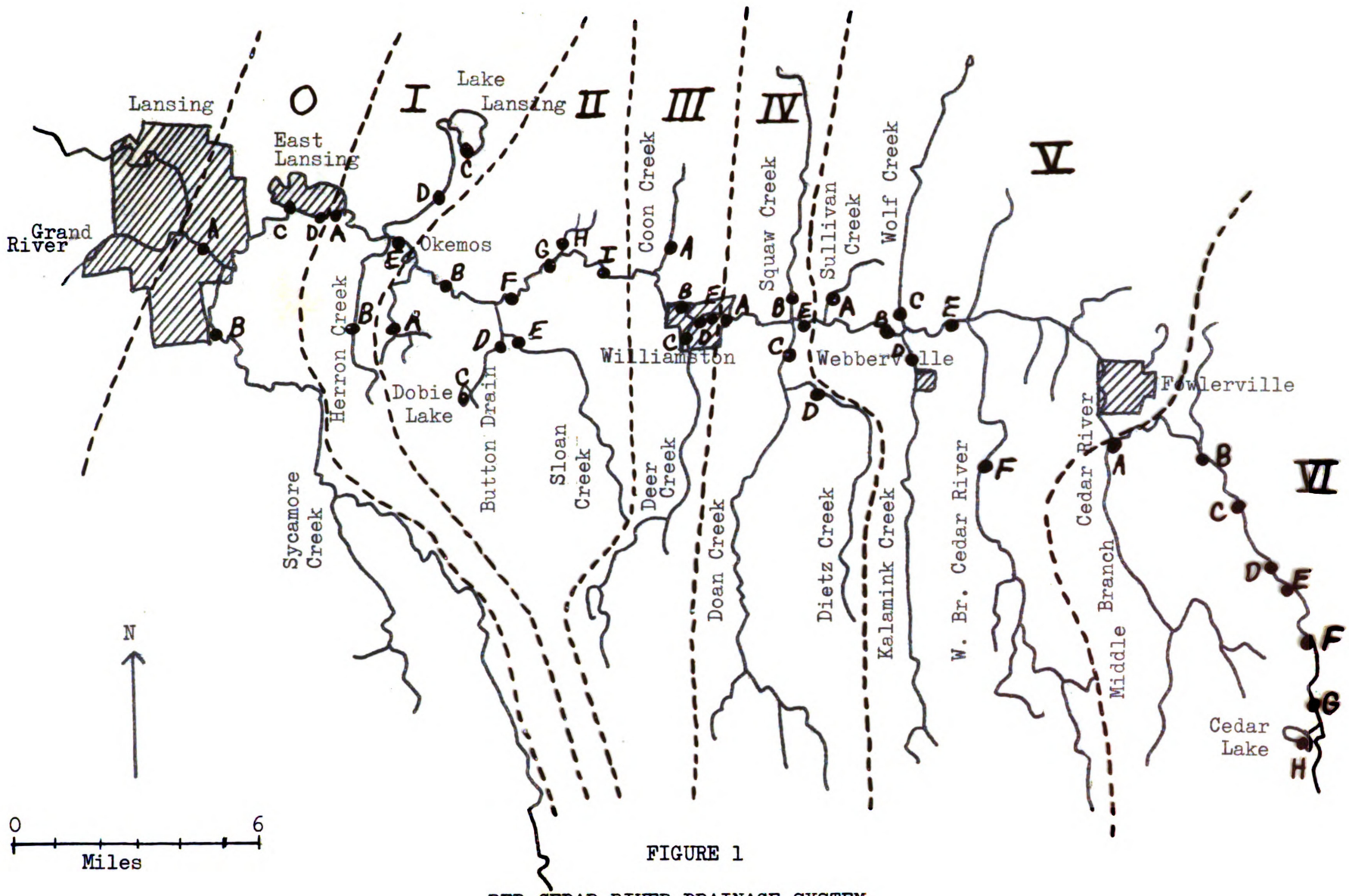

FIGURE 1

RED CEDAR RIVER DRAINAGE SYSTEM

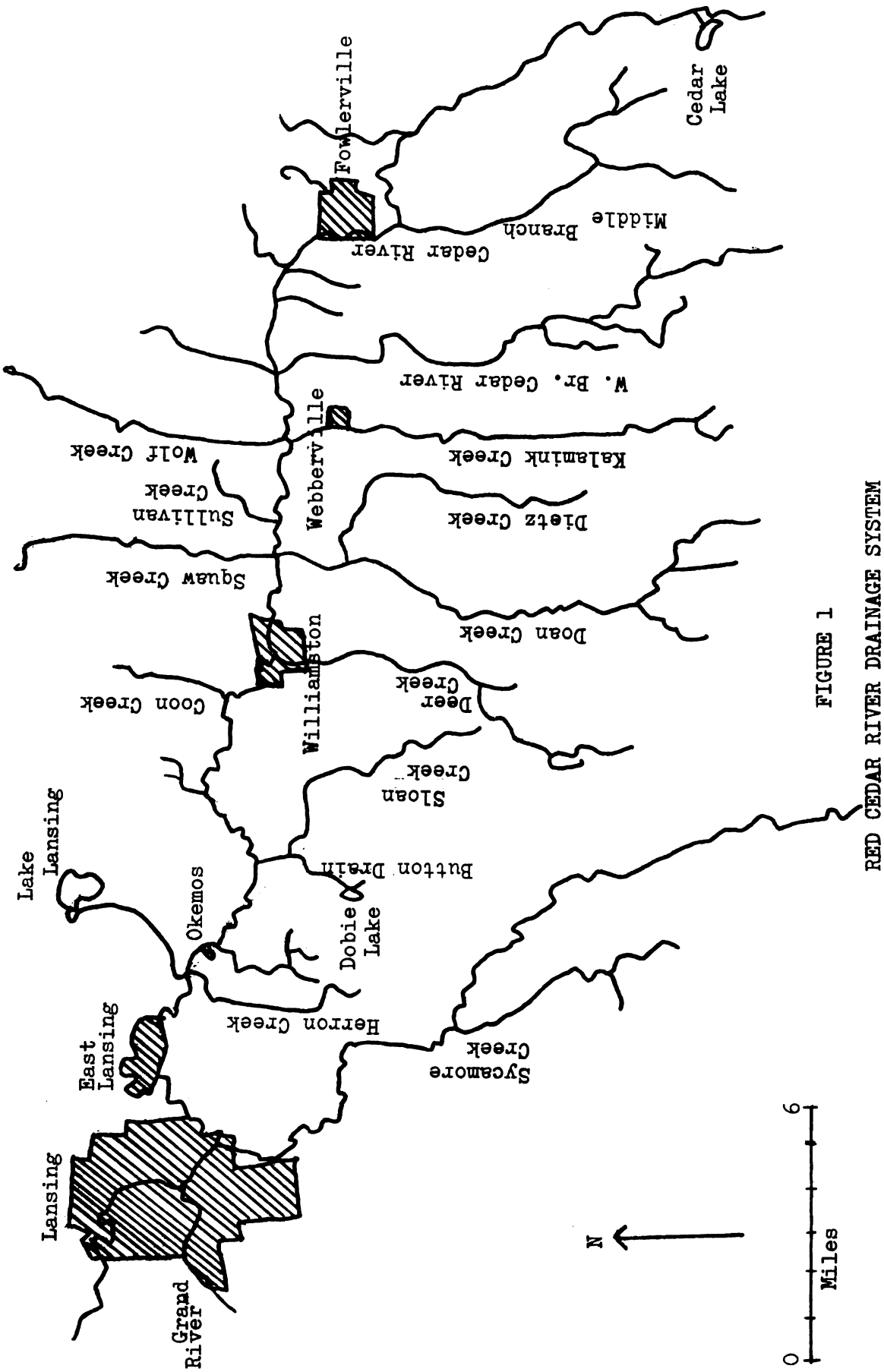

FIGURE 1

RED CEDAR RIVER DRAINAGE SYSTEM

I.D Ingham County, Meridian Township, southeast region of Section 16, Lake Lansing drain (Pine Lake outlet), from Okemos Rd. bridge to 100 ft. downstream.

I.E Ingham County, Meridian Township, northwest to central region of Section 21, one-half mile region upstream from Nakoma Rd. bridge.

II.A Ingham County, between Section 33 of Meridian Township and Section 4 of Alaiedon Township, approximately 0.15 mile west of Okemos Rd. on Jolly Rd. (drain under road).

II.B Ingham County, Meridian Township, central region of Section 27, one-half mile region downstream from Dobie Rd. bridge.

II.C Ingham County, Alaiedon Township, northeast corner of Section 10, Dobie Lake.

II.D Ingham County, Alaiedon Township, northeast corner of Section 2, Button Drain, under and 150 ft. upstream from Jolly Rd. bridge.

II.E Ingham County, Alaiedon Township, northwest corner of Section 1, Sloan Creek, under and upstream from Jolly Rd. bridge.

II.F Ingham County, Meridian Township, southwest region of Section 25, region 400 ft. in length (located approximately one-quarter mile upstream from Van Atta Rd. bridge).

II.G Ingham County, Meridian Township, northeast corner of Section 25, between 0 and 700 ft. upstream from Grand River Rd. (M-43) bridge.

II.H Ingham County, Williamston Township, west region between Sections 20 and 29, approximately 100 ft. upstream and downstream from Sherwood Rd. bridge.

II.I Ingham County, Williamston Township, central region of Section 28, one-half mile region downstream from first riffle which is 150 yds. below Thatcher Rd.

III.A Ingham County, Williamston Township, west region between Sections 23 and 26, Coon Creek, 50 ft. upstream and downstream from Sherwood Rd. bridge.

III.B Ingham County, Williamston Township, south central region of Section 35, one-half mile region (between 1,230 ft. downstream and 1,410 ft. upstream from the Williamston sewage plant outlet).

III.C Ingham County, Williamston Township, southern region of Section 35, Deer Creek, between 50 ft. below and 300 ft. above Grand River Rd. (M-43) bridge.

III.D Ingham County, Williamston Township, southern region of Section 35, mainstream - pool just upstream from mouth of Deer Creek.

III.E Ingham County, Williamston Township, southeast region of Section 35, from 0 to 600 ft. below Williamston dam.

IV.A Ingham County, Williamston Township, southeast corner of Section 35, just upstream from Williamston dam (west of Williamston Rd.).

IV.B Ingham County, Locke Township, central region of Section 32, Squaw Creek, 50 ft. above and below Rowley Rd. bridge.

IV.C Ingham County, Leroy Township, central area of Section 5, Doan Creek, between 25 ft. upstream and 150 ft. downstream from Grand River Rd. (M-43) bridge.

IV.D Ingham County, Leroy Township, southern area between Sections 8 and 9, Dietz Creek, between 400 ft. downstream and 310 ft. upstream from Dietz Rd. bridge.

IV.E Ingham County, Locke Township, southeast corner of Section 32, from Dietz Rd. bridge to one-half mile downstream.

V.A Ingham County, Locke Township, east central region of Section 33, Sullivan Creek, 50 ft. above and below Rowley Rd. bridge.

V.B Ingham County, Leroy Township, between Sections 2 and 3, from Webberville Rd. bridge to one-half mile upstream.

V.C Ingham County, border between Section 35 of Locke Township and Section 2 of Leroy Township, Wolf Creek, 70 ft. above and below Allen Rd. bridge.

V.D Ingham County, Leroy Township, central region between Sections 2 and 11, Kalamink Creek, between 330 ft. downstream and 1,400 ft. upstream from Pardee Rd. bridge.

V.E Ingham County, Locke Township, southwest corner of Section 36, between 0 and 500 ft. upstream from Gramer Rd. bridge.

V.F Livingston County, Handy Township, west central region of Section 19, West Branch Cedar River, 50 ft. above and below Van Orden Rd. bridge.

VI.A Livingston County, Handy Township, center between Sections 15 and 22, from 0 to 1,060 ft. upstream from Van Buren Rd. bridge (plus 440 ft. up Middle Branch Cedar River).

VI.B Livingston County, between Section 24 of Handy Township and Section 19 of Howell Township, from under Bowen Rd. bridge to 600 ft. upstream.

VI.C Livingston County, Howell Township, central east region of Section 30, beneath Milett Rd. bridge.

VI.D Livingston County, western region between Section 32 of Howell Township and Section 5 of Marion Township, 70 ft. above and below Mason Rd. bridge.

VI.E Livingston County, Marion Township, central east area of Section 5, 50 ft. above and below Norton Rd. bridge.

VI.F Livingston County, Marion Township, central region between Sections 9 and 16, 50 ft. above and below Jewell Rd. bridge.

VI.G Livingston County, Marion Township, south central region of Section 21, 50 ft. above and below Coon Lake Rd. bridge.

VI.H Livingston County, Marion Township, southern border between Sections 28 and 29, Cedar Lake (southern shoreline area).

Collecting Methods

Five methods of collecting were tried in order to determine the most efficient methods of collecting in the types of localities encountered. The factors which usually make a quantitative study difficult are: 1) the environmental conditions such as high and fast water and extreme turbidity, 2) type of habitat, for example, overhanging brush, rocks and stumps, 3) efficiency or selectivity of the collecting gear itself, 4) the mobility of the fish and 5) experience of collectors.

Funnel-type glass and wire traps with one-inch entrances were baited with bread and left overnight in small tributaries and pools of the mainstream. Hook and line were used in several regions in order to obtain large specimens which are often hard to trap or obtain specimens from areas which were quite deep. Gill nets (1-inch and 2-inch mesh) were set in two lakes by boat. Three $\frac{1}{4}$-inch mesh drag seines, one 4-ft. by

4-ft., another 4-ft. by 15-ft. and the other 4-ft. by 20-ft., were used where possible and where shocking gear could not be transported. The small seine was used for collecting in small tributaries and could be handled by one man. The larger seines were used along the banks and in pools of the main stream as well as in some of the larger tributaries. In manuevering a larger seine the man along the bank would walk approximately 5 ft. behind the man closest to the center of the stream. They would keep these positions while walking upstream. An area free from obstruction was chosen along the bank in order to lift the seine. When this area was reached the man closest to shore would stop while the other man turned in toward shore. When both would reach the shore, the seine would be lifted or dragged up onto the bank.

D.C. electro-fishing gear was used most often. This consisted of a Homelite 230-volt D.C. generator (Figure 2), placed in a 7-ft. wooden pram. A 3-ft. long, 6-inch wide negative electrode (copper plates attached to a board) hung over the side of the pram (Figure 3). The collectors held 6-ft. positive electrodes (copper tubing extending from the ends of wooden poles) which were on 50-ft. cords (Figure 3). The hand-held electrodes were rapidly thrust forward and slowly drawn back toward the dip net. Fish were drawn or attracted by the positive electrode toward the surface where the fish could be netted. The dip nets had a graduated mesh from 0.5-inch at the top to 0.125-inch at the bottom.

The procedures used for collecting in the larger portions of the river involved primarily three men. One man pulled the pram by means of a harness and two men manipulated the electrodes and dipped fish.

Figure 2

Homelite 230-volt D. C. generator

Figure 3

Trailer with pram, D. C. generator, electrodes and dip net

When others participated they helped to dip fish. Each man with an electrode working on opposite sides of the pram would work his way back and forth from the middle of the stream to the shore and back again toward the middle approximately 10 ft. ahead of the pram. When the net was full, it would be given to the person pulling the pram who would in turn give him an empty net. The person pulling the pram would then dump the fish into a tub in the pram. When the tub was relatively full, the collectors would stop, take measurements and scale samples, mark and release the larger fish and preserve many of the smaller minnows or types of fish which were difficult to identify. These specimens were fixed in 10% formalin and later stored in a 70% alcohol solution for easier handling and study.

The D.C. electro-fishing gear was modified for working alone on tributaries. Fifty-foot lockable extension cords were added to the 50-ft. positive electrodes and a 30-ft. extension cord was added to the negative electrode. The pram, still on the trailer and containing the D.C. generator, could then be parked on a bridge above the tributary. The negative electrode was then lowered into the water beneath the bridge. A positive electrode could then be used as far as 75 ft. to 100 ft. upstream and downstream from the bridge.

The D.C. shocking gear was also used for collecting in lakes and portions of the stream which were too deep for wading. This was done by placing the D.C. generator in the middle of a 12-ft. aluminum boat. The negative electrode was the same as that used for collecting in the stream. The positive electrode consisted of a 6-ft. aluminum tube from which hung seven 3-ft. wire cables. This electrode was suspended out

from the bow of the boat. One person rowed the boat while the other person held a dip net near the bow of the boat in readiness for fish.

Method for Describing Species Composition and Distribution

Fish were carefully identified by the following keys: Trautman (1957), Hubbs and Lagler (1958), Eddy (1957), Bailey (1956), Scott (1954), Mansueti (1957) and Slastenenko (1958). Articles by Gibbs (1963), Gilbert (1961) and Lackner and Jenkins (1967) also proved to be helpful in making identifications. The scientific and common names used in this paper are those taken from the American Fisheries Society publication entitled List of Common and Scientific Names of Fishes from the United States and Canada (1960).

The prevalence of a particular species at a certain station is described as the percentage of the total number of fish collected at that station. The prevalence of a particular species in the main stream, tributaries and lakes is also described as the percentage of the total number of fish collected in each of these three types of habitat. Likewise, the prevalence of each species in the entire drainage system (mainstream, tributaries and lakes) is described as the percentage of the total number of fish collected in the entire Red Cedar River Drainage System.

The distribution of species was described as the percentage of the total number of a particular species (collected from the entire drainage system) that came from the mainstream, tributary and lake habitat types.

Methods for Describing Stations

Each station was described using the following characteristics:

bottom types, depth, length, width, current, vegetation and shoreline. Most of these stations were photographed.

Bottom Type

The percentage of sand, silt, gravel and rock was determined by sampling every 50 ft. at long collecting stations and much more frequently at small collecting stations. At each sampling interval the bottom was observed in the middle of the stream and about a quarter of the distance across the stream from each shore.

Figure 4

Hypothetical Station

footage	depth and bottom types		
0'	16" S,G,R	10", G,R	13" S,G
50'	13" S	16" G,R	9" S,R
100'	9" Si	20" S	14" S
150'	10" Si	23" S	20" Si
200'	16" Si	40" Si	29" Si
250'	15" Si,S	36" Si,S	16" S
300'	9" S	15" S G	10" S

The procedure for determining percentage of bottom types can be understood by studying Figure 4 above. This figure shows that at a hypothetical station 21 bottom samples were taken. Notice, however, that 30 letters were used to indicate bottom types - silt (Si), sand (S), gravel (G), and rock (R). Some sampling positions indicate a mixture of bottom types. Eight of these samples indicate silt. The number of samples indicating silt divided by the total number of letters used and multiplied by 100 gives us 27% of the bottom at this station covered by

silt. In the same manner, 13 samples indicate sand which is 43% of the total number of letters used. Thus, 43% of the bottom is sand. Five samples indicate gravel which, therefore, makes up 17% of the bottom at this station. Four samples indicate rock which then makes up 13% of the bottom.

Depth

The depth was taken at each location where a bottom sample was taken. The average depth was then determined and the range given.

Length and Width

The length of each station was recorded. The width was measured at 100-ft. intervals or less depending on the length of the station. A 100-ft. tape was used. The average width was determined and the range given.

Current

Measurements of flow were recorded by the floating bobber system of Robbins and Crawford (Lagler, 1952). This involves simply the time required for a bobber to float a given distance with the current. A Gurley current meter was used occasionally when available and where suitable.

Vegetation

The aquatic vegetation was identified or samples taken for later identification. Relative abundance was indicated.

Shoreline

The shoreline was observed and described as being an open grass shoreline, overhanging brush shoreline or wooded shoreline. The height of the banks were recorded.

Other Observations

Notes were made concerning the water temperature, turbidity of the water, abundance of cover in the stream and the frequency of pools.

REPORT OF STUDY

Descriptions of Stations

Photographs

Specie Composition per Location

Station 0.A (Mainstream - Potter Park)

Bottom Type

The bottom was 87.1% silt, 6.4% clay, and 6.5% detritus. From 5 to 8 inches of silt covered the following bottom conditions: 62.5% sand, 5.0% gravel and 32.5% rock.

Depth

The average depth was 77.6 inches, ranging between 52 and 108 inches.

Length and Width

The length of this station was 385 feet. The average width was 144 feet, ranging from 140 to 148 feet.

Current

The current was a consistant 0.43 feet per second.

Vegetation

A small amount of Lemna minor and Rumex were found along the edges of the stream.

Shoreline

This station is within Potter Park and consisted of several large trees and mowed grass. The banks varied from one to 2 feet in height.

Other Observations

On 10/27/62 air temperature was 50°F, water temperature was 41°F. A sewer pipe fed the stream with a gray-green chalky colored water. Very little cover was present.

Collecting Information

Shocking gear was used for 2½ hours on 10/27/62 resulting in a collection of 272 fish.

TABLE 1

SPECIES COMPOSITION AT STATION O.A

(Mainstream - Potter Park)

Species	Number	Percentage of total
Umbra limi	2	0.74
Crassius auritus	6	2.21
Notropis cornutus frontalis	1	0.37
Notropis spilopterus	3	1.10
Pimephales notatus	143	52.57
Catostomus commersoni	7	2.57
Minytrema melanops	23	8.46
Ictalurus melas	46	16.91
Ictalurus natalis	5	1.84
Chaenobryttus gulosus	1	0.37
Lepomis cyanellus	24	8.82
Lepomis gibbosus	6	2.21
Lepomis macrochirus	4	1.47
Pomoxis nigromaculatus	1	0.37
Total =	272	

Station: 0.B (Sycamore Creek)

Bottom Type

The bottom was 20.0% silt, 24.0% sand, 35.2% gravel, 16.8% rock and 4.0% detritus.

