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INVENTORY OF FISH AND EVALUATION OF WATER QUALITY DURING MINIMUM FLOW PERIOD IN THE RIVER RAISIN, AUGUST, 1971

Raymond Shepherd, Fisheries Biologist

SUMMARY

A fisheries survey, in conjunction with an evaluation of water quality, was made of the River Raisin from headwaters in Hillsdale County to the confluence of the river with Lake Erie in Monroe County. In addition to recording species obtained, fish were measured and weighed, and samples were prepared for heavy-metals and pesticide analysis by John Hesse, Bureau of Water Management. Fish were obtained by use of electro-fishing gear and fyke nets. Smallmouth bass were the most numerous game fish, and white suckers the most numerous non-game fish. Generally low water quality was encountered throughout the survey -- turbidity increased from headwaters to the mouth of the river.

The co-relation of species of fish found in the waters examined are discussed. The survey data obtained provides a base for future management proposals of this major river in southeastern Michigan.

INVENTORY OF FISH AND EVALUATION OF WATER QUALITY DURING MINIMUM FLOW PERIOD IN THE RIVER RAISIN, AUGUST, 1971

Part "A": Fisheries Report and Illustrations
Fisheries Division, District #13, Jackson

Part "B": Fish Population Survey Sheets
Fisheries Division, District #13, Jackson

Part "C": Heavy Metals, PCB's, and Pesticide Analysis Water Quality Control Division, Lansing

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INVENTORY OF FISH AND EVALUATION OF WATER QUALITY DURING MINIMUM FLOW PERIOD IN THE RIVER RAISIN, AUGUST, 1971

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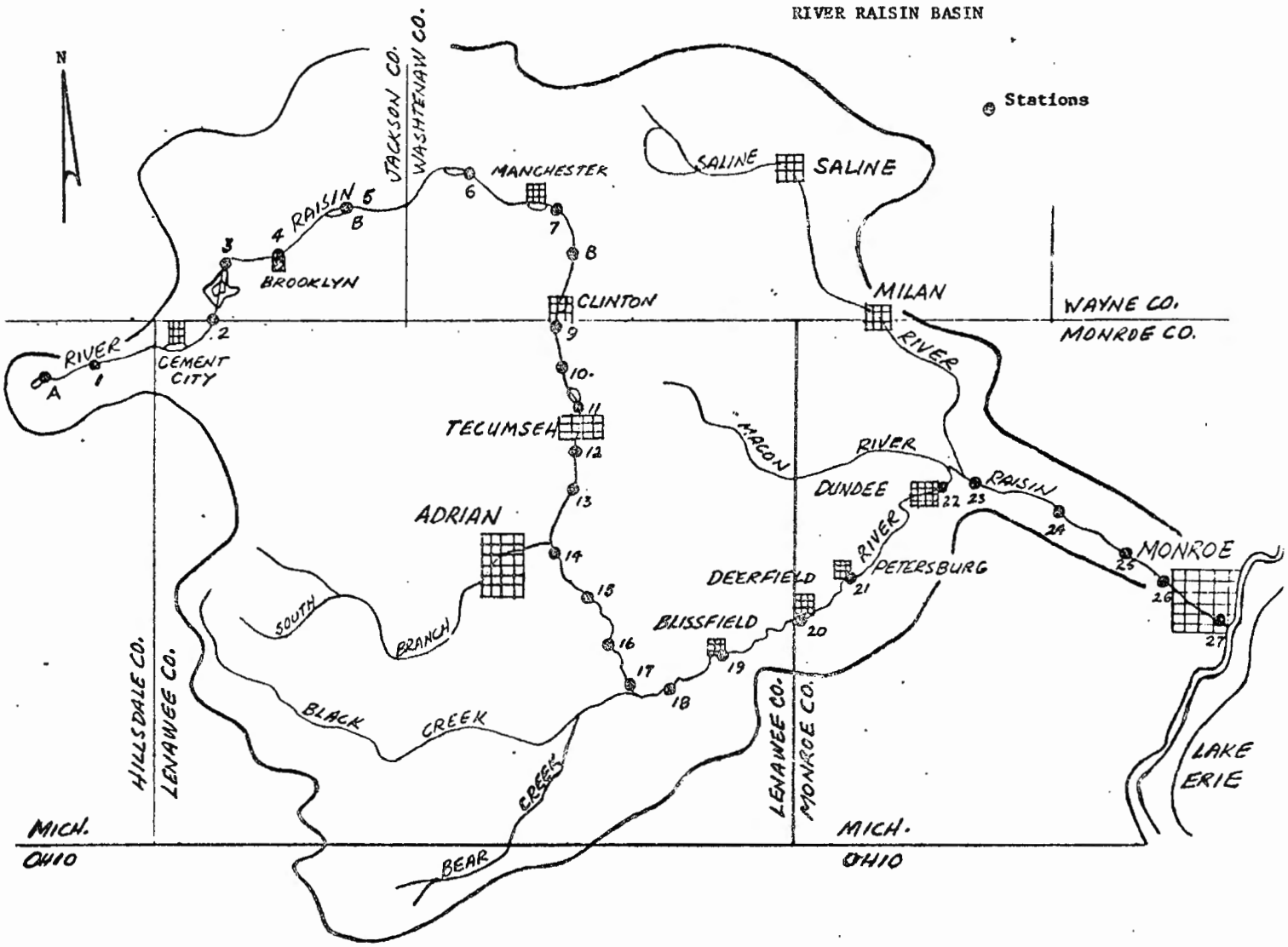