Depth

The average depth was 20.1 inches, ranging from 4 to 50 inches.

Length and Width

The length of this station was 725 feet. The average width was 37.7 feet, ranging from 26 to 47 feet.

Current

The average current was 0.23 feet per second, ranging from 0.08 to 0.52 feet per second.

Vegetation

The sparse aquatic vegetation consisted of Elodea canadensis, Potamogeton, Cladophora, Hypericum and Sparganium. One fairly dense patch of Elodea canadensis was found just downstream from the bridge.

Shoreline

Send and rock were along some of the shoreline. This station was well shaded by the stand of trees along the stream. The banks varied from 2-5 feet in height.

Other Observations

On 7/1/62 air temperature was 70°F, water temperature was 69°F. The water was slightly turbid. On 8/8/62 air temperature was 73°F, water temperature was 74°F. Cover was frequent in the form of brush piles, rocks and undercut banks with exposed tree roots. Pools were more or less continuous.

Station: O.B (Continued)

Collecting Information

The 4-ft. seine and hook and line were used for 2 hours on 7/1/62 resulting in a collection of 26 fish. Hook and line were used for 1 hour on 7/14/62, resulting in 5 fish. Shocking gear was used for $2\frac{1}{2}$ hours on 8/8/62, resulting in a collection of 240 fish.

Figure 5

Station O.B (Sycamore Creek - looking upstream from under Cavanaugh Rd. bridge)

TABLE 2

SPECIES COMPOSITION AT STATION O.B

(Sycamore Creek)

Species	Number	Percentage of total
Icthyomyzon castaneus	3	1.11
Umbra limi	2	0.74
Esox americanus vermiculatus	1	0.37
Esox lucius	3	1.11
Campostoma anomalum	13	4.80
Cyprinus carpio	1	0.37
Notropis cornutus frontalis	26	9.59
Notropis spilopterus	2	0.74
Pimephales notatus	55	20.30
Rhinichthys atratulus	1	0.37
Semotilus atromaculatus	9	3.32
Catostomus commersoni	2	0.74
Hypentelium nigricans	1	0.37
Minytrema melanops	1	0.37
Moxostoma erythrurum	2	0.74
Ictalurus melas	5	1.84
Ictalurus natalis	23	8.49
Noturus gyrinus	1	0.37
Ambloplites rupestris	30	11.07
Lepomis cyanellus	41	15.13
Lepomis gibbosus	1	0.37

TABLE 2 (Continued)

Species	Number	Percentage of total
Micropterus dolomieui	2	0.74
Micropterus salmoides	1	0.37
Pomoxis nigromaculatus	1	0.37
Etheostoma caeruleum	2	0.74
Etheostoma nigrum	24	8.86
Percina maculata	18	6.64
Total =	271	

Station: O.C (Mainstream - Behind Kellogg Center on campus of Michigan State University)

Bottom Type

The bottom was 35.5% silt, 22.6% sand, 19.3% gravel and 22.6% rock.

Depth

The average depth was 18.1 inches, ranging between 5 and 48 inches.

Length and Width

The length of this station was 470 feet. The average width was 70.5 feet, ranging between 67 and 74 feet.

Current

The average current was 1.05 feet per second, ranging from 0.85 to 1.25 feet per second.

Vegetation

Potamogeton grew abundantly near the center of the stream where the current was the strongest and the water was from 15 to 20 inches deep.

Shoreline

The shore consisted of mowed grass and many large trees which provided shade over much of this station. The banks varied from one to 5 feet in height.

Other Observations

On 7/22/62 the water was turbid. On 9/13/62 air temperature was 79°F, water temperature was 73.5°F. On 9/24/62 water temperature was 61°F. On 10/13/62 water temperature was 64°F. The dense growth of Potamogeton provided the greatest amount of cover. Cover on the east side of the stream consisted of an approximate 15 foot section of undercut bank with exposed tree roots and some cinder blocks in one fairly large pool.

Station: O.C (Continued)

Collecting Information

On 7/22/62 a 20-ft. seine was used for one hour resulting in a collection of 192 fish. Shocking gear was used for 2 hours on 8/29/62, resulting in a collection of 561 fish.

Figure 6

Station O.C (Mainstream - Behind Kellogg Center
on campus of Michigan State University -
looking downstream from footbridge)

TABLE 3

SPECIES COMPOSOTION AT STATION O.C

(Mainstream - Behind Kellogg Center on campus of Michigan State University)

Species	Number	Percentage of total
Umbra limi	3	0.40
Campostoma anomalum	10	1.33
Cyprinus carpio	3	0.40
Hybopsis biguttata	45	5.98
Notropis cornutus frontalis	452	60.03
Pimephales notatus	50	6.64
Semotilus atromaculatus	26	3.45
Catostomus commersoni	37	4.91
Ictalurus natalis	98	13.01
Eucalia inconstans	1	0.13
Lepomis cyanellus	21	2.79
Micropterus dolomieui	1	0.13
Etheostoma nigrum	2	0.27
Percina maculata	4	0.53

Total = 753

Station: O.D (Mainstream - just downstream from dam on campus of Michigan State University)

Bottom Type

The bottom was 5.3% silt, 27.6% sand, 25.0% gravel, 39.5% rock and 2.6% detritus. A very fine layer of silt covered most bottom types from 100 feet below the dam on downstream.

Depth

The average depth was 16.6 inches, ranging from 6 to 48 inches.

Length and Width

The length of this station was 500 feet. The average width was 73.6 feet, ranging from 64 to 81 feet.

Current

The average current was 0.68 feet per second, ranging from 0.15 to 3.03 feet per second.

Vegetation

Only Lemna minor was found at this station.

Shoreline

The edges of the stream were rocky. The high banks (approximately 12 to 15 feet) consisted of several large trees and mowed grass.

Other Observations

Cover was provided primarily by the rocky bottom and two small brush piles. Only one pool (just below the falls) was present at this station.

Collecting Information

Shocking gear was used for 2½ hours on 9/15/62, resulting in a collection of 826 fish.

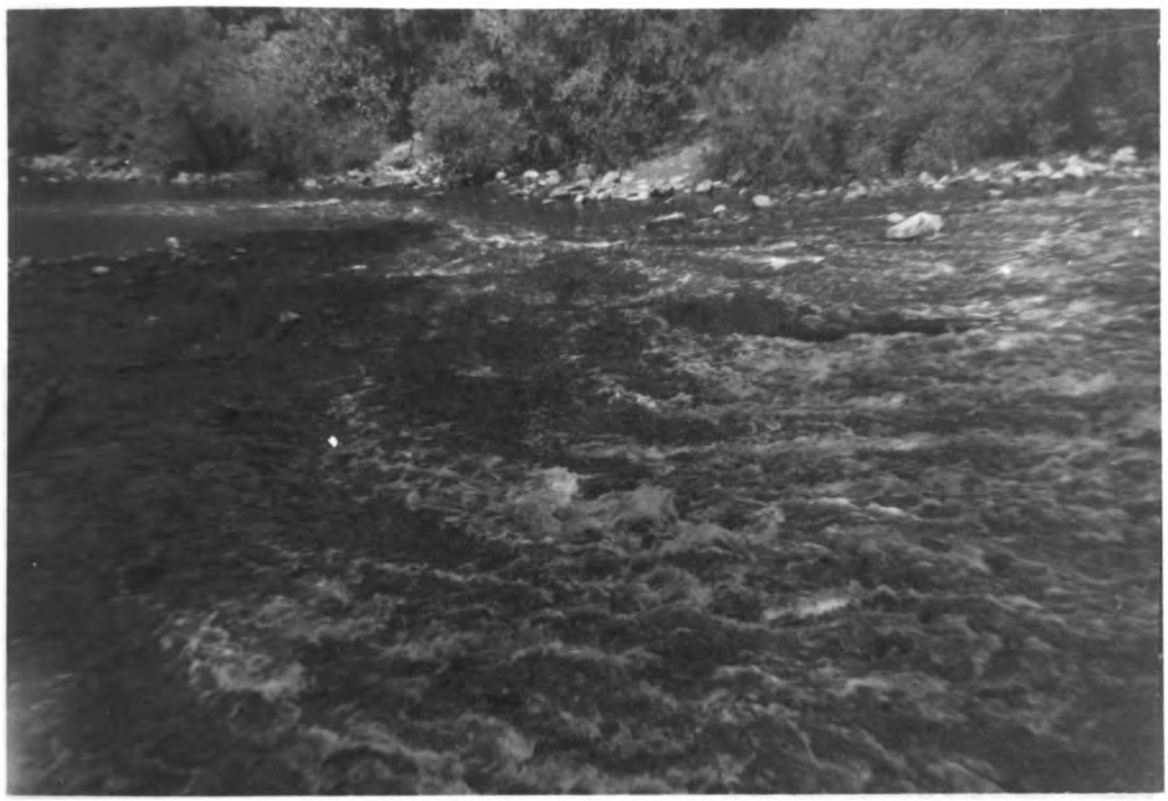

Figure 7
Station O.D (Mainstream - falls just below dam on campus of Michigan State University)

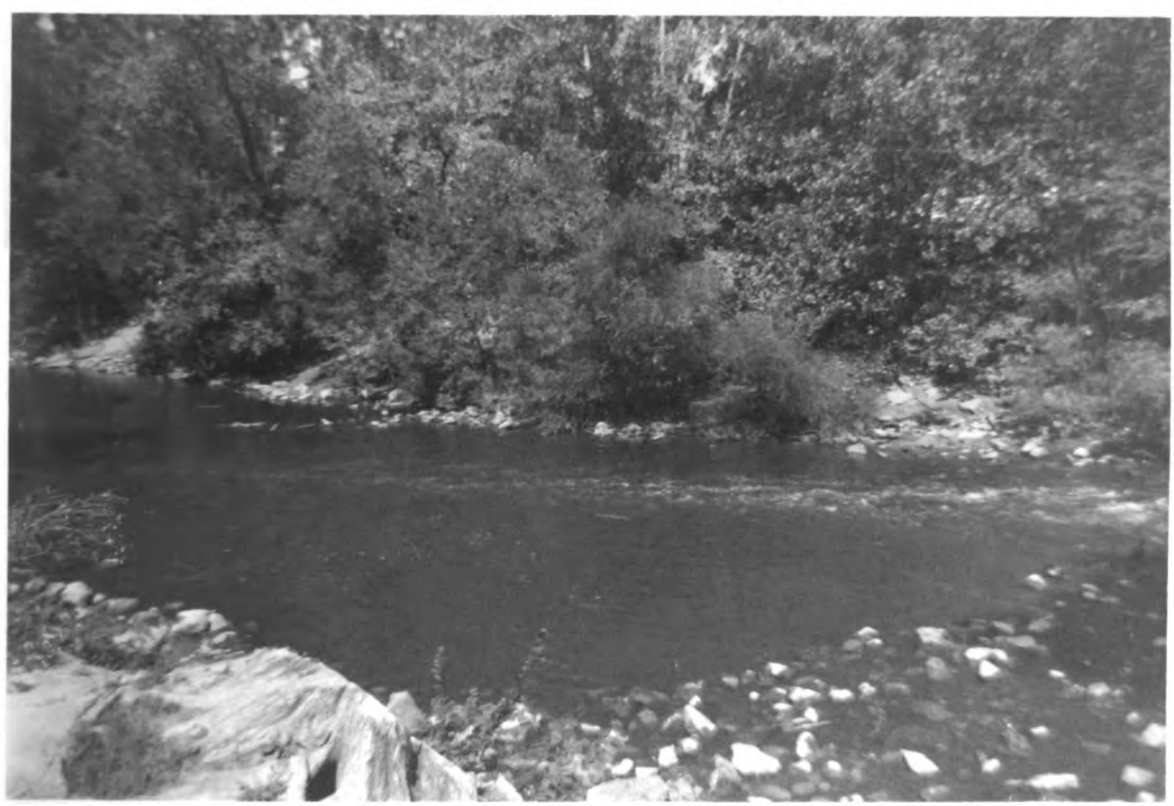

Figure 8
Station O.D (Mainstream - large pool just below falls on campus of Michigan State University)

Figure 9

Station O.D (Mainstream - riffles just upstream from footbridge behind Michigan State University Library)

TABLE 4

SPECIES COMPOSITION AT STATION O.D

(Mainstream - just downstream from dam on campus of Michigan State University)

Species	Number	Percentage of total
Icthyomyzon castaneus	1	0.12
Campostoma anomalum	159	19.25
Cyprinus carpio	5	0.61
Hybopsis biguttata	27	3.27
Notropis cornutus chrysocephalus	1	0.12
Notropis cornutus frontalis	232	28.09
Notropis rubellus	2	0.24
Notropis spilopterus	4	0.48
Notropis stramineus	5	0.61
Pimephales notatus	32	3.87
Rhinichthys atratulus	4	0.48
Semotilus atromaculatus	26	3.15
Catostomus commersoni	19	2.30
Minytrema melanops	7	0.85
Moxostoma erythrurum	2	0.24
Ictalurus melas	2	0.24
Ictalurus natalis	222	26.88
Ambloplites rupestris	2	0.24
Chaenobryttus gulosus	2	0.24
Lepomis cyanellus	37	4.48
Lepomis gibbosus	1	0.12

TABLE 4 (Continued)

Species	Number	Percentage of total
Lepomis macrochirus	1	0.12
Micropterus dolomieui	23	2.78
Pomoxis nigromaculatus	1	0.12
Percina maculata	8	0.97
Labidesthes sicculus	1	0.12
Total =	826	

Station: I.A (Mainstream - just upstream from dam on campus of Michigan State University)

Bottom Type

Rock and brush were abundant near the dam. From 50 feet above the dam on upstream the bottom was 100% silt. Scattered brush and stumps lined the shores.

Depth

The average depth was 51 inches, ranging from 13 to 72 inches.

Length and Width

The length of this station was 100 feet. The average width was 83 feet, ranging from 81 to 85 feet.

Current

The current was sluggish, measuring less than 0.50 feet per second.

Vegetation

Lemna minor was found at this station.

Shoreline

Overhanging trees and shrubs shaded the edges of the stream. The banks were rocky near the dam.

Other Observations

On 9/10/62 the air temperature was 70.5°F, water temperature was 79.5°F. Cover was provided by large rocks and brush near the dam and by overhanging shrubs, stumps, undercut banks and brush piles a little upstream from dam.

Collecting Information

Hook and line were used on 8/23/62, 9/10/62, 9/11/62, 9/12/62 and 9/15/62 for a total of 20 hours resulting in a collection of 87 fish.

Figure 10

Station I.A (Mainstream - looking upstream from dam on campus of Michigan State University)

TABLE 5

SPECIES COMPOSITION AT STATION I.A

(Mainstream - just upstream from dam on campus of Michigan State University)

Species	Number	Percentage of total
Icthyomyzon castaneus	10	14.49
Cyprinus carpio	12	17.39
Semotilus atromaculatus	1	1.45
Ictalurus melas	11	15.94
Ictalurus natalis	12	17.39
Lepomis cyanellus	4	5.80
Lepomis gibbosus	8	11.59
Lepomis macrochirus	5	7.25
*Hybrids (Lepomis)	2	2.90
Micropterus dolomieui	2	2.90
Micropterus salmoides	2	2.90
Total =	69	

*L. gibbosus x L. macrochirus

Station: I.B (Herron Creek)

Bottom Type

The bottom was 80.0% silt, 13.4% sand, 3.3% gravel and 3.3% rock.

Depth

The average depth was 9.8 inches, ranging from 1 to 30 inches.

Length and Width

The length of this station was 70 feet. The average width was 8.6 feet, ranging from 7 to 10 feet.

Current

The current was very sluggish, being much less than 0.50 feet per second.

Vegetation

Grasses grew abundantly in the creek. Other vegetation included Lemna minor and Elodea canadensis.

Shoreline

The shoreline consisted of the same type of grasses which grew in the creek bottom. One large tree (near the southeast corner of the bridge) provided shade. The average height of the banks was 3 feet.

Other Observations

On 7/1/62 air temperature was 76°F, water temperature was 70.5°F. The water was turbid. On 9/9/62 air temperature was 75°F, water temperature was 65°F. Cover was provided by the abundance of grasses and an undercut bank (near the bridge) with exposed tree roots.

Collecting Information

The 4-ft. seine was used for 2 hours on 7/1/62 resulting in a collection of 355 fish. The 4-ft. seine was used for one hour on 9/9/62 resulting in a collection of 507 fish.

Figure 11
Station I.B (Herron Creek - looking upstream
from Jolly Rd. bridge)

TABLE 6

SPECIES COMPOSITION AT STATION I.B

(Herron Creek)

Species	Number	Percentage of total
Umbra limi	38	4.26
Esox lucius	3	0.34
Chrosomus eos	1	0.11
Notemigonus crysoleucas	22	2.47
Notropis cornutus frontalis	73	8.18
Notropis heterodon	4	0.45
Notropis heterolepis	7	0.78
Pimephales notatus	12	1.34
Pimephales promelas	3	0.34
Rhinichthys atratulus	77	8.63
Semotilus atromaculatus	9	1.01
Catostomus commersoni	5	0.56
Ictalurus melas	1	0.11
Eucalia inconstans	597	66.93
Lepomis cyanellus	5	0.56
Lepomis gibbosus	14	1.57
*Hybrids (Lepomis)	3	0.34
Pomoxis nigromaculatus	17	1.91
Etheostoma nigrum	1	0.11
Total =	892	

*L. cyanellus x L. gibbosus

Station I.C (Lake Lansing)

Bottom Type

The bottom was 100% silt where collection was made.

Depth

The average depth was 31 inches, ranging from 10 to 84 inches where collection was made.

Length and Width

The length of the collecting area was approximately 1000 feet. The width of the collecting area was approximately 400 feet.

Vegetation

Myriophyllum, three species of Potamogeton, Chara and Elodea make up the dense vegetation.

Shoreline

Most of the shoreline where collected was marshy. Some of the area near the amusement park was residential with mowed lawns up to the water's edge.

Other Observations

On 10/29/62 the water was slightly turbid. Cover was provided by the extremely abundant vegetation.

Collecting Information

Hook and line were used on 8/27/62 for 2 hours resulting in a collection of 30 fish. Shocking gear was used for $2\frac{1}{2}$ hours on 10/29/62, resulting in a collection of 478 fish.

TABLE 7

SPECIES COMPOSITION AT STATION I.C

(Lake Lansing)

Species	Number	Percentage of total
Umbra limi	1	0.20
Esox americanus vermiculatus	22	4.33
Esox lucius	3	0.59
Cyprinus carpio	3	0.59
Hybopsis biguttata	1	0.20
Notemigonus crysoleucas	3	0.59
Notropis anogenus	5	0.98
Notropis cornutus frontalis	1	0.20
Notropis heterodon	10	1.97
Pimephales notatus	3	0.59
Erimyzon sucetta	40	7.87
Ictalurus natalis	31	6.10
Ictalurus nebulosus	7	1.38
Chaenobryttus gulosus	16	3.15
Lepomis cyanellus	6	1.18
Lepomis gibbosus	79	15.55
Lepomis macrochirus	130	25.59
*Hybrids (Lepomis)	12	2.36
Micropterus salmoides	29	5.71
Pomoxis nigromaculatus	2	0.39
Perca flavescens	104	20.47
	Total = 508	

*L. gibbosus x L. macrochirus

Station: I. D (Lake Lansing outlet)

Bottom Type

The bottom was 48.4% silt, 12.9% clay, 22.6% sand, 12.9% gravel and 3.2% detritus.

Depth

The average depth was 6.7 inches, ranging between 3 and 20 inches.

Length and Width

The length of this station was 120 feet. The average width was 7.3 feet, ranging from 1 to 15 feet.

Current

The average current was 0.67 feet per second, ranging from 0.20 to 2.00 feet per second.

Vegetation

The medium amount of vegetation included Elodea, Lemna minor and Hypericum.

Shoreline

The shoreline was open grassland. The average height of the banks was one foot.

Other Observations

Cover was provided by the aquatic vegetation, a little debris and overhanging grasses. The only pool present was the one under the bridge.

Collecting Information

A 4-ft. seine was used for one hour on 7/22/62 resulting in a collection of 75 fish.

TABLE 8

SPECIES COMPOSITION AT STATION I.D

(Lake Lansing outlet)

Species	Number	Percentage of total
Esox lucius	1	1.33
Notropis cornutus frontalis	65	86.67
Semotilus atromaculatus	2	2.67
Catostomus commersoni	3	4.00
Lepomis macrochirus	1	1.33
Etheostoma nigrum	3	4.00
Total =	75	

Station: I.E (Mainstream - Nakoma Road area)

Bottom Type

The bottom was 15.8% silt, 38.9% sand, 29.7% gravel, 8.6% rock and 7.0% detritus.

Depth

The average depth was 20.1 inches, ranging from 5 to 45 inches.

Length and Width

The length of this station was 2,640 feet. The average width was 72.5 feet, ranging from 61 to 80 feet.

Current

The average current was 0.42 feet per second, ranging from 0.18 to 0.90 feet per second.

Vegetation

The medium amount of aquatic vegetation included Vallisneria americana, Sagittaria latifolia, Sagittaria sp., Elodea canadensis, Pontederia cordata, Ceratophyllum demersum, Rumex, Nasturtium officinale, Potamogeton foliosus, or pusillus and Potamogeton tenuifolius. Lizard's tail (Saururus cernuus) was abundant along the edges of the stream.

Shoreline

The shore was approximately 20% open grassland and 80% woodland. The banks varied from 2 to 15 feet in height.