RIVER RAISIN BASIN
N
Stations
JACKSON CO.
WASHTENAW CO.
MANCHESTER
SALINE
SALINE
RAISIN
BROOKLYN
CLINTON
MILAN
WAYNE CO.
MONROE CO.
RIVER
CEMENT CITY
TECUMSEH
MACON
RIVER
DUNDEE
RAISIN
ADRIAN
RIVER
PETERSBURG
MONROE
DEERFIELD
SOUTH
BRANCH
BLISSFIELD
HILLSDALE CO.
LENAWEE CO.
BLACK
CREEK
LENAWEE CO.
MONROE CO.
LAKE
ERIE
MICH.
OHIO
BEAR
CREEK
MICH.
OHIO

PART A

INTRODUCTION

This report is compiled from a survey that inventoried the fish population and water quality in the River Raisin during a minimal-flow period. The survey was conducted during 1971, August 16 - 31, by personnel of the Fisheries Division, District #13, of the Michigan Department of Natural Resources. The survey included the entire River Raisin (tributaries not included) from the headwaters in Hillsdale County to the mouth at the City of Monroe on Lake Erie.

The purpose of this report is to provide specific and current information on the fish and on the factors that affect the fish within the river system. This report is intended for the fisheries manager as well as the general public.

BASIN DESCRIPTION

The River Raisin and its tributaries form a network draining approximately 1,070 square miles of southeastern Michigan with a small portion in northwestern Ohio. The basin, which is approximately 60 miles in length and from 2 to 45 miles in width, includes portions of Hillsdale, Jackson, Washtenaw, Lenawee, and Monroe Counties.

The River Raisin flows in a general east - southeast direction, passing through Cement City, Brooklyn, Manchester, Tecumseh, suburbs of Adrian, Blissfield, Deerfield, Petersburg, Dundee, and Monroe where it discharges to Lake Erie.

The major tributaries of the River Raisin include: Wolf Creek, Black Creek, south branch of the River Raisin, and the Macon and Saline Rivers.

TABLE #1

Raisin River Survey

Electro-Fishing Stations

ZONES	Stations	Location	County	Town	Range	Section
	1	Waldron Road	Hillsdale	5S	1W	9
	2	County Line Road	Lenawee	5S	1E	4
	3	Jefferson Road	Jackson	4S	1E	22
	4	Brooklyn Road	Jackson	4S	2E	19
1	5	Mill Road	Jackson	4S	2E	3
	6	Sharon Hollow Road	Washtenaw	3S	3E	28
	7	Austin Road	Washtenaw	4S	3E	1
	8	Wilbur Road	Washtenaw	4S	4E	20
	9	U.S. 12 at Clinton	Lenawee	5S	4E	5
	10	Staib Road	Lenawee	5S	4E	16
	11	Tecumseh Impoundment	Lenawee	5S	4E	28
	12	Comfort Road	Lenawee	6S	4E	5
	13	Raisin Center Hwy.	Lenawee	6S	4E	21
2	14	Laberdee Road	Lenawee	6S	4E	29
	15	Deerfield Road	Lenawee	7S	4E	8
	16	U.S. 223 Cadmus Road	Lenawee	7S	4E	22
	17	E. Gorman Road	Lenawee	7S	4E	34
	18	Beamer Road	Lenawee	8S	4E	2
	19	Below Blissfield WWTP	Lenawee	7S	5E	29
	20	Below Deerfield WWTP	Monroe	7S	6E	7
	21	Below Petersburg WWTP	Monroe	7S	6E	3
	22	M-50 (Dundee)	Monroe	6S	6E	13
3	23	Below Saline River	Monroe	6S	7E	9
	24	Ida Maybee Road	Monroe	6S	7E	13
	25	Raisinville Road	Monroe	6S	9E	3
	26	Waterloo Dam	Monroe	6S	9E	
	27	I-75 (Monroe)	Monroe	6S	9E	