Other Observations

On 7/12/62 air temperature was 74.5°F, water temperature was 72.5°F. The water was turbid. On 7/18/62 air temperature was 79°F, water temperature was 73°F. On 7/23/62 air temperature was 63.5°F, water temperature was 68°F. The water was turbid. On 9/27/62 air temperature was 47°F, water temperature was 52.5°F. Most of the cover was provided by a medium amount of

Station: I.E (Continued)

vegetation. Only 17 small brush piles were observed throughout this entire station. Pools were very sparse with long stretches of relatively shallow water between them.

Collecting Information

The 15-ft. seine was used for one hour on 7/12/62 resulting in a collection of 151 fish. Shocking gear was used for 3 hours on 7/18/62 resulting in a collection of 330 fish. Shocking gear was used for 2 hours on 7/23/62 resulting in a collection of 337 fish.

Figure 12
Station I.E (Mainstream - looking downstream
from Nakoma Rd. bridge)

Figure 13
Station I.E (Mainstream - looking upstream
from Nakoma Rd. bridge)

TABLE 9

SPECIES COMPOSITION AT STATION I.E

(Mainstream - Nakoma Road area)

Species	Number	Percentage of total
Ichthyomyzon castaneus	4	0.49
Umbra limi	16	1.96
Esox americanus vermiculatus	2	0.24
Esox lucius	4	0.49
Campostoma anomalum	22	2.69
Cyprinus carpio	3	0.37
Hybopsis biguttata	80	9.78
Hybopsis micropogon	7	0.86
Notropis cornutus frontalis	295	36.06
Notropis heterolepis	2	0.24
Notropis rubellus	16	1.96
Notropis stramineus	7	0.86
Pimephales notatus	27	3.30
Rhinichthys atratulus	2	0.24
Semotilus atromaculatus	83	10.15
Catostomus commersoni	74	9.05
Hypentelium nigricans	3	0.37
Minytrema melanops	14	1.71
Moxostoma erythrurum	15	1.83
Ictalurus melas	7	0.86
Ictalurus natalis	9	1.10

TABLE 9 (Continued)

Species	Number	Percentage of total
Eucalia inconstans	1	0.12
Ambloplites rupestris	38	4.65
Lepomis cyanellus	1	0.12
Lepomis gibbosus	2	0.24
Micropterus dolomieui	31	3.79
Etheostoma nigrum	26	3.18
Percina maculata	27	3.30
Total =	818	

Station: II.A (Drain - Jolly Road)

Bottom Type

The bottom was 100% silt.

Depth

The average depth was 3 inches, ranging between 1 and 11 inches.

Length and Width

The length of this station was 8 ft. (4 ft. on each end of the culvert). The average width was 2.5 feet, ranging between 2 and 6 feet.

Current

The current was very sluggish (not measurable).

Vegetation

Vegetation consisted of a filamentous alga and an abundance of grass.

Shoreline

The shore was open grassland. Shade was provided by overhanging grasses and the bridge.

Other Observations

The water was clear on 7/10/62. Cover was provided by the overhanging grasses and the filamentous alga.

Collecting Information

A 4-ft. seine was used for $\frac{1}{2}$ hour on 7/10/62 resulting in a collection of 51 fish.

Figure 14

Station II.A (unnamed drain - looking upstream from Jolly Rd.)

Figure 15

Station II.A (unnamed drain - looking downstream from Jolly Rd.)

TABLE 10

SPECIES COMPOSITION AT STATION II.A

(Drain under Jolly Road and near Okemos Road)

Species	Number	Percentage of total
Umbra limi	4	7.84
Campostoma anomalum	1	1.96
Semotilus atromaculatus	1	1.96
Eucalia inconstans	45	88.24
Total =	51	

Station: II.B (Mainstream - Dobie Road area)

Bottom Type

The bottom was 32.4% silt, 37.9% sand, 18.9% gravel and 10.8% rock.

Depth

The average depth was 26.8 inches, ranging between 14 and 39 inches

Length and Width

The length of this station was 300 feet. The average width was 66.7 feet, ranging between 61 and 72 feet.

Current

The average current was 0.31 feet per second, ranging from 0.25 to 0.48 feet per second.

Vegetation

A medium amount of Cladophora and Fontinalis grew on the rocks and logs. Water cress (Nasturtium officinale) and Elodea canadensis grew in dense patches along the southwest edge of the stream.

Shoreline

The southwest shore was relatively open consisting of grasses, weeds and shrubs; the other shore was thickly wooded. The banks varied from 4 to 15 feet in height.

Other Observations

On 6/28/62 air temperature was 79°F, water temperature was 76°F. Cover was provided primarily by the aquatic vegetation and scattered large rocks. Two very small brush piles and a few sunken logs were present.

Collecting Information

Shocking gear was used for 1½ hours on 6/28/62 resulting in a collection of 229 fish. This collection was not reliable due to the inefficiency of the crew.

TABLE 11

SPECIES COMPOSITION AT STATION II.B

(Mainstream - Dobie Road area)

Species	Number	Percentage of total
Ichthyomyzon castaneus	1	0.44
Umbra limi	2	0.87
Campostoma anomalum	1	0.44
Hybopsis biguttata	14	6.11
Notemigonus crysoleucas	1	0.44
Notropis cornutus frontalis	93	40.61
Notropis rubellus	16	6.99
Notropis spilopterus	1	0.44
Notropis volucellus	2	0.87
Pimephales notatus	17	7.42
Semotilus atromaculatus	5	2.18
Catostomus commersoni	1	0.44
Hypentelium nigricans	10	4.37
Minytrema melanops	2	0.87
Moxostoma erythrurum	3	1.31
Eucalia inconstans	1	0.44
Ambloplites rupestris	47	20.52
Lepomis gibbosus	1	0.44
Micropterus dolomieui	2	0.87
Etheostoma caeruleum	1	0.44
Percina maculata	8	3.49
Total =	229	

Station: II.C (Dobie Lake)

Bottom Type

The bottom was 100% silt.

Depth

The depth ranged from 24 to 144 inches where collections were made.

Vegetation

The abundant aquatic vegetation included *Nuphar* and/or *Nymphaea*, *Potamogeton*, *Chara* and *Ceratophyllum*.

Shoreline

The shoreline was boggy with grasses and shrubs.

Collecting Information

One one-inch meshed and one 2-inch meshed gill net were used for 5 hours on 9/5/62 resulting in a collection of 2 fish. Hook and line were used for 5 hours on 9/5/62 resulting in a collection of 21 fish.

TABLE 12

SPECIES COMPOSITION AT STATION II.C

(Dobie Lake)

Species	Number	Percentage of total
Notropis cornutus frontalis	2	8.70
Ictalurus natalis	4	17.39
Chaenobryttus gulosus	4	17.39
Lepomis cyanellus	1	4.35
Lepomis gibbosus	9	39.13
*Hybrid (Lepomis)	1	4.35
Micropterus salmoides	1	4.35
Perca flavescens	1	4.35
Total =	23	

*L. gibbosus x L. macrochirus

Station: II.D (Button Drain)

Bottom Type

The bottom was 30.8% silt, 23.1% sand, 26.9% gravel and 19.2% rock.

Depth

The average depth was 4.2 inches, ranging between 1 and 13 inches.

Length and Width

The length of this station was 150 feet. The average width was 5.1 feet, ranging between 2 and 13 feet.

Current

The average current was 1.1 feet per second, ranging from 0.4 to 2.0 feet per second.

Vegetation

Water cress (Nasturtium officinale) was found along the edges of the drain.

Shoreline

The shoreline was open grassland. Pigs grazed this area. The banks varied from 3 to 8 feet in height.

Other Observations

On 9/27/62 air temperature was 56°F, water temperature was 54°F. The water was clear. Cover was provided by the water cress, overhanging grasses and rocks. Pools were infrequent with relatively long stretches of shallow water between them.

Collecting Information

A 4-ft. seine was used for one and a half hours on 7/10/62 resulting in a collection of 86 fish. Shocking gear was used for one hour on 9/27/62 resulting in a collection of 113 fish.

Figure 16

Station II.D (Button Drain - looking upstream from Jolly Rd. bridge)

Figure 17

Station II. D (Button Drain, bottom type just upstream from Jolly Rd. bridge)

TABLE 13

SPECIES COMPOSITION AT STATION II.D

(Button Drain)

Species	Number	Percentage of total
Umbra limi	6	3.02
Campostoma anomalum	38	19.10
Notropis cornutus frontalis	18	9.05
Rhinichthys atratulus	54	27.14
Semotilus atromaculatus	29	14.57
Catostomus commersoni	24	12.06
Eucalia inconstans	9	4.52
Etheostoma caeruleum	1	0.50
Etheostoma microperca	12	6.03
Etheostoma nigrum	8	4.02
Total =	199	

Station: II.E (Sloan Creek)

Bottom Type

The bottom was 23.5% silt, 41.2% sand, 29.4% gravel and 5.9% rock.

Depth

The average depth was 7.6 inches, ranging between 3 and 13 inches.

Length and Width

The length of this station was 120 feet. The average width was 9 feet, ranging between 7 and 14 feet.

Current

The average current was 0.22 feet per second, ranging from 0.13 to 0.40 feet per second.

Vegetation

Water cress (Nasturtium officinale) grew abundantly along the edges of the stream.

Shoreline

The shoreline just upstream from Jolly Road consisted of weeds and grasses. From 75 ft. on upstream the shore was thickly wooded with small trees and large shrubs. Downstream the shore was similarly wooded. The banks varied from 1 to 3 ft. in height.

Other Observations

On 7/13/62 air temperature was 73.4°F, water temperature was 63°F. The water was turbid. Cover was provided by only the water cress and a few small rocks. The only pool at this station was the one under the culvert.

Collecting Information

A 4-ft. seine was used for one and a half hours on 7/13/62 resulting in a collection of 128 fish.

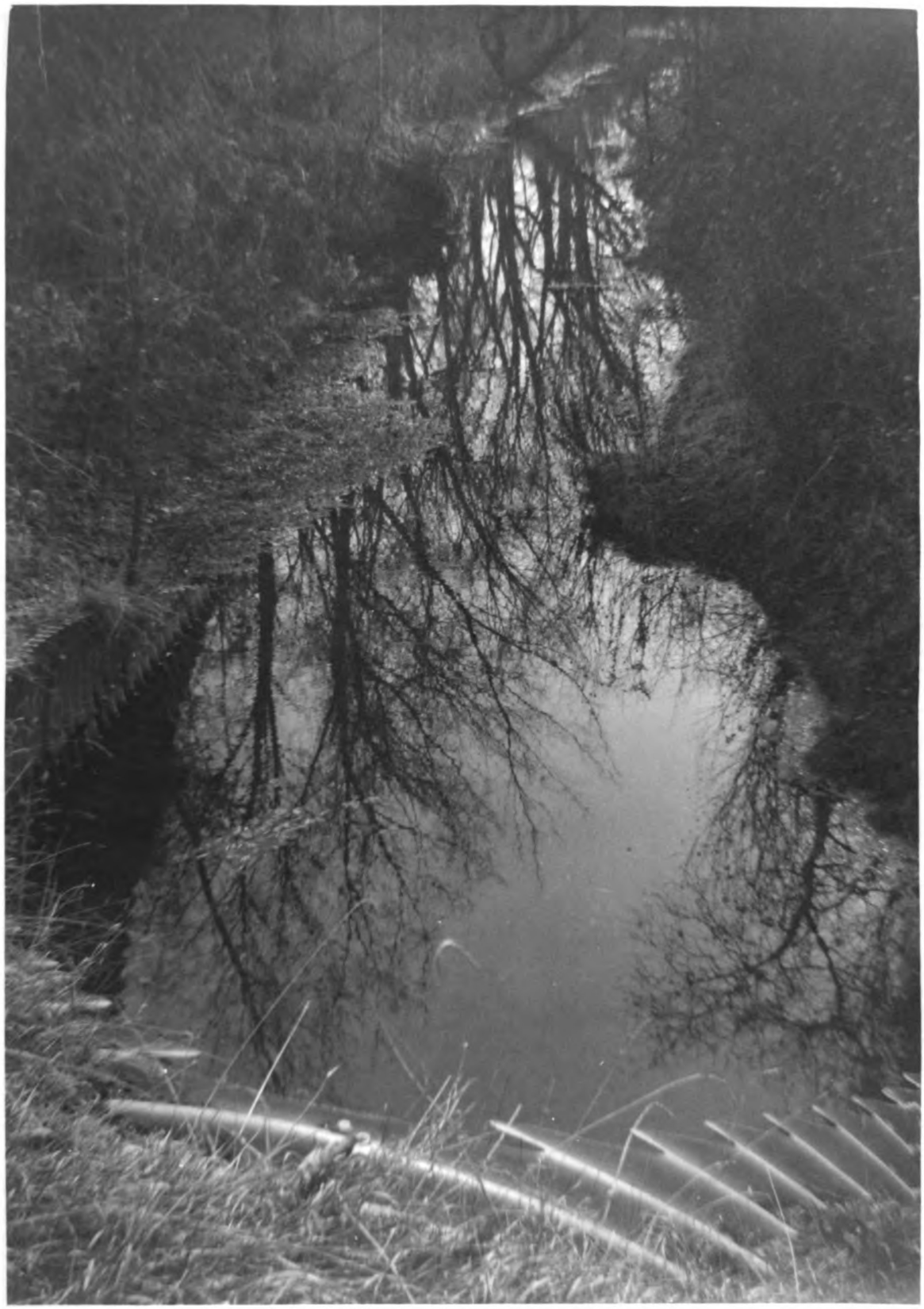

Figure 18
Station II.E (Sloan Creek - looking upstream from Jolly Rd. culvert)

TABLE 14

SPECIES COMPOSITION AT STATION II.E

(Sloan Creek)

Species	Number	Percentage of total
Umbra limi	3	2.34
Campostoma anomalum	3	2.34
Notropis cornutus frontalis	24	18.75
Notropis heterolepis	1	0.78
Pimephales notatus	4	3.12
Rhinichthys atratulus	11	8.59
Semotilus atromaculatus	28	21.88
Catostomus commersoni	17	13.28
Eucalia inconstans	11	8.59
Etheostoma microperca	4	3.12
Etheostoma nigrum	21	16.41
Percina maculata	1	0.78
Total =	128	

Station: II.F (Mainstream - Van Atta Road area)

Bottom Type

The bottom was 17.7% silt, 36.5% sand, 27.1% gravel, 9.3% rock and 9.4% detritus. Rocks included cinder blocks that had been dumped into the stream.

Depth

The average depth was 17.3 inches, ranging from 5 to 41 inches.

Length and Width

The length of this station was 500 feet. The average width was 56.2 feet, ranging from 40 to 83 feet.

Current

The average current was 0.79 feet per second, ranging from 0.55 to 1.06 feet per second.

Vegetation

The sparse aquatic vegetation included Elodea canadensis, Sagittaria and Cladophora.

Shoreline

The shoreline was thickly wooded with large trees. The banks varied from 3 to 6 feet in height.

Other Observations

On 6/28/62 air temperature was 79°F, water temperature was 76°F. Cover was provided by cinder blocks, a couple of brush piles, and a few areas where the bank had been undercut exposing tree roots. Pools were moderately frequent.

Station: II.F (Continued)

Collecting Information

Shocking gear was used for one hour on 6/28/62 resulting in a collection of 173 fish. This was not a reliable collection due to the inefficiency of the crew.

TABLE 15

SPECIES COMPOSITION AT STATION II.F

(Mainstream - Van Atta Road area)

Species	Number	Percentage of total
Umbra limi	1	0.58
Hybopsis biguttata	10	5.78
Hybopsis micropogon	1	0.58
Notropis cornutus frontalis	92	53.18
Notropis rubellus	1	0.58
Notropis spilopterus	1	0.58
Notropis volucellus	1	0.58
Pimephales notatus	11	6.36
Semotilus atromaculatus	12	6.94
Catostomus commersoni	2	1.16
Hypentelium nigricans	6	3.47
Moxostoma erythrurum	4	2.31
Ictalurus natalis	5	2.89
Ambloplites rupestris	21	12.14
Etheostoma nigrum	2	1.16
Percina maculata	3	1.73
Total =	173	

Station: II.G (Mainstream - Grand River Road [M-43] area)

Bottom Type

The bottom was 4.3% silt, 35.1% sand, 31.6% gravel, 22.2% rock and 6.8% detritus.

Depth

The average depth was 21.5 inches, ranging between 9 and 34 inches.

Length and Width

The length of this station was 700 feet. The average width was 65.9 feet, ranging between 58 and 80 feet.

Current

The average current was 0.54 feet per second, ranging from 0.25 to 1.07 feet per second.

Vegetation

Fontinalis and Cladophora were abundant on the rocks in the riffles near the bridge. Lizard's tail (Saururus cernuus) was very abundant along the edges of the stream. Medium amounts of Lemna minor and Elodea canadensis were found along the edges of the stream. Vallisneria (found in open shallow water) and Rumex (found along the edges of the stream)were sparse.

Shoreline

Approximately 85% of the shore was wooded (large trees) and 15% open grassland. The banks varied from 4 to 16 feet in height.

Other Observations

On 9/25/62 water temperature was 58°F. On 10/3/62 air temperature was 69°F, water temperature was 59°F. On 10/13/62 water temperature was 58°F. Most of the cover was provided by the dense growth of

Station II.G (Continued)

lizard's tail. The rest of the cover was provided by three log jams, several large rocks or boulders, other aquatic vegetation and 3 sunken logs. Most of this station above the riffles consisted of more or less continuous pools.

Collecting Information

Shocking gear was used for 2 hours on 6/27/62 resulting in a collection of 167 fish. This was not a reliable collection due to the inefficiency of the crew. Shocking gear was used for one and a half hours on 10/3/62 resulting in a collection of 667 fish. This was a reliable collection.

Figure 19
Station II.G (Mainstream - looking upstream
from near the Grand River Rd. (M-43) bridge)

Figure 20
Station II.G (Mainstream - looking upstream from 320 ft.
upstream from the Grand River Rd. (M-43) bridge)

TABLE 16

SPECIES COMPOSITION AT STATION II.G

(Mainstream - Grand River Road [M-43] area)

Species	Number	Percentage of total
Umbra limi	1	0.12
Esox lucius	1	0.12
Campostoma anomalum	26	3.12
Hybopsis biguttata	47	5.64
Hybopsis micropogon	41	4.92
Notropis cornutus frontalis	45	5.40
Notropis rubellus	2	0.24
Notropis volucellus	1	0.12
Pimephales notatus	12	1.44
Semotilus atromaculatus	13	1.56
Catostomus commersoni	7	0.84
Hypentelium nigricans	53	6.35
Minytrema melanops	6	0.72
Moxostoma erythrurum	4	0.48
Ictalurus melas	1	0.12
Ictalurus natalis	8	0.96
Noturus gyrinus	1	0.12
Ambloplites rupestris	436	52.28
Lepomis cyanellus	13	1.56
Lepomis gibbosus	2	0.24
Lepomis megalotis	2	0.24

TABLE 16 (Continued)

Species	Number	Percentage of total
Micropterus dolomieui	30	3.60
Pomoxis nigromaculatus	1	0.12
Etheostoma caeruleum	2	0.24
Etheostoma nigrum	27	3.24
Percina maculata	52	6.24
Total =	834	

Station: II.H (Creek - under Sherwood Road, near Meridian Road).

Bottom Type

The bottom was 39.2% silt, 13.4% sand, 39.2% gravel and 8.2% rock.

Depth

The average depth was 6.4 inches, ranging between 1 and 15 inches.

Length and Width

The length of this station was 231 feet. The average width was 5.0 feet, ranging between 3 and 10 feet.

Current

The average current was 0.26 feet per second, ranging from 0.04 to 1.50 feet per second.

Vegetation

Nasturtium officinale and Lemna minor were abundant along the edges of the creek.

Shoreline

The shoreline consisted of mowed grass and a few large trees providing better than 50% shade over this station. The banks varied from 1 to 3 feet in height.

Other Observations

Cover was provided by the aquatic vegetation and fallen leaves along the edges of the creek. Pools were infrequent with long shallow stretches between them.

Collecting Information

Shocking gear was used for one hour and fifteen mimutes on 10/31/62 resulting in a collection of 470 fish.

Figure 21
Station II.H (unnamed creek - looking upstream from Sherwood Rd. culvert)

Figure 22
Station II.H (unnamed creek - looking downstream from Sherwood Rd. culvert)

TABLE 17

SPECIES COMPOSITION AT STATION II.H

(Creek - under Sherwood Road, near Meridian Road)

Species	Number	Percentage of total
Campostoma anomalum	39	8.30
Notropis cornutus frontalis	8	1.70
Notropis spilopterus	2	0.43
Pimephales notatus	8	1.70
Rhinichthys atratulus	221	47.02
Semotilus atromaculatus	86	18.30
Catostomus commersoni	10	2.13
Eucalia inconstans	71	15.11
Ambloplites rupestris	1	0.21
Lepomis cyanellus	1	0.21
Etheostoma microperca	3	0.64
Etheostoma nigrum	20	4.26

Total = 470

Station: II.I (Mainstream - Thatcher Road area)

Bottom Type

The bottom consisted of 20.9% silt, 21.2% sand, 39.4% gravel, 15.4% rock and 3.1% detritus.

Depth

The average depth was 14.3 inches, ranging between 5 and 23 inches.

Length and Width

The length of the station was 2640 feet. The average width was 62.4 feet, ranging between 56 and 75 feet.

Current

The average current was 0.87 feet per second, ranging from 0.28 to 2.78 feet per second.

Vegetation

Fontinalis and Cladophora were abundant on the rocks in the riffles. Medium amounts of Elodea canadensis, Elodea occidentalis, and Hydrodictyon were found along the edges of the stream in quiet water. Sagittaria and Vallisneria were very abundant. Saururus cernuus (lizard's tail) was very abundant in the shallows along the shore.

Shoreline

The shore consisted of very large trees (heavily wooded). The banks varied from 10 to 25 feet in height.

Other Observations

On 7/25/62 air temperature was 76.5°F, water temperature was 72°F. On 7/26/62 at 9 am air temperature was 58°F, water temperature was 65°F; at 4 pm air temperature was 63°F, water temperature was 69.5°F. On 7/27/62 air temperature was 62.5°F, water temperature was 63.5°F. On 8/1/62 air

Station: II.I (Continued)

temperature was 65.5°F, water temperature was 67.5°F. On 9/5/62 air temperature was 59°F, water temperature was 65.5°F.

Cover was primarily provided by the dense vegetation. Some brush piles and large rocks also provided cover. Pools were very infrequent with very long stretches of shallow water and riffles between them.

Collecting Information

Shocking gear was used for 3 hours on 7/25/62 resulting in a collection of 841 fish, for 3 hours on 7/26/62 resulting in a collection of 786 fish, for $1\frac{3}{4}$ hours on 7/27/62 resulting in a collection of 416 fish, for $3\frac{3}{4}$ hours on 7/31/62 resulting in a collection of 697 fish, for $3\frac{3}{4}$ hours on 8/1/62 resulting in a collection of 651 fish, and for $\frac{1}{2}$ hour on 9/5/62 resulting in a collection of 94 fish.

Figure 23
Station II.I (Mainstream - looking upstream from ½ mile downstream from Thatcher Rd.)

Figure 24
Station II.I (Mainstream - showing dense aquatic vegetation ½ mile downstream from Thatcher Rd.)

TABLE 18

SPECIES COMPOSITION AT STATION II.I

(Mainstream - Thatcher Road area)

Species	Number	Percentage of total
Icthyomyzon castaneus	5	0.14
Umbra limi	1	0.03
Esox lucius	5	0.14
Campostoma anomalum	182	5.22
Cyprinus carpio	6	0.17
Hybopsis biguttata	406	11.65
Hybopsis micropogon	35	1.00
Notropis cornutus chrysocephalus	1	0.03
Notropis cornutus frontalis	332	9.53
Notropis heterolepis	1	0.03
Notropis rubellus	17	0.49
*Hybrid (Notropis)	1	0.03
Pimephales notatus	86	2.47
Rhinichthys atratulus	7	0.20
Semotilus atromaculatus	86	2.47
Catostomus commersoni	424	12.17
Hypentelium nigricans	460	13.20
Minytrema melanops	26	0.75
Moxostoma erythrurum	160	4.59
Moxostoma valenciennesi	2	0.06

*Notropis cornutus frontalis x Notropis rubellus

TABLE 18 (Continued)

Species	Number	Percentage of total
Ictalurus melas	1	0.03
Ictalurus natalis	17	0.49
Eucalia inconstans	3	0.09
Ambloplites rupestris	888	25.48
Lepomis cyanellus	2	0.06
Lepomis gibbosus	5	0.14
Lepomis macrochirus	1	0.03
Lepomis megalotis	2	0.06
Micropterus dolomieui	180	5.16
Etheostoma caeruleum	1	0.03
Etheostoma nigrum	54	1.55
Percina maculata	88	2.53
Total =	3,485	

Station: III.A (Coon Creek)

Bottom Type

The bottom was 58.6% silt, 13.8% sand, 13.8% gravel and 13.8% rock.

Depth

The average depth was 10.5 inches, ranging between 2 and 36 inches.

Length and Width

The length of this station was 133 feet. The average width was 9.2 feet, ranging between 4 and 32 feet.

Current

The average current was 0.30 feet per second, ranging from 0.08 to 0.62 feet per second.

Vegetation

The medium amounts of vegetation included Vallisneria, Potamogeton, Chara, Sparganium, Hypericum and a filamentous green alga.

Shoreline

The shoreline consisted of grasses, weeds and a few shrubs. Shading was provided by some overhanging shrubs and grasses and the bridge. The land upstream from the bridge was grazed by cattle. The banks varied from 2 to 5 feet in height.

Other Observations

On 11/1/62 the water was slightly turbid. A little cover was provided by the aquatic vegetation, overhanging grasses, shrubs and a few rocks. The one and only pool at this station was the one just below the bridge.

Collecting Information

Shocking gear was used for one hour on 11/1/62 resulting in a collection of 145 fish.

Figure 25
Station III.A (Coon Creek - looking downstream towards Sherwood Rd. bridge)

Figure 26
Station III.A (Coon Creek - looking upstream towards Sherwood Rd. bridge)

TABLE 19

SPECIES COMPOSITION AT STATION III.A

(Coon Creek)

Species	Number	Percentage of total
Umbra limi	5	3.45
Esox lucius	1	0.69
Campostoma anomalum	5	3.45
Rhinichthys atratulus	4	2.76
Semotilus atromaculatus	40	27.59
Catostomus commersoni	31	21.38
Ictalurus natalis	1	0.69
Eucalia inconstans	29	20.00
Etheostoma nigrum	29	20.00

Total = 145

Station III.B (Mainstream - Williamston Sewage Plant area)

Bottom Type

The bottom was 17.9% silt, 24.1% sand, 36.5% gravel, 11.7% rock and 9.8% detritus.

Depth

The average depth was 21.4 inches, ranging from 8 to 70 inches.

Length and Width

The length of this station was 2640 feet. The average width was 57.0 feet, ranging from 31 to 74 feet.

Current

The average current was 0.44 feet per second, ranging from 0.26 to 0.98 feet per second.

Vegetation

The sparse aquatic vegetation included Sparganium, Sagittaria, Elodea canadensis, Saururus cernuus, Rumex, Lemna minor, Nasturtium officinale, Vallisneria and Ceratophyllum.

Shoreline

Approximately 87% of the shoreline was wooded, while 13% was open grassland. The banks varied from 3 to 5 feet in height.

Other Observations

On 8/6/62 air temperature was 68°F, water temperature was 74.5°F. The temperature of the water in a small creek leading from the golf course was 59.5°F. Downstream from the sewage plant cover was provided only by many large rocks. Pools were non-existent. Upstream from the sewage plant cover was provided by an abundance of log jams and brush piles. Large rocks and undercut banks were also present. Pools were more or less

Station: III.B (Continued)

continuous with relatively short shallow stretches of water between them.

Collecting Information

Shocking gear was used for 3½ hours on 8/3/62 resulting in a collection of 903 fish. Shocking gear was used for 2 hours on 8/4/62 resulting in a collection of 254 fish. Shocking gear was used for 4 hours on 8/6/62 resulting in a collection of 681 fish.

Figure 27
Station III.B (Mainstream - looking downstream from 800 ft. downstream from the Williamston Sewage Plant outlet)

Figure 28
Station III.B (Mainstream- looking upstream from 70 ft. downstream from the Williamston Sewage Plant outlet)

Figure 29
Station III.B (Mainstream - looking downstream from 1100 ft. upstream from the Williamston Sewage Plant outlet)

Figure 30
Station III.B (Mainstream - looking upstream from 1100 ft. upstream from the Williamston Sewage Plant outlet)

TABLE 20

SPECIES COMPOSITION AT STATION III.B

(Mainstream - Williamston Sewage Plant area)

Species	Number	Percentage of total
Ichthyomyzon castaneus	6	0.33
Esox americanus vermiculatus	17	0.92
Esox lucius	11	0.60
Campostoma anomalum	7	0.38
Cyprinus carpio	1	0.05
Hybopsis biguttata	58	3.16
Notemigonus crysoleucas	1	0.05
Notropis atherinoides	1	0.05
Notropis cornutus frontalis	314	17.08
Notropis rubellus	9	0.49
Notropis stramineus	2	0.11
Pimephales notatus	39	2.12
Semotilus atromaculatus	25	1.36
Catostomus commersoni	45	2.45
Erimyzon sucetta	3	0.16
Hypentelium nigricans	220	11.97
Minytrema melanops	9	0.49
Moxostoma erythrurum	164	8.92
Ictalurus melas	1	0.05
Ictalurus natalis	24	1.31
Noturus gyrinus	10	0.54
Eucalia inconstans	1	0.05

TABLE 20 (Continued)

Species	Number	Percentage of total
Ambloplites rupestris	418	22.74
Chaenobryttus gulosus	1	0.05
Lepomis cyanellus	38	2.07
Lepomis gibbosus	169	9.19
Lepomis macrochirus	1	0.05
Lepomis megalotus	13	0.71
*Hybrides (Lepomis)	3	0.16
Micropterus dolomieui	20	1.09
Micropterus salmoides	1	0.05
Pomoxis nigromaculatus	3	0.16
Etheostoma nigrum	30	1.63
Percina maculata	173	9.41

Total = 1,838

*Believed to be L. cyanellus x L. gibbosus

Station: III.C (Deer Creek)

Bottom Type

The bottom was 35.9% silt, 2.6% clay, 44.9% sand, 3.8% gravel, 5.1% rock and 7.7% detritus.

Depth

The average depth was 10.8 inches, ranging from 1 to 43 inches.

Length and Width

The length of this station was 340 feet. The average width was 15.4 feet, ranging from 6 to 26.5 feet.

Current

The average current was 0.37 feet per second, ranging from 0.19 to 0.86 feet per second.

Vegetation

Only Lemna minor was found at this station.

Shoreline

The shore consisted of grasses, weeds and a few shrubs. The banks averaged 5 feet in height.

Other Observations

A little cover was provided by one small sunken log, a few overhanging shrubs and one small brush pile under the M-43 bridge. Pools were infrequent, only two being present at this station. One large one was at the base of the dam and foot bridge, the other under Grand River Road (M-43) bridge.

Collecting Information

A 4-ft. and 20-ft. seine were used for one and a half hours on 7/21/62 resulting in a collection of 247 fish.

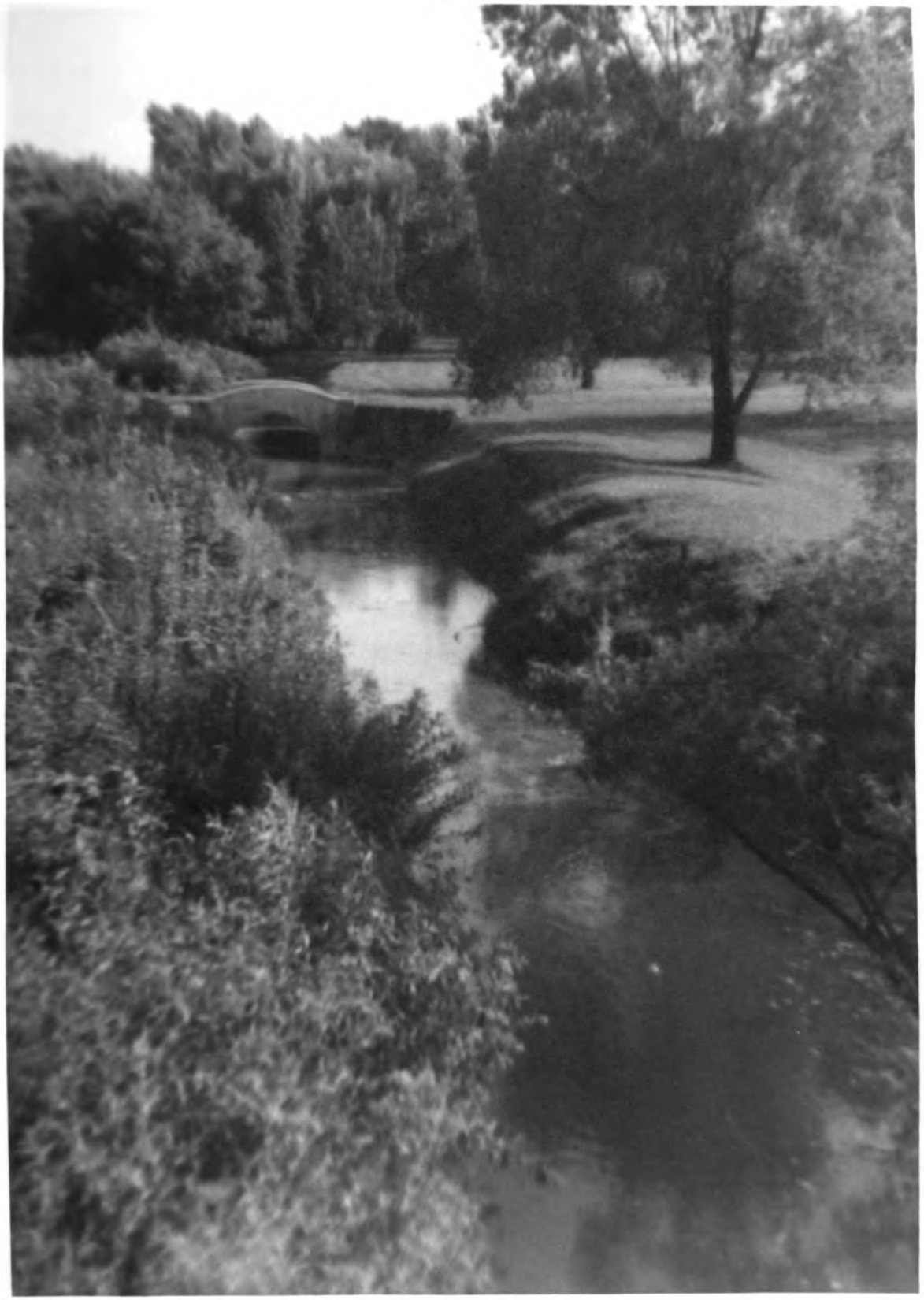

Figure 31
Station III.C (Deer Creek - looking upstream
from Grand River Rd. (M-43) bridge)

TABLE 21

SPECIES COMPOSITION AT STATION III.C

(Deer Creek)

Species	Number	Percentage of total
Esox lucius	3	1.21
Campostoma anomalum	6	2.43
Notemigonus crysoleucas	2	0.81
Notropis cornutus frontalis	51	20.65
Notropis stramineus	5	2.02
Pimephales notatus	57	23.08
Semotilus atromaculatus	10	4.05
Catostomus commersoni	52	21.05
Ictalurus melas	7	2.83
Ictalurus natalis	2	0.81
Ambloplites rupestris	31	12.55
Lepomis gibbosus	1	0.40
Micropterus dolomieui	8	3.24
Etheostoma nigrum	12	4.86

Total = 247

Station: III.D (Mainstream - pool just upstream from mouth of Deer Creek)

Bottom Type

The bottom was 86% silt, 10% sand, 1% rock and 3% detritus.

Depth

The average depth was 15 inches, ranging between 8 and 36 inches.

Length and Width

The length of the pool was 40 feet. The width across both the mainstream and pool was 90 feet. The pool was 30 feet across.

Current

The eddy current in the pool was very sluggish.

Vegetation

The abundant vegetation included Myriophyllum, Elodea canadensis, Lemna minor and Ceratophyllum.

Shoreline

The shoreline consisted of grasses, weeds, shrubs and several large trees. The bank next to the pool was approximately 15 feet in height.

Other Observations

Cover was provided by the dense aquatic vegetation and one small brush pile.

Collecting Information

A 4-ft. and a 20-ft. seine were used for 2 hours on 7/21/62, resulting in a collection of 130 fish. A 4-ft. seine was used for ½ hour on 10/24/62 resulting in a collection of 13 fish.

TABLE 22

SPECIES COMPOSITION AT STATION III.D

(Mainstream - pool just upstream from mouth of Deer Creek)

Species	Number	Percentage of total
Esox americanus vermiculatus	1	0.70
Esox lucius	1	0.70
Notemigonus crysoleucas	18	12.59
Notropis cornutus frontalis	12	8.39
Pimephales notatus	19	13.29
Moxostoma erythrurum	15	10.49
Ictalurus melas	2	1.40
Noturus gyrinus	1	0.70
Ambloplites rupestris	8	5.59
Lepomis cyanellus	1	0.70
Lepomis gibbosus	31	21.68
Lepomis megalotis	4	2.80
*Hybrid (Lepomis)	1	0.70
Pomoxis nigromaculatus	21	14.69
Etheostoma nigrum	7	4.90
Percina maculata	1	0.70
Total =	143	

*L. cyanellus x L. sp. See page 172 for discussion.

Station: III.E (Mainstream - just downstream from Williamston Dam)

Bottom Type

The bottom was 16.1% silt, 25.4% sand, 22.9% gravel, 28.8% rock and 6.8% detritus.

Depth

The average depth was 20.9 inches, ranging from 6 to 41 inches.

Length and Width

The length of this station was 600 feet. The average width was 79.1 feet, ranging from 46 to 150 feet at the base of the dam.

Current

The average current was 1.01 feet per second, ranging from 0.25 to 2.94 feet per second.

Vegetation

Medium amounts of aquatic vegetation included Lemna minor, Hydrodictyon, Elodea, Sagittaria, Ceratophyllum, Elisma plantago-aquatica and Myriophyllum.

Shoreline

The shore was 90% wooded with rocks lining most of the banks. The banks varied from 2 to 15 feet in height.

Other Observations

On 9/16/62 air temperature was 76°F, water temperature was 70°F. On 9/24/62 air temperature was 68°F, water temperature was 56°F. On 9/25/62 water temperature was 57.5°F. On 10/13/62 water temperature was 60°F. A moderate amount of cover was provided by 2 log jams, 2 brush piles, aquatic vegetation, and many large rocks. Pools were moderately frequent with equal distances of shallow water between them.

Station: III.E (Continued)

Collecting Information

Shocking gear was used for 2 hours on 9/16/62 resulting in a collection of 221 fish, for 2 hours on 9/18/62 resulting in a collection of 209 fish, for 2 hours on 9/23/62 resulting in a collection of 267 fish, and for 3 hours on 9/29/62 resulting in a collection of 445 fish.

Figure 32
Station III.E (Mainstream - looking upstream from 400 ft. downstream from the Williamston Dam)

Figure 33
Station III.E (Mainstream - looking downstream from 400 ft. downstream from the Williamston Dam)

TABLE 23

SPECIES COMPOSITION AT STATION III.E

(Mainstream - just downstream from Williamston Dam)

Species	Number	Percentage of total
Icthyomyzon castaneus	11	0.96
Amia calva	6	0.52
Umbra limi	9	0.79
Esox americanus vermiculatus	37	3.23
Esox lucius	19	1.66
Cyprinus carpio	3	0.26
Hybopsis biguttata	8	0.70
Notemigonus crysoleucas	12	1.05
Notropis atherinoides	1	0.09
Notropis cornutus frontalis	2	0.17
Pimephales notatus	15	1.31
Catostomus commersoni	32	2.80
Erimyzon sucetta	7	0.61
Hypentelium nigricans	125	10.93
Minytrema melanops	31	2.71
Moxostoma erythrurum	57	4.98
Moxostoma valenciennesi	1	0.09
Ictalurus melas	38	3.32
Ictalurus natalis	61	5.33
Noturus gyrinus	19	1.66
Ambloplites rupestris	114	9.97
Chaenobryttus gulosus	6	0.52

TABLE 23 (Continued)

Species	Number	Percentage of total
Lepomis cyanellus	28	2.45
Lepomis gibbosus	282	24.65
Lepomis macrochirus	4	0.35
Lepomis megalotis	73	6.38
*Hybrids (*Lepomis*)	9	0.79
Micropterus dolomieui	31	2.71
Micropterus salmoides	10	0.87
Pomoxis nigromaculatus	13	1.14
Etheostoma caeruleum	1	0.09
Etheostoma nigrum	6	0.52
Percina maculata	73	6.38
Total =	1,144	

*The combination was not identified. See page 172 for discussion.

Station: IV.A (Mainstream - just upstream from Williamston Dam)

Bottom Type

The bottom consisted of silt and detritus. Some rocks were present at the base of the Williamston Road bridge.

Depth

The average depth was 68 inches, ranging from 24 to 96 inches.

Width

The average width was 275 feet, ranging from 150 to 400 feet.

Current

The current was very sluggish, much less than 0.50 feet per second.

Vegetation

Lemna minor completely covered the surface around the dam. Nuphar and/or Nymphaea, Ceratophyllum and Elodea were abundant.

Shoreline

The shoreline consisted primarily of grasses. Some shrubs were present. The banks varied from 1 to 6 feet in height.

Other Observations

On 9/9/62 air temperature was 75°F, water temperature was 68°F. On 9/12/62 air temperature was 83°F, water temperature was 68°F. On 9/25/62 air temperature was 55.5°F, water temperature was 58.5°F. An abundance of cover was provided by the dense aquatic vegetation. Some cover was also provided by a brush pile near the dam and the rocks near the bridge.

Collecting Information

Hook and line were used: with live bait on 9/9/62 for 1½ hours resulting in 6 fish, with artificial bait on 9/12/62 for 2½ hours resulting in 5 fish and with live bait on 9/16/62 for ½ hour resulting in 2 fish.

Figure 34

Station IV.A (Mainstream - looking downstream towards Williamston Dam from the Williamston Rd. bridge)

TABLE 24

SPECIES COMPOSITION AT STATION IV.A

(Mainstream - just upstream from Williamston Dam)

Species	Number	Percentage of total
Esox lucius	3	23.08
Ictalurus melas	2	15.38
Ictalurus natalis	3	23.08
Ambloplites rupestris	1	7.69
Lepomis cyanellus	2	15.38
Lepomis gibbosus	2	15.38
Total =	13	

Station: IV.B (Squaw Creek)

Bottom Type

The bottom was 75.6% silt, 20.0% sand and 4.4% gravel.

Depth

The average depth was 9.0 inches, ranging from 3 to 22 inches.

Length and Width

The length of this station was 135 feet. The average width was 7.8 feet, ranging from 4 to 18 feet.

Current

The average current was 0.36 feet per second, ranging from 0.20 to 0.67 feet per second.

Vegetation

The medium amounts of aquatic vegetation included Sparganium, Hypericum, Vallisneria, Nasturtium officinale, Cladophora, Potamogeton and Lemna minor.

Shoreline

The shoreline was open grassland with some shrubs along the edges of the creek. The banks varied from 6 inches to 2 feet in height.

Other Observations

Cover was provided by the aquatic vegetation and the overhanging grasses and shrubs. The only pool was the one under the bridge.

Collecting Information

Shocking gear was used for 1½ hours on 11/24/62 resulting in a collection of 231 fish.

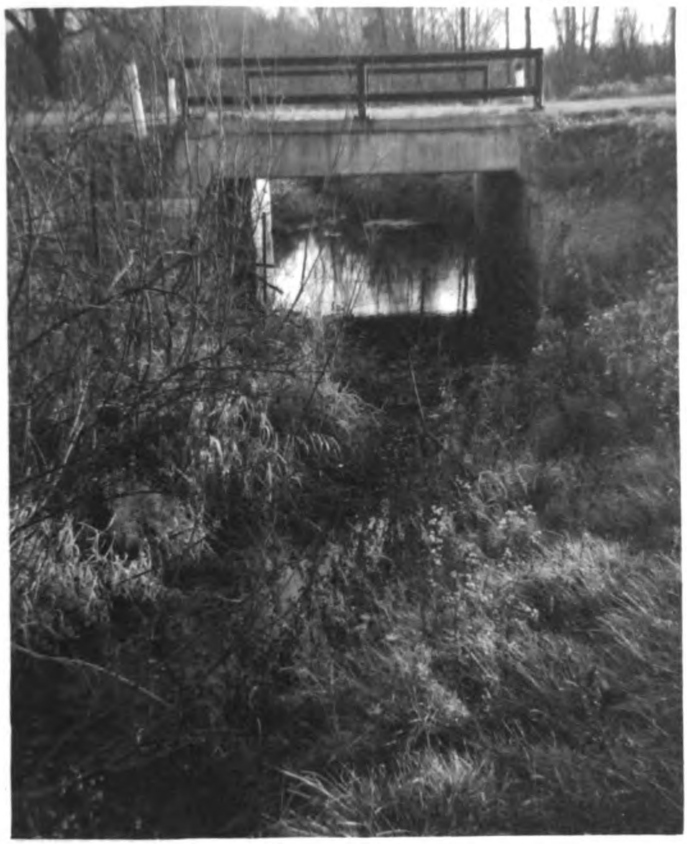

Figure 35

Station IV.B (Squaw Creek - looking downstream towards Rowley Rd. bridge)

Figure 36

Station IV.B (Squaw Creek - looking downstream from Rowley Rd. bridge)

TABLE 25

SPECIES COMPOSITION AT STATION IV.B

(Squaw Creek)

Species	Number	Percentage of total
Umbra limi	40	17.32
Esox lucius	6	2.60
Notropis cornutus frontalis	22	9.52
Pimephales notatus	3	1.30
Rhinichthys atratulus	10	4.33
Semotilus atromaculatus	5	2.16
Catostomus commersoni	38	16.45
Ictalurus melas	2	0.87
Eucalia inconstans	3	1.30
Lepomis cyanellus	2	0.87
Etheostoma microperca	6	2.60
Etheostoma nigrum	84	36.36
Percina maculata	10	4.33

Total = 231

Station: IV.C (Doan Creek)

Bottom Type

The bottom was 57.1% silt, 17.9% sand, 10.7% gravel and 14.3% rock.

Depth

The average depth was 21 inches, ranging from 9 to 34 inches.

Length and Width

The length of this station was 325 feet. The average width was 30.2 feet, ranging from 23 to 39 feet.

Current

The average current was 0.15 feet per second, ranging from 0.03 to 0.50 feet per second.

Vegetation

One dense patch of Elodea canadensis was found just below the bridge. Otherwise aquatic vegetation was sparse at this station.

Shoreline

The shoreline consisted of a dense growth of overhanging woody shrubs.

Other Observations

On 7/21/62 air temperature was 75°F, water temperature was 77°F. On 9/25/62 water temperature was 59°F. A moderate amount of cover was provided by the overhanging shrubs, some rocks under the bridge, and the one dense patch of Elodea. This station had neither pools nor riffles, but was more or less like one long continuous pool.

Collecting Information

A dipnet and 20-ft. seine were used for one hour and 15 minutes on 7/21/62 resulting in a collection of 123 fish.

Figure 37
Station IV.C (Doan Creek - looking downstream
towards Grand River Rd. (M-43) bridge)

Figure 38
Station IV.C (Doan Creek - looking downstream
from Grand River Rd. (M-43) bridge)

TABLE 26

SPECIES COMPOSITION AT STATION IV.C

(Doan Creek)

Species	Number	Percentage of total
Icthyomyzon castaneus	1	0.81
Esox lucius	1	0.81
Notropis cornutus frontalis	27	21.95
Pimephales notatus	1	0.81
Catostomus commersoni	2	1.63
Noturus gyrinus	1	0.81
Ambloplites rupestris	12	9.76
Lepomis gibbosus	32	26.02
Micropterus salmoides	2	1.63
Etheostoma nigrum	22	17.89
Percina maculata	22	17.89

Total = 123

Station: IV.D (Dietz Creek)

Bottom Type

The bottom was 35.9% silt, 29.9% sand, 27.4% gravel and 6.8% rock.

Depth

The average depth was 7.2 inches, ranging from 2 to 16 inches.

Length and Width

The length of this station was 734 feet. The average width was 8.2 feet, ranging from 3 to 13 feet.

Current

The average current was 0.28 feet per second, ranging from 0.07 to 1.03 feet per second.

Vegetation

The medium amount of aquatic vegetation included Ceratophyllum, Nitella, Ranunculus, Lemna minor, and a filamentous alga.

Shoreline

The shoreline consisted of overhanging grasses and a few shrubs. The banks varied from 4 to 6 feet. Sheep grazed the shore around this station.

Other Observations

The only cover available was provided by the aquatic vegetation and the overhanging grasses. The only pool was the one just downstream from the bridge.

Collecting Information

A 4-ft. seine was used for one hour on 11/4/62 resulting in a collection of 1,721 fish.

Figure 39

Station IV.D (Dietz Creek - looking upstream from Dietz Rd. bridge)

Figure 40

Station IV.D (Dietz Creek - looking downstream from Dietz Rd. bridge)

TABLE 27

SPECIES COMPOSITION AT STATION IV.D

(Dietz Creek)

Species	Number	Percentage of total
Campostoma anomalum	17	0.99
Hybopsis biguttata	3	0.17
Notropis cornutus frontalis	985	57.23
Notropis stramineus	3	0.17
Pimephales notatus	65	3.78
Rhinichthys atratulus	167	9.70
Semotilus atromaculatus	88	5.11
Eucalia inconstans	25	1.45
Etheostoma caeruleum	26	1.51
Etheostoma microperca	303	17.61
Etheostoma nigrum	38	2.21
Percina maculata	1	0.06

Total = 1,721

Station: IV.E (Mainstream - Dietz Road area)

Bottom Type

The bottom was 43.4% silt, 33.3% sand, 16.5% gravel, 2.4% rock and 4.4% detritus.

Depth

The average depth was 26.7 inches, ranging from 11 to 77 inches.

Length and Width

The length of this station was 2640 feet. The average width was 62.1 feet, ranging from 39 to 82 feet.

Current

The average current was 0.28 feet per second, ranging from 0.14 to 0.38 feet per second.

Vegetation

Medium amounts of Elodea canadensis were found along the edges of the stream. Sparse amounts of Potamogeton amplifolius, Nuphar and/or Nymphaea, Vallisneria and Hydrodictyon were present.

Shoreline

Better than 50% of the shoreline was wooded, the rest was open grassland with overhanging shrubs. The banks varied from one to four feet.

Other Observations

On 8/7/62 at 11:30 a.m. air temperature was 78.5°F and water temperature was 71.5°F; at 6 p.m. air temperature was 69°F and water temperature was 72°F. On 8/9/62 at noon air temperature was 73.5°F, water temperature was 69.5°F; at 6:30 p.m. air temperature was 66°F

Station: IV.E (Continued)

and water temperature was 69°F. On 9/25/62 air temperature was 55.5°F, water temperature was 58°F. An abundance of cover was provided primarily by brush piles, overhanging trees and shrubs, sunken logs and undercut banks with exposed tree roots.

Collecting Information

Shocking gear was used for 4 hours on 8/7/62 resulting in a collection of 1,277 fish, and for 4½ hours on 8/9/62 resulting in a collection of 1,183 fish.

Figure 41
Station IV.E (Mainstream - looking upstream from
1740 ft. downstream from Dietz Rd. bridge)

Figure 42
Station IV.E (Mainstream - looking downstream from
1740 ft. downstream from Dietz Rd. bridge)

Figure 43
Station IV.E (Mainstream - looking upstream from
600 ft. downstream from Dietz Rd. bridge)

Figure 44
Station IV.E (Mainstream - looking downstream from Dietz Rd. bridge)

TABLE 28

SPECIES COMPOSITION AT STATION IV.E

(Mainstream - Dietz Road area)

Species	Number	Percentage of total
Ichthyomyzon castaneus	1	0.04
Amia calva	21	0.85
Umbra limi	111	4.51
Esox americanus vermiculatus	25	1.02
Esox lucius	21	0.85
Cyprinus carpio	10	0.41
Hybopsis biguttata	3	0.12
Notemigonus crysoleucas	29	1.18
Notropis atherinoides	1	0.04
Notropis cornutus frontalis	197	8.00
Pimephales notatus	88	3.57
Semotilus atromaculatus	2	0.08
Catostomus commersoni	227	9.22
Erimyzon sucetta	26	1.06
Hypentelium nigricans	2	0.08
Minytrema melanops	95	3.86
Ictalurus melas	625	25.38
Ictalurus natalis	43	1.75
Noturus gyrinus	31	1.26
Eucalia inconstans	1	0.04
Ambloplites rupestris	226	9.18
Chaenobryttus gulosus	1	0.04

TABLE 28 (Continued)

Species	Number	Percentage of total
Lepomis cyanellus	12	0.49
Lepomis gibbosus	503	20.42
Lepomis macrochirus	7	0.28
Lepomis megalotis	5	0.20
*Hybrids (Lepomis)	15	0.61
Micropterus dolomieui	8	0.32
Micropterus salmoides	2	0.08
Pomoxis nigromaculatus	28	1.14
Etheostoma nigrum	32	1.30
Perca flavescens	2	0.08
Percina maculata	63	2.56
Total =	2,463	

*Three - L. macrochirus x L. megalotis
Two - L. gibbosus x. L. macrochirus
Ten were released and not available for positive identification.
See page 172 for discussion.

Station: V.A (Sullivan Creek)

Bottom Type

The bottom was 66.7% silt, 15.6% sand, 4.4% gravel and 13.3% rock.

Depth

The average depth was 8.7 inches, ranging from 2 to 15 inches.

Length and Width

The length of this station was 104 feet. The average width was 5.4 feet, ranging from 1 to 16 feet.

Current

The average current was 0.31 feet per second, ranging from 0.08 to 1.00 feet per second.

Vegetation

Grasses choked the creek upstream from the bridge. A filamentous alga was quite abundant in the pool below the bridge.

Shoreline

Grasses and weeds grew around the pool. One large tree and several shrubs provided a great deal of shade around the pool below the bridge. Upstream shade was provided only by overhanging grasses. The banks varied from 3 to 5 feet in height.

Other Observations

On 11/4/62 the water was clear. An abundance of cover was provided by the dense growth of a filamentous alga and the grasses. Some cover was provided by a few rocks and the overhanging grasses and shrubs. The only pool was the one just downstream from the road.

Collecting Information

Shocking gear was used for one hour on 11/4/62 resulting in a collection of 214 fish.

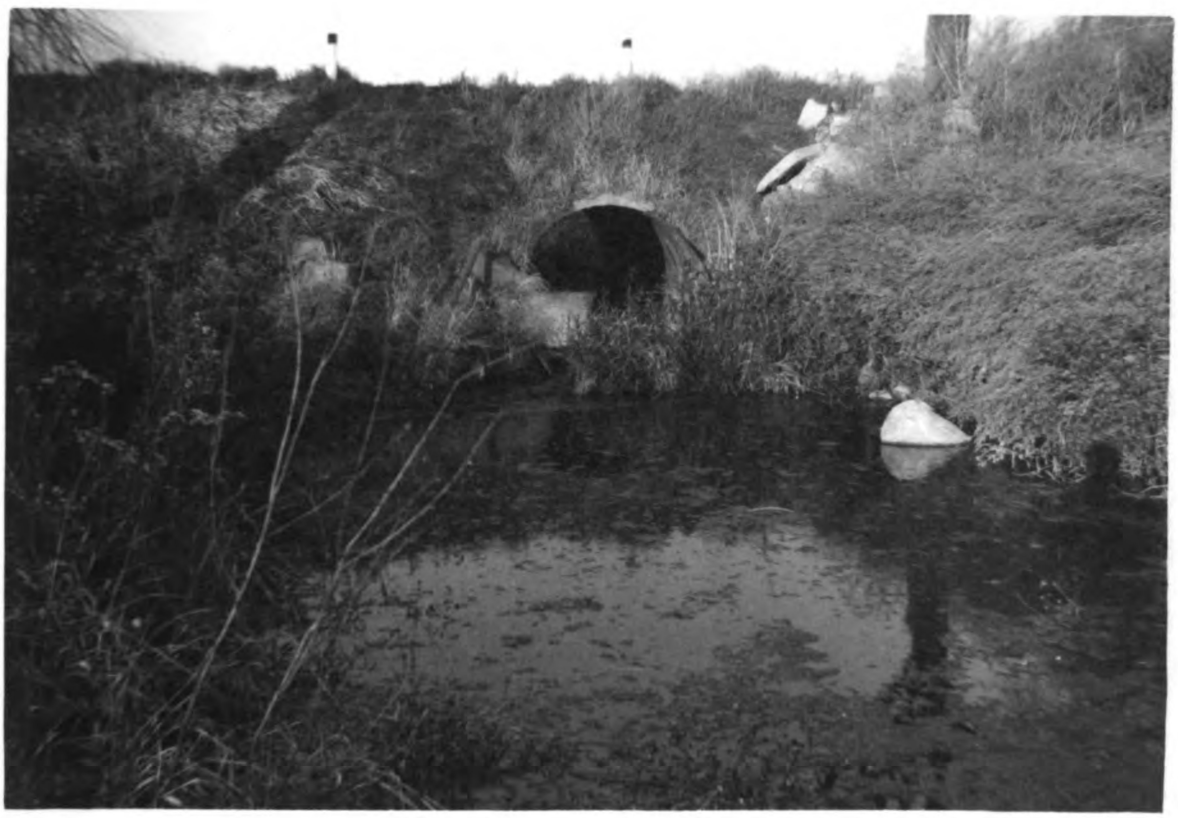

Figure 45

Station V.A (Sullivan Creek - looking upstream towards Rowley Rd. bridge)

TABLE 29

SPECIES COMPOSITION AT STATION V.A

(Sullivan Creek)

Species	Number	Percentage of total
Campostoma anomalum	3	1.40
Notropis cornutus frontalis	63	29.44
Pimephales notatus	93	43.46
Rhinichthys atratulus	2	0.93
Semotilus atromaculatus	21	9.81
Catostomus commersoni	6	2.80
Eucalia inconstans	1	0.47
Etheostoma microperca	3	1.40
Etheostoma nigrum	22	10.28
Total =	214	

Station: V.B (Mainstream - Webberville Road area)

Bottom Type

The bottom was 21.2% silt, 37.4% sand, 8.1% gravel, 6.0% rock and 27.3% detritus.

Depth

The average depth was 25.2 inches, ranging from 6 to 72 inches.

Length and Width

The length of this station was 2640 feet. The average width was 29.1 feet, ranging from 19 to 47 feet.

Current

The average current was 1.45 feet per second, ranging from 0.94 to 1.92 feet per second.

Vegetation

Medium amounts of Elodea canadensis, Vallisneria and Sparganium were present. Sparse amounts of Nuphar and/or Nymphaea were present.

Shoreline

The shore consisted of open grassland with many large trees along the banks providing shade. Cattle graze in this area. The banks varied from 1 to 3 feet in height.

Other Observations

On 7/19/62 air temperature was 80°F, water temperature was 71°F; the water was clear. On 7/20/62 air temperature was 72°F, water temperature was 71°F; the water was clear. On 7/24/62 air temperature was 67°F, water temperature was 64.5°F; the water was slightly turbid. On 9/23/62 air temperature was 60°F, water temperature was 55°F. On 9/25/62 air temperature was 55.5°F, water temperature was 58°F.

Station: V.B (Continued)

An abundance of cover was provided by several sunken logs, many log jams and brush piles, medium amounts of aquatic vegetation and undercut banks with exposed grass and tree roots. Pools were frequent with short stretches of relatively shallow water between them.

Collecting Information

Shocking gear was used for 4 hours and 15 minutes on 7/19/62 resulting in a collection of 552 fish, for $1\frac{1}{4}$ hours on 7/20/62 resulting in a collection of 233 fish and for 4 hours on 7/24/62 resulting in a collection of 871 fish.

Figure 46
Station V.B (Mainstream - looking upstream
from Webberville Rd. bridge)

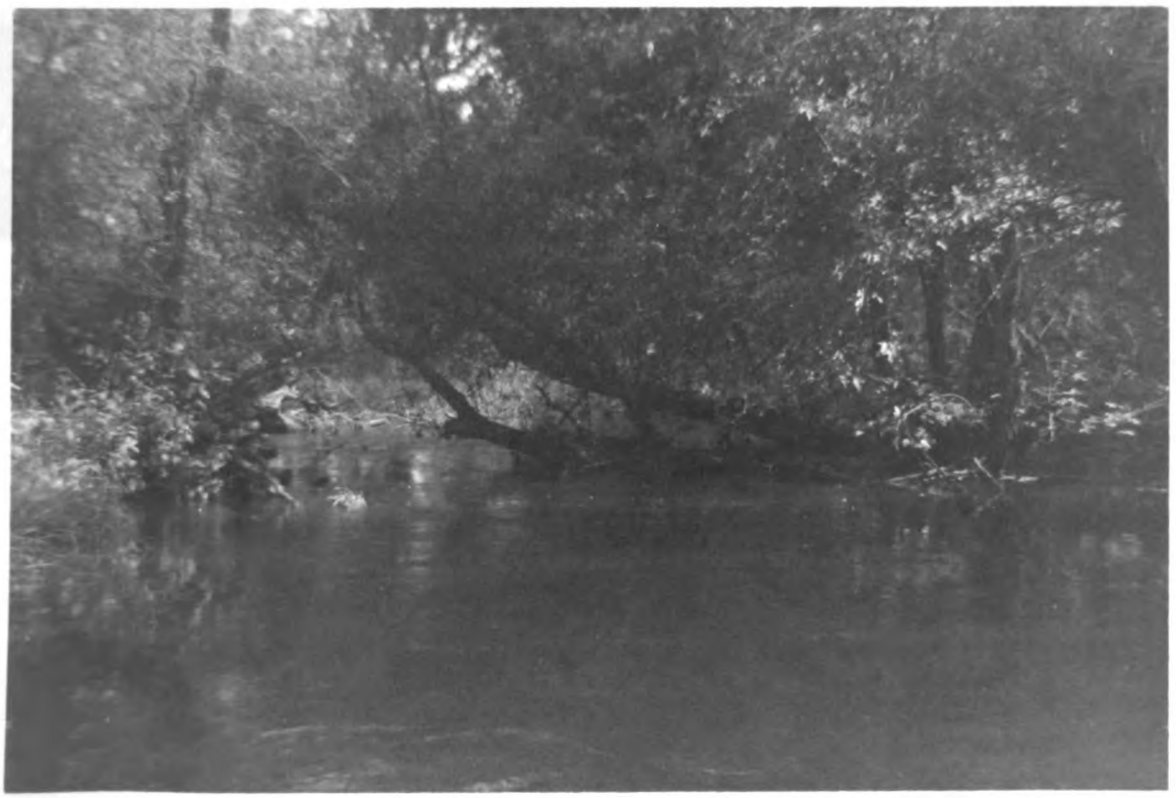

Figure 47
Station V.B (Mainstream - looking upstream from
500 ft. upstream from Webberville Rd. bridge)

Figure 48

Station V.B (Mainstream - looking upstream from 900 ft. upstream from Webberville Rd. bridge - off in the distance the mainstream bears to the left and Kalamink Creek comes in from the right - in the foreground Wolf Creek comes in from the left)

TABLE 30

SPECIES COMPOSITION AT STATION V.B

(Mainstream - Webberville Road area)

Species	Number	Percentage of total
Icthyomyzon castaneus	5	0.30
Umbra limi	78	4.71
Esox americanus vermiculatus	43	2.60
Esox lucius	23	1.39
Campostoma anomalum	3	0.18
Hybopsis biguttata	36	2.17
Notemigonus crysoleucas	1	0.06
Notropis cornutus frontalis	379	22.89
Notropis stramineus	4	0.24
Pimephales notatus	48	2.90
Rhinichthys atratulus	1	0.06
Semotilus atromaculatus	33	1.99
Catostomus commersoni	757	45.71
Hypentelium nigricans	1	0.06
Minytrema melanops	8	0.48
Ictalurus melas	16	0.97
Ictalurus natalis	23	1.39
Noturus gyrinus	6	0.36
Ambloplites rupestris	41	2.48
Lepomis cyanellus	52	3.14
Lepomis gibbosus	12	0.72

TABLE 30 (Continued)

Species	Number	Percentage of total
Lepomis macrochirus	3	0.18
Etheostoma nigrum	26	1.57
Perca flavescens	1	0.06
Percina maculata	56	3.38
Total =	1,656	

Station: V.C (Wolf Creek)

Bottom Type

The bottom was 68.0% silt, 18.0% sand and 14.0% gravel.

Depth

The average depth was 8.3 inches, ranging from 3 to 16 inches.

Length and Width

The length of this station was 157 feet. The average width was 12.9 feet, ranging from 7 to 17 feet.

Current

The average current was 0.10 feet per second, ranging from 0.04 to 0.19 feet per second.

Vegetation

The dense growth of aquatic vegetation included Lemna minor, Ceratophyllum, Potamogeton, Nasturtium officinale, Cladophora, Vallisneria, and Ranunculus.

Shoreline

Open grassland bordered the stream. The area is grazed by cattle. The banks varied from one to 3 feet in height.

Other Observations

An abundance of cover was provided by the dense growth of aquatic vegetation. There were no pools.

Collecting Information

Shocking gear was used for 1 hour on 11/24/62 resulting in a collection of 14 fish.

Figure 49

Station V.C (Wolf Creek - looking upstream from Allen Rd. bridge)

Figure 50

Station V.C (Wolf Creek - looking downstream from Allen Rd. bridge)

TABLE 31

SPECIES COMPOSITION AT STATION V.C

(Wolf Creek)

Species	Number	Percentage of total
Umbra limi	9	64.29
Semotilus atromaculatus	1	7.14
Catostomus commersoni	4	28.57
Total =	14	

Station: V.D (Kalamink Creek)

Bottom Type

The bottom was 37.2% silt, 55.8% sand and 7.0% gravel.

Depth

The average depth was 7 inches, ranging from 2 to 20 inches.

Length and Width

The length of this station was 1730 feet. The average width was 10.4 feet, ranging from 9 to 14 feet.

Current

The average current was 0.94 feet per second, ranging from 0.83 to 1.00 feet per second.

Vegetation

Medium amounts of aquatic vegetation included Hypericum, Nasturtium officinale, Lemna minor, Elodea, Typha and Eleocharus.

Shoreline

The shore was open grassland with shrubs lining much of the banks. The banks varied from 1 to 3 feet in height.

Other Observations

On 7/22/62 air temperature was 67°F water temperature was 71°F. Cover was provided by medium amounts of aquatic vegetation and by some undercut banks with exposed grass and shrub roots. Pools were infrequent with long stretches of shallow water between them.

Collecting Information

A dip net and 4-ft. seine were used for 1½ hours on 7/22/62 resulting in a collection of 181 fish.

Figure 51

Station V.D (Kalamink Creek - looking upstream from Pardee Rd. bridge)

Figure 52

Station V.D (Kalamink Creek- looking downstream from Pardee Rd. bridge)

TABLE 32

SPECIES COMPOSITION AT STATION V.D

(Kalamink Creek)

Species	Number	Percentage of total
Umbra limi	11	6.08
Notropis cornutus frontalis	69	38.12
Notropis heterodon	5	2.76
Notropis stramineus	4	2.21
Pimephales notatus	12	6.63
Rhinichthys atratulus	11	6.08
Semotilus atromaculatus	7	3.87
Catostomus commersoni	43	23.76
Eucalia inconstans	7	3.87
Lepomis cyanellus	4	2.21
Lepomis macrochirus	1	0.55
Etheostoma nigrum	7	3.87
Total =	181	

Station: V.E (Mainstream - Gramer Road Area)

Bottom Type

The bottom was 21.4% silt, 40.0% sand and 38.6% gravel.

Depth

The depth averaged 19.3 inches, ranging from 6 to 60 inches.

Length and Width

The length of this station was 500 feet. The average width was 43.4 feet, ranging from 20 to 61 feet.

Current

The average current was 0.46 feet per second, ranging from 0.23 to 0.71 feet per second.

Vegetation

Dense growths of Elodea canadensis and Nasturtium officinale lined the edges of the stream. Medium amounts of aquatic vegetation included Potamogeton tenuifolius, Potamogeton pusillus or foliosus, Ranunculus trichophyllus, Vallisneria americana, Sagittaria, Sparganium, Pontederia cordata, Ceratophyllum demersum, Rumex and Eleocharus.

Shoreline

The shore consisted of open grassland with numerous shrubs along the banks. The banks varied from 2 to 7 feet in height.

Other Observations

On 9/30/62 at noon air temperature was 63°F, water temperature was 52°F; at 6p.m.the water temperature was 54°F; the water was clear. On 10/13/62 water temperature was 57°F. Cover was provided by an abundance of aquatic vegetation. The only pool was the one just upstream from the bridge.

Station: V.E (Continued)

Collecting Information

Shocking gear was used for 3 hours on 9/30/62 resulting in a collection of 593 fish and for ¾ hour on 10/6/62 resulting in a collection of 160 fish.

TABLE 33

SPECIES COMPOSITION AT STATION V.E

(Mainstream - Gramer Road area)

Species	Number	Percentage of total
Icthyomyzon castaneus	1	0.13
Umbra limi	52	6.91
Esox americanus vermiculatus	2	0.27
Esox lucius	9	1.20
Campostoma anomalum	3	0.40
Cyprinus carpio	1	0.13
Hybopsis biguttata	40	5.31
Notemigonus crysoleucas	1	0.13
Notropis cornutus frontalis	269	35.72
Pimephales notatus	24	3.19
Rhinichthys atratulus	1	0.13
Semotilus atromaculatus	3	0.40
Catostomus commersoni	201	26.69
Erimyzon sucetta	2	0.27
Minytrema melanops	10	1.33
Ictalurus natalis	8	1.06
Eucalia inconstans	3	0.40
Ambloplites rupestris	7	0.93
Chaenobryttus gulosus	1	0.13
Lepomis cyanellus	3	0.40
Lepomis gibbosus	21	2.79

TABLE 33 (Continued)

Species	Number	Percentage of total
Lepomis macrochirus	5	0.66
Micropterus dolomieui	1	0.13
Micropterus salmoides	1	0.13
Etheostoma caeruleum	1	0.13
Etheostoma nigrum	40	5.31
Percina maculata	43	5.71
Total =	753	

Station: V.F (West Branch Cedar River)

Bottom Type

The bottom was 29.1% silt, 39.2% sand, 13.9% gravel and 17.8% rock.

Depth

The average depth was 15.5 inches, ranging from 7 to 29 inches.

Length and Width

The length of this station was 121 feet. The average width was 17.8 feet, ranging from 13 to 23 feet.

Current

The average current was 0.65 feet per second, ranging from 0.33 to 1.00 feet per second.

Vegetation

Medium amounts of Nasturtium officinale grew along the edges of the stream. Sparse amounts of Elodea canadensis, Najas, and Ceratophyllum were present.

Shoreline

The shore was heavily wooded. The banks varied from 1 to 3 feet in height.

Other Observations

On 10/2/62 water temperature was 56°F. On 10/7/62 air temperature was 69°F, water temperature was 58.5°F. A fair amount of cover was provided by one brush pile, aquatic vegetation, and rocks. This station consisted of one pool upstream and one downstream with riffles between them under the bridge.

Collecting Information

Shocking gear was used for 5 hours on 10/2/62 resulting in a collection of 309 fish.

Figure 53
Station V.F (West Branch Cedar River - looking at area just upstream from Van Orden Rd. bridge)

Figure 54
Station V.F (West Branch Cedar River - looking downstream from under Van Orden Rd. bridge)

TABLE 34

SPECIES COMPOSITION AT STATION V.F

(West Branch Cedar River)

Species	Number	Percentage of total
Umbra limi	4	1.29
Esox lucius	1	0.32
Hybopsis biguttata	33	10.68
Notropis cornutus frontalis	124	40.13
Notropis rubellus	2	0.65
Notropis stramineus	1	0.32
Pimephales notatus	13	4.21
Rhinichthys atratulus	2	0.65
Semotilus atromaculatus	9	2.91
Catostomus commersoni	11	3.56
Ambloplites rupestris	22	7.12
Lepomis cyanellus	2	0.65
Lepomis macrochirus	1	0.32
Pomoxis nigromaculatus	1	0.32
Etheostoma caeruleum	51	16.50
Etheostoma nigrum	16	5.18
Percina maculata	12	3.88
Labidesthes sicculus	4	1.29
Total =	309	

Station: VI.A (Mainstream - Van Buren Road area plus 440 feet of Middle Branch Cedar River)

Bottom Type

The mainstream was 31.7% silt, 29.3% sand, 22.0% gravel, 2.4% rock and 14.6% detritus. The Middle Branch of the Cedar River was 85% silt and 15% detritus.

Depth

The average depth in the mainstream was 28.9 inches ranging from 20 to 42 inches. The average depth in the Middle Branch was 13.5 inches, ranging between 12 and 15 inches.

Length and Width

The length of the mainstream sampled was 1060 feet, and the length of the Middle Branch sampled was 440 feet. The average width was 24.2 feet, ranging from 18 to 30 feet.

Current

Current in the Middle Branch was very sluggish and measured 0.17 feet per second. The average current in the mainstream was 0.83 feet per second, ranging from 0.50 to 1.00 feet per second.

Vegetation

The medium amounts of aquatic vegetation in the mainstream consisted of Ceratophyllum, Elodea and Hypericum. The only aquatic vegetation found in Middle Branch Cedar River was sparse amounts of Hypericum.

Shoreline

Grasses and overhanging shrubs primarily characterized one shore while the other was lined with trees. The banks varied from 1 to 3 feet in height.

Station: VI.A (Continued)

Other Observations

On 8/2/62 air temperature was 72°F, water temperature was 65°F. On 9/22/62 air temperature was 57.5°F, water temperature was 55°F; the water was slightly turbid. On 10/13/62 water temperature was 55°F. An abundance of cover in the mainstream was provided by numerous brush piles, several sunken logs, overhanging shrubs and the medium amounts of aquatic vegetation. The mainstream at this station could be described as one long continuous pool (deepest near the bridge). The Middle Branch was shallow but abounded with brush, sunken logs and exposed tree roots for cover.

Collecting Information

Shocking gear was used for 4 hours on 8/2/62 resulting in a collection of 508 fish.

Figure 55

Station VI.A (Mainstream - looking upstream
from Van Buren Rd. bridge)

TABLE 35

SPECIES COMPOSITION AT STATION VI.A

(Mainstream - Van Buren Road area plus 440 feet of Middle Branch Cedar River)

Species	Number	Percentage of total
Esox americanus vermiculatus	3	0.59
Esox lucius	3	0.59
Hybopsis biguttata	2	0.39
Notropis cornutus frontalis	81	15.94
Pimephales notatus	8	1.57
Catostomus commersoni	3	0.59
Minytrema melanops	4	0.79
Ictalurus melas	122	24.02
Ictalurus natalis	23	4.53
Noturus gyrinus	52	10.24
Fundulus notatus	5	0.98
Ambloplites rupestris	55	10.83
Lepomis gibbosus	6	1.18
Lepomis macrochirus	9	1.77
Lepomis megalotis	1	0.20
Etheostoma nigrum	83	16.34
Percina maculata	48	9.45
Total =	508	

Station: VI.B (Mainstream - Bowen Road area)

Bottom Type

The bottom was 72.2% silt, 5.6% sand, 5.6% rock and 16.6% detritus. The rock was found only under the bridge.

Depth

The average depth was 15.9 inches, ranging from 6 to 28 inches.

Length and Width

The length of this station was 600 feet. The average width was 21.8 feet, ranging between 19 and 26 feet.

Current

The average current was 0.19 feet per second, ranging from 0.08 to 0.40 feet per second.

Vegetation

The medium amounts of aquatic vegetation included Lemna minor, Sagittaria, Vallisneria, Sparganium, Elodea canadensis and Nasturtium officinale. The aquatic vegetation was very dense just upstream from the bridge.

Shoreline

Grazing land and trees were on one side while the other was heavily wooded. Both shorelines were lined with shrubs which overhung into the water. The banks varied from one to 3 feet in height.

Other Observations

On 7/29/62 air temperature was 70.8°F, water temperature was 65.0°F. On 8/28/62 air temperature was 78°F, water temperature was 69°F. On 9/22/62 air temperature was 55.5°F, water temperature was 54°F; the water was slightly turbid. On 10/13/62 water temperature was 54°F.

Station: VI.B (Continued)

An abundance of cover was provided by the numerous brush piles and sunken logs, by medium amounts of aquatic vegetation, and by the abundance of overhanging shrubs. This station could be described as one long continuous shallow pool being deepest just upstream from the bridge.

Collecting Information

The 20-ft. seine was used for $1\frac{1}{2}$ hours on 7/29/62 resulting in a collection of 40 fish. Shocking gear was used for 2 hours on 8/28/62 resulting in a collection of 150 fish.

Figure 56
Station VI.B (Mainstream - looking upstream from Bowen Rd. bridge)

Figure 57
Station VI.B (Mainstream - looking downstream from 600 ft. upstream from Bowen Rd. bridge)

TABLE 36

SPECIES COMPOSITION AT STATION VI.B

(Mainstream - Bowen Road area)

Species	Number	Percentage of total
Umbra limi	42	22.11
Esox americanus vermiculatus	7	3.68
Esox lucius	3	1.58
Notropis roseus	1	0.53
Pimephales notatus	6	3.16
Catostomus commersoni	12	6.32
Ictalurus melas	5	2.63
Ictalurus natalis	4	2.11
Noturus gyrinus	1	0.53
Eucalia inconstans	19	10.00
Ambloplites rupestris	44	23.16
Lepomis cyanellus	10	5.26
Micropterus salmoides	4	2.11
Pomoxis nigromaculatus	1	0.53
Etheostoma nigrum	25	13.16
Percina maculata	6	3.16
Total =	190	

Station: VI.C (Mainstream - Milett Road area)

Bottom Type

The bottom under the bridge was 41.7% silt, 25.0% sand, 8.3% gravel and 25.0% rock. Upstream and downstream from the bridge the bottom was 100% silt with a large amount of brush downstream.

Depth

The average depth was 7.4 inches, ranging from 3 to 12 inches under the bridge. Upstream it was much deeper, very silty and not possible to wade. Downstream it looked shallow but the silt was exceedingly deep (2 ft. or better) again making wading impossible.

Length and Width

The length of this station was 36 feet. The average width was 16 feet, ranging from 15 to 17 feet.

Current

Under the bridge the average current was 0.51 feet per second, ranging from 0.49 to 0.54 feet per second. Both upstream and downstream from the bridge the current was very sluggish, much slower than 0.50 feet per second.

Vegetation

There was no vegetation under the bridge.

Shoreline

The shoreline around the bridge consisted of grasses.

Other Observations

On 7/29/62 air temperature was 70°F, water temperature was 66°F. On 9/22/62 air temperature was 55°F, water temperature was 55°F. On 10/13/62 water temperature was 53°F. The only cover available was provided by the rocks.

Station: VI.C (Continued)

Collecting Information

The 4 and 15-ft. seines were used for one hour on 7/29/62 resulting in a collection of 3 fish.

TABLE 37

SPECIES COMPOSITION AT STATION VI.C

(Mainstream - Milett Road area)

Species	Number	Percentage of total
Etheostoma nigrum	3	100.00
Total =	3	

Station: VI.D (Mainstream - Mason Road area)

Bottom Type

The bottom was 4% silt, 66.7% sand, 13.3% gravel, 13.3% rock and 2.7% detritus. The rock was found primarily beneath the bridge.

Depth

The average depth was 4.8 inches, ranging from 1 to 12 inches.

Length and Width

The length of this station was 100 feet. The average width was 9 feet, ranging from 8 to 12 feet.

Current

The average current was 0.79 feet per second, ranging from 0.67 to 0.96 feet per second.

Vegetation

Sparganium and Nasturtium officinale were moderately abundant at this station. Other aquatic vegetation included sparse amounts of Potamogeton, Elodea, Lemna minor and Vallisneria.

Shoreline

Grasses lined the shore 30 feet on either side of the bridge. Further downstream and upstream from the bridge there was an abundance of overhanging shrubs providing nearly 100% shade. The banks varied from 2 to 4 feet in height near the bridge.

Other Observations

On 7/29/62 air temperature was 76°F, water temperature was 68°F; the water was clear. On 9/21/62 air temperature was 61°F, water temperature was 56°F. On 9/22/62 air temperature was 55°F, water temperature was 55°F. On 10/13/62 air temperature was 62°F, water temperature was 55.5°F. Some

Station: VI.D (Continued)

cover was provided by overhanging shrubs, one waterlogged board, the aquatic vegetation and a few rocks. No pools were present at this station.

Collecting Information

A 4-ft. seine was used for one hour on 7/29/62 resulting in a collection of 38 fish.

Figure 58

Station VI.D (Mainstream - looking upstream from Mason Rd. bridge)

Figure 59

Station VI.D (Mainstream - looking downstream from Mason Rd. bridge)

TABLE 38

SPECIES COMPOSITION AT STATION VI.D

(Mainstream - Mason Road area)

Species	Number	Percentage of total
Pimephales notatus	1	2.63
Semotilus atromaculatus	5	13.16
Catostomus commersoni	1	2.63
Etheostoma nigrum	31	81.58
Total =	38	

Station: VI.E (Mainstream - Norton Road area)

Bottom Type

The bottom was 60.0% silt, 30.0% sand and 10.0% rock.

Depth

The average depth was 7.4 inches, ranging from 3 to 12 inches.

Length and Width

The length of this station was 75 feet. The average width was 12.0 feet, ranging from 8.0 to 14.0 feet.

Current

The average current was 0.72 feet per second, ranging from 0.55 to 1.00 feet per second.

Vegetation

Sparganium americanum was very abundant, while Nasturtium officinale was moderately abundant. Sparse amounts of Lemna minor, Ceratophyllum and Hypericum were also present.

Shoreline

Grasses lined the shore around the bridge. The edges of the stream were bog-like (floating grasses). The banks varied from 3 to 5 feet in height.

Other Observations

On 7/11/62 air temperature was 84°F, water temperature was 78.5°F. On 9/21/62 air temperature was 60°F, water temperature was 57°F. On 10/13/62 air temperature was 61°F, water temperature was 55°F. Some cover was provided by the aquatic vegetation and a few rocks. No pools were present.

Station: VI.E (Continued)

Collecting Information

A 4-ft. seine was used for one hour on 7/11/62, resulting in a collection of 56 fish.

Figure 60

Station VI.E (Mainstream - looking upstream from Norton Rd. bridge)

Figure 61

Station VI.E (Mainstream - looking downstream from Norton Rd. bridge)

TABLE 39

SPECIES COMPOSITION AT STATION VI.E

(Mainstream - Norton Road area)

Species	Number	Percentage of total
Notropis cornutus frontalis	7	12.50
Pimephales notatus	1	1.79
Semotilus atromaculatus	3	5.36
Catostomus commersoni	4	7.14
Ambloplites rupestris	1	1.79
Etheostoma nigrum	39	69.64
Percina maculata	1	1.79
Total =	56	

Station: VI.F (Mainstream - Jewell Road area)

Bottom Type

The bottom was 46.7% silt, 30.0% sand, 16.7% gravel, 3.3% rock and 3.3% detritus. The silt along the edges was only an inch or two in thickness overlying sand and gravel.

Depth

The average depth was 6.3 inches, ranging from 1 to 17 inches.

Length and Width

The length of this station was 125 feet. The average width was 7.4 feet, ranging from 4 to 18 feet.

Current

The average current was 0.91 feet per second, ranging from 0.40 to 1.50 feet per second.

Vegetation

The medium amounts of aquatic vegetation included Zygnema, Chara, Vallisneria and Hypericum.

Shoreline

Grasses and a few small shrubs grew along the shore. The banks varied from 2 to 5 feet in height.

Other Observations

On 7/11/62 air temperature was 85°F, water temperature was 79°F. On 9/21/62 water temperature was 54.5°F. On 10/13/62 water temperature was 54°F. The only cover available was provided by the aquatic vegetation and a few rocks. The only pool present was the small one found upstream from the bridge.

Station: VI.F (Continued)

Collecting Information

A dip net and 4-ft. seine were used for one hour on 7/11/62 resulting in a collection of 72 fish.

Figure 62
Station VI.F (Mainstream - looking upstream
from Jewell Rd. bridge)

TABLE 40

SPECIES COMPOSITION AT STATION VI.F

(Mainstream - Jewell Road area)

Species	Number	Percentage of total
Umbra limi	2	2.78
Notropis cornutus frontalis	9	12.50
Pimephales notatus	6	8.33
Rhinichthys atratulus	4	5.56
Semotilus atromaculatus	28	38.89
Catostomus commersoni	11	15.28
Etheostoma nigrum	12	16.67
Total =	72	

Station: VI.G (Mainstream - Coon Lake Road area)

Bottom Type

The bottom was 69.2% silt, 15.4% sand, 7.7% gravel and 7.7% rock.

Depth

The average depth was 9.3 inches, ranging from 3 to 18 inches.

Length and Width

The length of this station was 75 feet. The average width was 5.9 feet, ranging from 3.5 to 8 feet.

Current

The average current was 0.49 feet per second, ranging from 0.21 to 1.00 feet per second.

Vegetation

Elodea canadensis and Potamogeton crispis were abundant in the downstream area. Nasturtium officinale an Nitella were most abundant upstream from the bridge. Medium amounts of Vallisneria, Ceratophyllum, Chara and Lemna minor were present.

Shoreline

Grasses lined the shore. This area was grazed by cattle. The banks varied from 1 to 3 feet in height.

Other Observations

On 7/11/62 air temperature was 81°F, water temperature 78°F, the water was clear. On 9/21/62 water temperature was 50°F. On 10/13/62 water temperature was 56°F. Cover was provided by only the aquatic vegetation. The only pool present was the one under the culvert.

Collecting Information

A dip net and 4-ft. seine were used for one hour on 7/11/62 resulting in a collection of 50 fish.

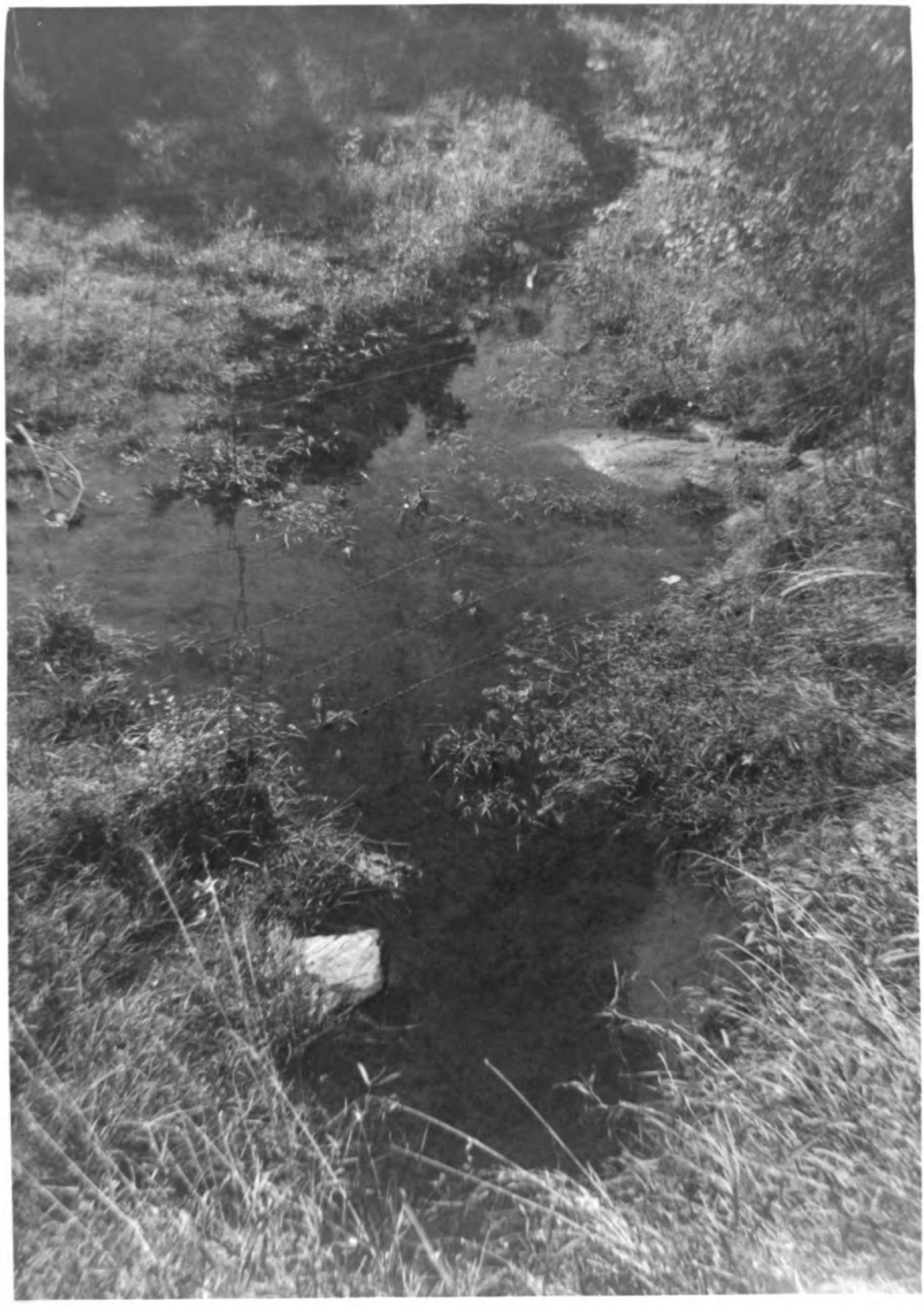

Figure 63
Station VI.G (Mainstream - looking upstream
from Coon Lake Rd. bridge)

TABLE 41

SPECIES COMPOSITION AT STATION VI.G

(Mainstream - Coon Lake Road area)

Species	Number	Percentage of total
Umbra limi	3	6.00
Esox americanus vermiculatus	1	2.00
Notropis cornutus frontalis	13	26.00
Rhinichthys atratulus	2	4.00
Semotilus atromaculatus	15	30.00
Ictalurus melas	2	4.00
Ictalurus natalis	4	8.00
Lepomis macrochirus	1	2.00
Micropterus dolomieui	1	2.00
Etheostoma nigrum	8	16.00
Total =	50	

Station: VI.H (Cedar Lake - southwestern shore)

Bottom Type

The bottom was 100% silt and covered with decaying vegetation near the boat launch. Sand, gravel and rock were near the shore on the southwestern area of the lake.

Depth

The average depth of the area collected was approximately 24 inches. Depths range from 5 to 96 inches.

Width

The collection was made from one to 300 feet out from the shore.

Vegetation

The abundant aquatic vegetation included Juncus, Myriophyllum, Vallisneria, Nymphaea and/or Nuphar, Elodea canadensis, Elodea occidentalis, Potamogeton, Nitella, Ceratophyllum and Lemna minor.

Shoreline

Cattails (Typha) grew along the marshy shoreline areas. Some of the southwestern shoreline was a sand and gravel beach.

Other Observations

On 6/19/62 air temperature was 66°F, water temperature was 72°F. On 6/21/62 air temperature was 70°F, water temperature was 72°F. On 6/26/62 air temperature was 65°F, water temperature was 72°F. The water was clear. Cover was provided by the abundant aquatic vegetation.

Collecting Information

A dip net was used for one hour on 6/19/62 resulting in a collection of 15 fish. The 4 and 15-ft. seines were used for 1½ hours on 6/19/62 resulting in a collection of 189 fish. Hook and line (live bait) were

Station: VI.H (Continued)

used for 4 hours on 6/21/62 resulting in a collection of 7 fish. Gill nets resulted in no fish on the same date. Hook and line (live bait) were used for one hour on 6/26/62 resulting in a collection of 32 fish.

Figure 64

Station VI.H (Cedar Lake - southern shoreline area)

TABLE 42

SPECIES COMPOSITION AT STATION VI.H

(Cedar Lake)

Species	Number	Percentage of total
Umbra limi	11	4.36
Esox americanus vermiculatus	1	0.40
Notropis heterodon	7	2.78
Ictalurus nebulosus	1	0.40
Chaenobryttus gulosus	1	0.40
Lepomis gibbosus	2	0.79
Lepomis macrochirus	41	16.27
Micropterus salmoides	17	6.75
Etheostoma exile	23	9.13
Perca flavescens	148	58.73
Total =	252	

DISCUSSION

Composition and Distribution

During the course of this study 22,440 fish were collected and identified resulting in 54 species (including two sub-species), 32 genera and 12 families. A check list of these species is found on page 192 Tables 43, 44, 45 and 46 (from which Tables 47 and 48 were constructed) show the species composition of the mainstream, tributaries, lakes and complete drainage system.

Table 47 compares the species composition of the main stream, tributaries, and lakes as well as for the entire Red Cedar River drainage system. Table 48 shows the percentage distribution of each species in the mainstream, tributary and lake habitat types.

From Table 47 one finds that the minnow family, Cyprinidae, was the most abundant making up 37.34% of the total number of fish collected in the entire drainage system. The northern common shiner (Notropis cornutus frontalis) was approximately five times more abundant than any other species of minnow collected. Of the 22 species of minnows, 6 made up more than 95% of the total number of minnows collected. These were the northern common shiner (Notropis cornutus frontalis), the bluntnose minnow (Pimephales notatus), the stoneroller (Campostoma anomalum), the hornyhead chub (Hybopsis biguttata), the black nosed dace (Rhinichthys atratulus) and the creek chub (Semotilus atromaculatus).

Table 47 also shows that the minnows were the most abundant family in both the mainstream and tributaries, making up 50.95% of the total number collected in the tributaries and 32.54% of the total number collected in the mainstream, while only making up 4.46% of the total number collected in lakes. The northern common shiner (Notropis cornutus

frontalis) was the most abundant minnow in both the mainstream (17.24%) and the tributaries (29.50%) while the blackchin shiner (Notropis heterodon) was the most abundant in the lakes (2.17%).

From Table 48 one finds that of the 8,379 minnows collected from the entire drainage system 63.67% were from the mainstream, 35.91% were from the tributaries and 0.42% were from the lakes. The goldfish (Carrassius auratus), river chub (Hybopsis micropogon), emerald shiner (Notropis atherinoides),central common shiner (Notropis cornutus chrysocephalus), weed shiner (Notropis roseus) and the mimic shiner (Notropis volucellus) were found only in the mainstream. The redbellied dace (Chrosomus eos) and the fathead minnow (Pimephales promelas) were found only in one particular tributary (Herron Creek) and nowhere else. The pugnose shiner (Notropis anogenus) was found only in the lakes.

Table 47 shows that the second most abundant family collected was the sunfish family, Centrarchidae, which made up 21.36% of the total number of fish collected. The rockbass (Ambloplites rupestris) was the most abundant centrarchid, making up 50.98% of the sunfish collected. The second most abundant sunfish, the pumpkinseed (Lepomis gibbosus) made up nearly 25% of the centrarchids collected. Of the nine species of Centrarchids collected 4 made up more than 89% of the total sunfish collected. These are the rock bass (Ambloplites rupestris), the pumpkinseed (Lepomis gibbosus), the small mouth bass (Micropterus dolomieui) and the green sunfish (Lepomis cyanellus).

From Table 47 one also finds that the centrarchids were most abundant in the lakes, making up 44.82% of the total number collected from the lakes, while they made up 25.90% of the fish collected in the

mainstream and only 4.50% of the fish collected in the tributaries. The rockbass (Ambloplites rupestris) was the most abundant centrarchid in the mainstream (14.32%) and in the tributaries (1.82%) while the bluegill (Lepomis macrochirus) was the most abundant in the lakes (21.84%).

From Table 48 one finds that of the 4,836 centrarchids collected from the entire drainage system 87.84% were from the mainstream, while only 7.26% were from the lakes and 4.90% were from the tributaries. The longear sunfish (Lepomis megalotis) was the only centrarchid found exclusively in the mainstream. None were found exclusively in the tributaries or lakes.

The third most abundant family was the sucker family, Catostomidae, which made up 16.65% of the total fish collected from the entire drainage system. Of the 6 species of suckers collected, the white sucker (Catostomus commersoni) made up more than 56% of all the suckers collected, while the hog sucker (Hypentelium nigricans) made up more than 23% of the total suckers collected. These two combined made up over 80% of all the suckers collected from the entire drainage system.

The sucker family made up 21.02% of the fish collected from the mainstream, 4.78% of the total fish collected from the tributaries and 5.11% of the total fish collected from lakes. The lake chub sucker (Erimyzon sucetta) was the only sucker collected from the lakes.

Of the 3,736 suckers collected from the entire drainage system, 92.18% of them were collected from the mainstream, while 6.75% were collected from the tributaries and only 1.07% were collected from the lakes. More than 99% of all the hog suckers (Hypentelium nigricans), spotted suckers (Minytrema melanops), and the golden redhorse suckers

(Moxostoma erythrurum) were found in the mainstream. More than 88% of the white suckers (Catostomus commersoni) were from the mainstream. The rare greater redhorse sucker (Moxostoma valenciennesi) was found exclusively in the mainstream.

The perch family, Percidae, made up 9.9% of the total number of fish collected from the entire drainage system. Two of the six species of percids collected, the Johnny darter (Etheostoma nigrum) and the Blackside darter (Percina maculata), made up more than 66% of the total number of percids collected.

Members of the perch family made up more than 35% of the total fish collected in lakes, 14% of those collected in tributaries and 6% of those collected in the mainstream.

Of the 2,174 percids collected in the entire drainage system 51.33% were collected from the mainstream, 35.97% from the tributaries and 12.70% from the lakes. The yellow perch (Perca flavescens) made up more than 91% of all the percids collected in lakes while the only other percid found in the lakes was the Iowa Darter (Etheostoma exile).

Ninety-eight percent of all the yellow perch (Perca flavescens) collected were from the lakes. All of the Iowa darters (Etheostoma exile) were from the lakes and all the least darters (Etheostoma microperca) were from the tributaries. Ninety-three percent of all the rainbow darters (Etheostoma caeruleum) were collected from tributaries and 91% of the blackside darters (Percina maculata) were from the mainstream.

Of the Johnny darters (Etheostoma nigrum) more than 59% were collected from the mainstream and the rest were collected from tributaries;

none were found in lakes.

The catfish family, Ictaluridae (fifth most abundant family) made up 7.39% of the total number of fish collected from the entire drainage system. Two of the four species of catfish, the black bullhead (Ictalurus melas) and the yellow bullhead (Ictalurus natalis) made up 92% of all the catfish collected from the entire drainage system.

Members of the catfish family made up 9.59% of the total fish collected from the mainstream, 0.81% of those collected from the tributaries and 5.49% of those collected from lakes. The black bullhead made up more than 56% of the catfish collected from the mainstream while the yellow bullhead made up 36% of the catfish collected from the mainstream.

Of the 1,657 catfish collected 94.80% came from the mainstream, 2.60% from the tributaries and 2.60% from the lakes. The brown bullhead (Ictalurus nebulosus) was collected exclusively from the lakes. More than 90% of the yellow bullheads, 98% of the black bullheads and 98% of the tadpole madtoms (Noturus gyrinus) came from the mainstream.

The sixth most abundant family, the stickleback family (Gasterosteidae) made up 3.69% of the total number of fish collected from the entire drainage system. The brook stickleback (Eucalia inconstans) was the only member of the stickleback family collected. The brook stickleback made up 0.18% of the total fish collected from the mainstream and 15.15% of the total fish collected from the tributaries; none were found in the lakes. More than 96% of the 828 sticklebacks collected came from the tributaries.

The central mudminnow (Umbra limi), the only representative of

the family Umbridae, made up 2.04% of the total fish collected in the entire drainage system. The central mudminnow was nearly equal in abundance in each of the three habitat types (mainstream, tributaries, and lakes) making up between 1.5 and 2.3% of the total collected in each habitat type. Of the 457 mudminnows collected in the entire drainage system, 70.68% came from the mainstream, 26.70% from the tributaries and 2.62% from the lakes.

The pike family (Esocidae) made up 1.28% of the total fish collected in the entire drainage system. Two species represented the pike family, the mud pickerel (Esox americanus vermiculatus) and the northern pike (Esox lucius) both of which were present in all three habitat types (mainstream, tributaries and lakes). Of the 287 members of the pike family collected, 83.9% came from the mainstream, 6.97% from the tributaries and 9.07% from lakes.

The other four families combined, the lampreys (Petromyzontidae), the bowfin (Amiidae), the killifishes (Cyprinodontidae) and the silversides (Atherinidae), made up only 0.38% of the total number of fish collected from the entire drainage system.

Two of the fifty-four species, the carp (Cyprinus carpio) and the northern pike (Esox lucius), were less abundant than expected. This is possibly because these two species do not have a particular home range, but instead wander over very large areas. It was noticed that most fish would swim ahead of us, while shocking an area, turn around as though they had reached a limit and swim right into the electrodes. The pike and the carp rarely if ever did this but instead would keep on going.

I am puzzled about the distribution of the golden redhorse sucker

(Moxostoma erythrurum) which was never collected from any water above the Williamston dam. Does the water above the dam have a lower oxygen content than the water below the dam, and if so, does this sucker have a higher oxygen requirement than the waters above the dam can offer?

I believe that the longear sunfish (Lepomis megalotis) should have been more abundant in the mainstream than the collection indicates. This is because of the difficulty in trying to distinquish between young pumpkinseeds (Lepomis gibbosus) and young longear sunfish. When cooperating with my colleagues on some collecting trips several small sunfish (1-2") were either listed as small pumpkinseeds or as hybrids. It seemed strange to have adult longear sunfish at these stations and no small ones. On the next few collections I preserved many of the young sunfish for close observations. From these I found several that were positively young longear sunfish (approximately $1\frac{1}{2}$" in length) but the smallest ones (less than $1\frac{1}{2}$") were impossible to identify positively. Thus, I am sure that there were more longear sunfish and at the same time fewer pumpkinseeds and hybrids than recorded. Some characteristics must be found which will allow one to quickly and easily distinquish between young pumpkinseeds and young longear sunfish.

Hybridization

The questions arose concerning the hybridization of the pumpkinseed and longear sunfish. Trautman does not include this as a known combination, but at the same time he does not rule it out. This of course would further complicate distinquishing between the young of the pumpkinseed and the longear sunfish.

Forty-six hybrids of the genus Lepomis were collected from the entire drainage system. Seventeen were identified as crosses between the pumpkinseed (Lepomis gibbosus) and the bluegill (Lepomis macrochirus); 2 from station I.A, 12 from station I.C, 1 from station II.C, and 2 from station IV.E.

Six were identified as crosses between the green sunfish (Lepomis cyanellus) and the bluegill (Lepomis macrochirus), 3 from station I.B and 3 from station III.B. One hybrid from station III.D was identified as a cross between the green sunfish and either the pumpkinseed or the longear sunfish (Lepomis megalotis). Three from station IV.E were identified as crosses between the bluegill and the longear.

Nine hybrids from station III.E were not positively identified. The following species of Lepomis were located at this station; the green sunfish, the pumpkinseed, the bluegill and the longear. Each of these species prefer quiet waters except the longear sunfish, but even the longear was not found in the swift waters close to the dam. The 9 hybrids, however, all came from this swift water. Each of these hybrids were very much alike in all their characteristics (little variation). This raises the following questions: Why was their habitat choice different from those of the four species of sunfish found here? Why was there so little variation in their characteristics? Are these hybrids sterile or fertile? Can they reproduce their own kind? Maybe they are not really hybrids!

Ten other hybrids had been released from station IV.E the same day the collection was made. At that time they had been identified as hybrids, but in view of later studies, some or all of them may have been

young longear sunfish rather than hybrids.

One minnow of the genus Notropis (from station II.I) was identified as a hybrid of the northern common shiner (N. cornutus frontalis) and the rosyface shiner (N. rubellus). At station I.A (just below the M.S.U. campus dam) a large variation in the characteristics of the northern common shiner (Notropis cornutus frontalis) began to occur. One specimen of questionable identification was found at this station. It is probably a hybrid of the rosyface shiner and either the northern common shiner or the central common shiner (N. cornutus chrysocephalus). It may be just a young central common shiner.

Effectiveness of Collecting Gear

The hook and line was most effective in collecting the northern pike (Esox lucius). Other fish were collected by hook and line from areas where it was too deep for wading.

Seines were not very effective unless the area was clear of debris, rocks and vegetation, which was a rare location indeed.

The D.C. shocking gear was very effective for collecting nearly all species of fish. As explained earlier the northern pike and carp seemed to be the only fish which could often avoid this method of capture even when seen in the area. The thrusting forward motion with the positive electrodes seemed much more effective than holding the electrode stationary while walking upstream. Apparently this would catch fish by surprise which were either swimming or resting just out of reach of the shock until it was quickly thrust forward.

The experience of the crew determined how well they could cover the

full width of the stream while netting fish. Larger crews made it easier to net fish and transfer them to the tub without losing coverage of the stream. When collecting in an area wider than 25 feet a crew of five would be desirable for good coverage, one pulling the pram, two with positive electrodes and dip nets and two others with dip nets.

Sampling in the tributaries with the D.C. shocking gear worked extremely well. By parking the trailer (containing the pram and generator) on the bridge and adding fifty-foot extension cords to the positive electrodes, one man could very efficiently collect 100 feet upstream and downstream from the bridge. Two men are recommended, however, just for reasons of safety.

A.C. shocking gear was used once but was considered ineffective simply because most stunned fish would settle to the bottom where they were hard to see and net. The fish, however, were drawn to the positive electrodes of the D.C. shocking unit and could, therefore, be brought to the surface where they could easily be netted.

TABLE 43

SPECIES COMPOSITION OF MAINSTREAM

Species	Number	Percentage of total
Icthyomyzon castaneus	45	0.27
Amia calva	27	0.16
Umbra limi	323	1.97
Esox americanus vermiculatus	138	0.84
Esox lucius	103	0.63
Campostoma anomalum	413	2.52
Carassius auratus	6	0.04
Cyprinus carpio	44	0.27
Hybopsis biguttata	776	4.74
Hybopsis micropogon	84	0.51
Notemigonus crysoleucas	63	0.38
Notropis atherinoides	3	0.02
Notropis cornutus chrysocephalus	2	0.01
Notropis cornutus frontalis	2,825	17.24
Notropis heterolepis	3	0.02
Notropis roseus	1	0.006
Notropis rubellus	63	0.38
Notropis spilopterus	9	0.05
Notropis stramineus	18	0.11
Notropis volucellus	4	0.02
Hybrid (*Notropis*)	1	0.006
Pimephales notatus	633	3.86

TABLE 43 (Continued)

Species	Number	Percentage of total
Rhinichthys atratulus	21	0.13
Semotilus atromaculatus	366	2.23
Catostomus commersoni	1,864	11.38
Erimyzon sucetta	38	0.23
Hypentelium nigricans	880	5.37
Minytrema melanops	235	1.43
Moxostoma erythrurum	424	2.59
Moxostoma valenciennesi	3	0.02
Ictalurus melas	881	5.38
Ictalurus natalis	569	3.47
Noturus gyrinus	121	0.74
Fundulus notatus	5	0.03
Eucalia inconstans	30	0.18
Ambloplites rupestris	2,347	14.32
Chaenobryttus gulosus	12	0.07
Lepomis cyanellus	248	1.51
Lepomis gibbosus	1,051	6.41
Lepomis macrochirus	41	0.25
Lepomis megalotis	100	0.61
Hybrids (Lepomis)	30	0.18
Micropterus dolomieui	330	2.01
Micropterus salmoides	20	0.12
Pomoxis nigromaculatus	69	0.42

TABLE 43 (Continued)

Species	Number	Percentage of total
Etheostoma caeruleum	6	0.04
Etheostoma nigrum	453	2.76
Perca flavescens	3	0.02
Percina maculata	654	3.99
Labidesthes sicculus	1	0.006

Total = 16,386

TABLE 44

SPECIES COMPOSITION OF TRIBUTARIES

Species	Number	Percentage of total
Ichthyomyzon castaneus	4	0.08
Umbra limi	122	2.31
Esox americanus vermiculatus	1	0.02
Esox lucius	19	0.36
Campostoma anomalum	125	2.37
Chrosomus eos	1	0.02
Cyprinus carpio	1	0.02
Hybopsis biguttata	36	0.68
Notemigonus crysoleucas	24	0.46
Notropis cornutus frontalis	1,555	29.50
Notropis heterodon	9	0.17
Notropis heterolepis	8	0.15
Notropis rubellus	2	0.04
Notropis spilopterus	4	0.08
Notropis stramineus	13	0.25
Pimephales notatus	323	6.13
Pimephales promelas	3	0.06
Rhinichthys atratulus	560	10.62
Semotilus atromaculatus	345	6.55
Catostomus commersoni	248	4.70
Hypentelium nigricans	1	0.02
Minytrema melanops	1	0.02

TABLE 44 (Continued)

Species	Number	Percentage of total
Moxostoma erythrurum	2	0.04
Ictalurus melas	15	0.28
Ictalurus natalis	26	0.49
Noturus gyrinus	2	0.04
Eucalia inconstans	798	15.14
Ambloplites rupestris	96	1.82
Lepomis cyanellus	55	1.04
Lepomis gibbosus	48	0.91
Lepomis macrochirus	3	0.06
Hybrids (*Lepomis*)	3	0.06
Micropterus dolomieui	10	0.19
Micropterus salmoides	3	0.06
Pomoxis nigromaculatus	19	0.36
Etheostoma caeruleum	80	1.52
Etheostoma microperca	331	6.28
Etheostoma nigrum	307	5.82
Percina maculata	64	1.21
Labidesthes sicculus	4	0.08
Total =	5,271	

TABLE 45

SPECIES COMPOSITION OF LAKES

Species	Number	Percentage of total
Umbra limi	12	1.53
Esox americanus vermiculatus	23	2.94
Esox lucius	3	0.38
Cyprinus carpio	3	0.38
Hybopsis biguttata	1	0.13
Notemigonus crysoleucas	3	0.38
Notropis anogenus	5	0.64
Notropis cornutus frontalis	3	0.38
Notropis heterodon	17	2.17
Pimephales notatus	3	0.38
Erimyzon sucetta	40	5.11
Ictalurus natalis	35	4.47
Ictalurus nebulosus	8	1.02
Chaenobryttus gulosus	21	2.68
Lepomis cyanellus	7	0.89
Lepomis gibbosus	90	11.49
Lepomis macrochirus	171	21.84
Hybrids (Lepomis)	13	1.66
Micropterus salmoides	47	6.00
Pomoxis nigromaculatus	2	0.26
Etheostoma exile	23	2.94
Perca flavescens	253	32.31
Total =	783	

TABLE 46

SPECIES COMPOSITION OF COMPLETE DRAINAGE SYSTEM

Species	Number	Percentage of total
Icthyomyzon castaneus	49	0.22
Amia calva	27	0.12
Umbra limi	457	2.04
Esox americanus vermiculatus	162	0.72
Esox lucius	125	0.56
Campostoma anomalum	538	2.40
Carassius auratus	6	0.03
Chrosomus eos	1	0.004
Cyprinus carpio	48	0.21
Hybopsis biguttata	813	3.62
Hybopsis micropogon	84	0.37
Notemigonus crysoleucas	90	0.40
Notropis anogenus	5	0.02
Notropis atherinoides	3	0.01
Notropis cornutus chrysocephalus	2	0.009
Notropis cornutus frontalis	4,383	19.53
Notropis heterodon	26	0.12
Notropis heterolepis	11	0.05
Notropis roseus	1	0.004
Notropis rubellus	65	0.29
Notropis spilopterus	13	0.06
Notropis stramineus	31	0.14
Notropis volucellus	4	0.02

TABLE 46 (Continued)

Species	Number	Percentage of total
Hybrid (Notropis)	1	0.004
Pimephales notatus	959	4.27
Pimephales promelas	3	0.01
Rhinichthys atratulus	581	2.59
Semotilus atromaculatus	711	3.17
Catostomus commersoni	2,112	9.41
Erimyzon sucetta	78	0.35
Hypentelium nigricans	881	3.93
Minytrema melanops	236	1.05
Moxostoma erythrurum	426	1.90
Moxostoma valenciennesi	3	0.01
Ictalurus melas	896	3.99
Ictalurus natalis	630	2.81
Ictalurus nebulosus	8	0.04
Noturus gyrinus	123	0.55
Fundulus notatus	5	0.02
Eucalia inconstans	828	3.69
Ambloplites rupestris	2,443	10.89
Chaenobryttus gulosus	33	0.15
Lepomis cyanellus	310	1.38
Lepomis gibbosus	1,189	5.30
Lepomis macrochirus	215	0.96
Lepomis megalotis	100	0.45

TABLE 46 (Continued)

Species	Number	Percentage of total
Hybrids (*Lepomis*)	46	0.20
Micropterus dolomieui	340	1.52
Micropterus salmoides	70	0.31
Pomoxis nigromaculatus	90	0.40
Etheostoma caeruleum	86	0.38
Etheostoma exile	23	0.10
Etheostoma microperca	331	1.48
Etheostoma nigrum	760	3.39
Perca flavescens	256	1.14
Percina maculata	718	3.20
Labidesthes sicculus	5	0.02

Total = 22,440

TABLE 47

SPECIES COMPOSITION OF MAINSTREAM, TRIBUTARIES, LAKES AND THE ENTIRE RED CEDAR RIVER DRAINAGE SYSTEM

Figures in each column express the percentage of the total number of fish collected in the corresponding habitat type.

Family and Species Composition	Mainstream	Tributaries	Lakes	Entire Drainage
	16,386	5,271	508	22,440
PETROMYZONTIDAE	0.27	0.08	--	0.22
Ichthyomyzon castaneus	0.27	0.08	--	0.22
AMIIDAE	0.16	--	--	0.12
Amia calva	0.16	--	--	0.12
UMBRIDAE	1.97	2.31	1.53	2.04
Umbra limi	1.97	2.31	1.53	2.04
ESOCIDAE	1.47	0.38	3.32	1.28
Esox americanus vermiculatus	0.84	0.02	2.94	0.72
Esox lucius	0.63	0.36	0.38	0.56
CYPRINIDAE	32.54	50.95	4.46	37.34
Campostoma anomalum	2.52	2.37	--	2.40
Carassius auratus	0.04	--	--	0.03
Chrosomus eos	--	0.02	--	0.004
Cyprinus carpio	0.27	0.02	0.38	0.21
Hybopsis biguttata	4.74	0.68	0.13	3.62
Hybopsis micropogon	0.51	--	--	0.37

TABLE 47 (Continued)

Family and Species Composition	Mainstream	Tributaries	Lakes	Entire Drainage
Notemigonus crysoleucas	0.38	0.46	0.38	0.40
Notropis anogenus	--	--	0.64	0.02
Notropis atherinoides	0.02	--	--	0.01
Notropis cornutus chrysocephalus	0.01	--	--	0.009
Notropis cornutus frontalis . . .	17.24	29.50	0.38	19.53
Notropis heterodon	--	0.17	2.17	0.12
Notropis heterolepis	0.02	0.15	--	0.05
Notropis roseus	0.006	--	--	0.004
Notropis rubellus	0.38	0.04	--	0.29
Notropis spilopterus	0.05	0.08	--	0.06
Notropis stramineus	0.11	0.25	--	0.14
Notropis volucellus	0.02	--	--	0.02
*Hybrid (Notropis)	0.006	--	--	0.004
Pimephales notatus	3.86	--	0.38	4.27
Pimephales promelas	--	0.06	--	0.01
Rhinichthys atratulus	0.13	10.62	--	2.59
Semotilus atromaculatus	2.23	6.55	--	3.17
CATOSTOMIDAE	21.02	4.78	5.11	16.65
Catostomus commersoni	11.38	4.70	--	9.41
Erimyzon sucetta	0.23	--	5.11	0.35
Hypentelium nigricans	5.37	0.02	--	3.93
Minytrema melanops	1.43	0.02	--	1.05

*Notropis cornutus frontalis x Notropis rubellus

TABLE 47 (Continued)

Family and Species Composition	Mainstream	Tributaries	Lakes	Entire Drainage
Moxostoma erythrurum	2.59	0.04	--	1.90
Moxostoma valenciennesi	0.02	--	--	0.01
ICTALURIDAE	9.59	0.81	5.49	7.39
Ictalurus melas	5.38	0.28	--	3.99
Ictalurus natalis	3.47	0.49	4.47	2.81
Ictalurus nebulosus	--	--	1.02	0.04
Noturus gyrinus	0.74	0.04	--	0.55
CYPRINCDONTIDAE	0.03	--	--	0.02
Fundulus notatus	0.03	--	--	0.02
GASTEROSTEIDAE	0.18	15.14	--	3.69
Eucalia inconstans	0.18	15.14	--	3.69
CENTRARCHIDAE	25.90	4.50	44.82	21.56
Ambloplites rupestris	14.32	1.82	--	10.89
Chaenobryttus gulosus	0.07	--	2.68	0.15
Lepomis cyanellus	1.51	1.04	0.89	1.38
Lepomis gibbosus	6.41	0.91	11.49	5.30
Lepomis macrochirus	0.25	0.06	21.84	0.96
Lepomis megalotis	0.61	--	--	0.45
*Hybrids (Lepomis)	0.18	0.06	1.66	0.20
Micropterus dolomieui	2.01	0.19	--	1.52
Micropterus salmoides	0.12	0.06	6.00	0.31

*See page 171 for a discussion on hybridization of Lepomis species in the Red Cedar River Drainage System.

TABLE 47 (Continued)

Family and Species Composition	Mainstream	Tributaries	Lakes	Entire Drainage
Pomoxis nigromaculatus	0.42	0.36	0.26	0.40
PERCIDAE	6.81	14.83	35.25	9.69
Etheostoma caeruleum	0.04	1.52	--	0.38
Etheostoma exile.	--	--	2.94	0.10
Etheostoma microperca	--	6.28	--	1.48
Etheostoma nigrum	2.76	5.82	--	3.39
Perca flavescens	0.02	--	32.31	1.14
Percina maculata	3.99	1.21	--	3.20
ATHERINIDAE	0.006	0.08	--	0.02
Labidesthes sicculus	0.006	0.08	--	0.02

TABLE 48

PERCENTAGE DISTRIBUTION OF EACH SPECIES IN THE MAINSTREAM, TRIBUTARIES, AND LAKES OF THE RED CEDAR RIVER DRAINAGE SYSTEM

Figures in each column express the percentage of the total number of a particular species that came from each habitat type.

Family and species distribution	Number collected in entire drainage system	Main Stream %	Tributaries %	Lakes %
PETROMYZONTIDAE	49	91.84	8.16	--
Icthyomyzon castaneus	49	91.84	8.16	--
AMIIDAE	27	100.00	--	--
Amia calva	27	100.00	--	--
UMBRIDAE	457	70.68	26.70	2.62
Umbra limi	457	70.68	26.70	2.62
ESOCIDAE	287	83.97	6.97	9.06
Esox americanus vermiculatus	162	85.18	0.62	14.20
Esox lucius	125	82.40	15.20	2.40
CYPRINIDAE	8,379	63.67	35.91	0.42
Campostoma anomalum	538	76.77	23.23	--
Carassius auratus	6	100.00	--	--
Chrosomus eos	1	--	100.00	--
Cyprinus carpio	48	91.67	2.08	6.25
Hybopsis biguttata	813	95.45	4.43	0.12
Hybopsis micropogon	84	100.00	--	--

TABLE 48 (Continued)

Family and species distribution	Number collected in entire drainage system	Main Stream %	Tributaries %	Lakes %
Notemigonus crysoleucas	90	70.00	26.67	3.33
Notropis anogenus	5	--	--	100.00
Notropis atherinoides . .	3	100.00	--	--
Notropis cornutus chrysocephalus	2	100.00	--	--
Notropis cornutus frontalis	4,383	64.45	35.48	0.07
Notropis heterodon . . .	26	--	34.62	65.38
Notropis heterolepis . .	11	27.27	72.73	--
Notropis roseus	1	100.00	--	--
Notropis rubellus	65	96.92	3.08	--
Notropis spilopterus . .	13	69.23	30.77	--
Notropis stramineus . . .	31	58.06	41.94	--
Notropis volucellus . . .	4	100.00	--	--
*Hybrid (Notropis)	1	100.00	--	--
Pimephales notatus . . .	959	66.01	33.68	0.31
Pimephales promelas . . .	3	--	100.00	--
Rhinichthys atratulus . .	581	3.61	96.39	--
Semotilus atromaculatus .	711	51.48	48.52	--
CATOSTOMIDAE	3,736	92.18	6.75	1.07
Catostomus commersoni .	2,112	88.26	11.74	--
Erimyzon sucetta. . . .	78	48.72	--	51.28
Hypentelium nigricans .	881	99.89	0.11	--

*Notropis cornutus frontalis x Notropis rubellus

TABLE 48 (Continued)

Family and species distribution	Number collected in entire drainage system	Main Stream %	Tributaries %	Lakes %
Minytrema melanops . .	236	99.58	0.42	--
Moxostoma erythrurum .	426	99.53	0.47	--
Moxostoma valenciennesi	3	100.00	--	--
ICTALURIDAE	1,657	94.80	2.60	2.60
Ictalurus melas . . .	896	98.33	1.67	--
Ictalurus natalis . .	630	90.32	4.13	5.55
Ictalurus nebulosus .	8	--	--	100.00
Noturus gyrinus . . .	123	98.37	1.63	--
CYPRINODONTIDAE	5	100.00	--	--
Fundulus notatus . . .	5	100.00	--	--
GASTEROSTEIDAE.	828	3.62	96.38	--
Eucalia inconstans . .	828	3.62	96.38	--
CENTRARCHIDAE	4,836	87.84	4.90	7.26
Ambloplites rupestris.	2,443	96.07	3.93	--
Chaenobryttus gulosus.	33	36.36	--	63.64
Lepomis cyanellus . .	310	80.00	17.74	2.26
Lepomis gibbosus . . .	1,189	88.39	4.04	7.57
Lepomis macrochirus. .	215	19.07	1.40	79.53
Lepomis megalotis. . .	100	100.00	--	--
*Hybrids (Lepomis). . .	46	65.22	6.52	28.26

*See page 171 for a discussion on hybridization of Lepomis species in the Red Cedar River Drainage System.

TABLE 48 (Continued)

Family and species distribution	Number collected in entire drainage system	Main Stream %	Tributaries %	Lakes %
Micropterus dolomieui	340	97.06	2.94	--
Micropterus salmoides	70	28.57	4.29	67.14
Pomoxis nigromaculatus	90	76.67	21.11	2.22
PERCIDAE	2,174	51.33	35.97	12.70
Etheostoma caeruleum.	86	6.98	93.02	--
Etheostoma exile. . .	23	--	--	100.00
Etheostoma microperca	331	--	100.00	--
Etheostoma nigrum . .	760	59.61	40.39	--
Perca flavescens. . .	256	1.17	--	98.83
Percina maculata. . .	718	91.09	8.91	--
ATHERINIDAE.	5	20.00	80.00	--
Labidesthes sicculus	5	20.00	80.00	--

Check List of Fishes Recorded During the Present Study of the Red Cedar River Drainage System

Petromyzontidae

Ichthyomyzon castaneus (Girard) - chestnut lamprey

Amiidae

Amia calva (Linnaeus) - bowfin

Umbridae

Umbra limi (Kirtland) - central mudminnow

Esocidae

Esox americanus vermiculatus (LeSuer) - grass pickerel

Esox lucius (Linnaeus) - northern pike

Cyprinidae

Campostoma anomalum (Rafinesque) - stoneroller

Carassius auratus (Linnaeus) - goldfish

Chrosomus eos (Cope) - northern redbelly dace

Cyprinus carpio (Linnaeus) - carp

Hybopsis biguttata (Kirtland) - horneyhead chub

Hybopsis micropogon (Cope) - river chub

Notemigonus crysoleucas (Mitchill) - golden shiner

Notropis anogenus (Forbes) - pugnose shiner

Notropis atherinoides (Rafinesque) - emerald shiner

Notropis cornutus chrysocephalus (Rafinesque) - central common shiner

Notropis cornutus frontalis (Agassiz) - northern common shiner

Notropis heterodon (Cope) - blackchin shiner

Notropis heterolepis (Eigenmann and Eigenmann) - blacknose shiner

*Notropis roseus richardsoni (Hubbs and Green) - northern weed shiner

Notropis rubellus (Agassiz) - rosyface shiner

Notropis spilopterus (Cope) - spotfin shiner

Notropis stramineus (Cope) - sand shiner

Notropis volucellus (Cope) - mimic shiner

Pimephales notatus (Rafinesque) - bluntnose minnow

Pimephales promelas (Rafinesque) - fathead minnow

Rhinichthys atratulus (Hermann) - blacknose dace

Semotilus atromaculatus (Mitchill) - creek chub

Catostomidae

Catostomus commersoni (Lacépède) - white sucker

Erimyzon sucetta (Lacépède) - lake chubsucker

Hypentelium nigricans (LeSueur) - northern hog sucker

Minytrema melanops (Rafinesque) - spotted sucker

Moxostoma erythrurum (Rafinesque) - golden redhorse

Moxostoma valenciennesi (Jordan) - greater redhorse

Ictaluridae

Ictalurus melas (Rafinesque) - black bullhead

Ictalurus natalis (LeSueur) - yellow bullhead

Ictalurus nebulosus (LeSueur) - brown bullhead

Noturus gyrinus (Mitchill) - tadpole madtom

Cyprinodontidae

Fundulus notatus (Rafinesque) - blackstripe topminnow

*Listed as Notropis texanus (Girard) - weed shiner in the American Fisheries Society Special Publication No. 2.

Gasterosteidae

Eucalia inconstans (Kirtland) - brook stickleback

Centrarchidae

Ambloplites rupestris (Rafinesque) - rock bass

Chaenobryttus gulosus (Cuvier) - warmouth

Lepomis cyanellus (Rafinesque) - green sunfish

Lepomis gibbosus (Linnaeus) - pumpkinseed

Lepomis macrochirus (Rafinesque) - bluegill

Lepomis megalotis (Rafinesque) - longear sunfish

Micropterus dolomieui (Lacépède) - smallmouth bass

Micropterus salmoides (Lacépède) - largemouth bass

Pomoxis nigromaculatus (LeSueur) - black crappie

Percidae

Etheostoma caeruleum (Storer) - rainbow darter

Etheostoma exile (Girard) - Iowa darter

Etheostoma microperca (Jordan and Gilbert) - least darter

Etheostoma nigrum (Rafinesque) - Johnny darter

Perca flavescens (Mitchill) - yellow perch

Percina maculata (Girard) - blackside darter

Atherinidae

Labidesthes sicculus (Cope) - brook silverside

SUMMARY

1. Collections of fish were made throughout the entire Red Cedar River drainage system in order to determine species composition and distribution.
2. D.C. shocking gear was used and proved to be the most effective means for collecting nearly all species of fish. Gill nets, hook and line and drag seines were also employed.
3. The Red Cedar River was divided into seven regions each of which consists of several collecting stations (42 stations in all).
4. Each of the 42 stations was carefully studied and described by using the following characteristics: length of station; bottom types; average and range of depth, width and current; type and abundance of aquatic vegetation; shoreline; water temperature; amount of cover in the stream and the turbidity of the water.
5. 22,440 fish were collected representing 54 species (including two sub-species), 32 genera and 12 families.
6. The greatest diversity of species was found in the mainstream (48 species, 31 genera, 12 families), with less diversity in the tributaries (39 species, 26 genera, 10 families) and lakes (21 species, 15 genera, 7 families).
7. The minnow family (Cyprinidae) was the most abundant, making up more than 37% of the total fish collected from the entire drainage system.
8. The five most abundant fish, in order of their abundance (percentage of the total number of fish collected), were as follows: the northern common shiner, Notropis cornutus frontalis (19.53%); the rock bass,

Ambloplites rupestris (10.89%); the white sucker, Catostomus commersoni (9.41%); the pumpkinseed, Lepomis gibbosus (5.30%) and the bluntnose minnow, Pimephales notatus (4.27%).

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