NETTING STATIONS

A	Goose Lake	Hillsdale	5S	1W	17
B	Norvell Lake	Jackson	4S	2E	4

GUIDELINES AND PROCEDURES

A total of 29 stations were selected as study areas (see table #1). The survey sites were selected on a basis of accessibility to the river, in a somewhat regular interval of spacing, and below sources that may contribute to pollution. Sites below sources of pollution were selected by personnel from the Water Quality Control Division, District #1, prior to the survey.

Most fish collecting was completed by using electro-fishing gear. A 20 minute shocking interval directed at the variety of habitat present was performed at each station. A variety of electro-fishing equipment was utilized depending on the circumstances. A 240 volt, 10 amp, A.C. generator was used on a 16 foot barge for large open waters. This same generator was used in areas that could be waded, with the generator towed in a small boat. In areas too shallow for 16 foot barge and too deep to wade, a 14 foot fiberglass boat was used. This boat was equipped with a 110 volt, A.C. generator that produced 6 amps. A 12 volt D.C. backpack battery producing 3 amps was used where the discharge of the stream was less than 10 cubic feet per second.

Fish passing through the electrical field were stunned temporarily and retrieved with a scap net. These fish were collected in tubs for weighing and measuring, and returned to the water.

At netting stations, two fyke nets were set overnight. These fish were also collected in tubs for weighing and measuring and returned to the water.

Fish from each collection were separated according to species, and measured to the nearest inch group. The total weight of each species was

recorded to the nearest tenth of a pound. Maximum and minimum lengths were recorded to the nearest tenth of an inch for each species. Average length and weight were computed for a species that included 10 or more fish. Tallies for game fish (panfish, bass, pike, etc.) were separated from non-game fish (bullheads, carp, suckers, etc.). Young-of-the-year (YOY) game and non-game species, minnows and other forage species were noted but not tallied, measured or weighed.

Fish samples were collected during the survey, frozen, and sent to Water Quality Control Division in Lansing for analysis of heavy metals, PCB's and pesticides. A total of 83 fish, mainly larger predator species (bass, pike), from 19 stations were collected for analysis. The results of this analysis are included in Part C of this report.

At each station the time, temperature (air and water), weather conditions and water conditions (clarity, color, and odor) were recorded. Forage species and any YOY species were noted. The bottom type, amount of cover, and types of aquatic vegetation were also recorded.

The dissolved oxygen (DO), acidity (pH), and water hardness were determined at each station using a Hach Chemical Kit.

The river discharge in cubic feet per second (dfs) was computed, where practicable, for the method used at each station. Discharge was computed by the formula:

$$R = \frac{WDaL}{T}$$

Where: R = Volume of flow in cubic feet per second.
W = Average width of stream in feet.
D = Average depth in feet.
a = Constant factor for bottom type:
smooth sand, etc. = 0.9
rough rock, etc. = 0.8
L = Length of stream section measured.
T = Time in seconds for float to travel measured section.

TABLE #2

FISH POPULATION SURVEY
SUMMARY SHEET

Station	GAME			NON-GAME			TOTALS		
	No. SPP.	No. Fish	Wt. Lbs.	No. SPP.	No. Fish	Wt. Lbs.	No. SPP.	No. Fish	Wt. Lbs.
1	1	12	0.1	1	1	0.1	5	13	0.2
2	4	23	2.7	1	0	0	9	23	2.7
3	7	3	0.3	3	31	3.9	16	34	4.2
4	8	33	3.9	3	11	8.7	12	44	12.6
5	6	116	9.3	5	12	4.2	13	128	13.5
6	5	30	2.5	6	16	5.3	13	46	7.8
7	5	27	5.1	3	57	19.8	14	84	24.9
8	6	36	3.5	3	56	24.4	12	92	27.9
9	7	13	4.6	4	32	16.1	19	45	20.7
10	3	6	1.7	4	23	7.3	13	29	9.0
11	5	1	0.1	2	12	11.4	7	13	11.5
12	4	8	1.8	4	6	1.8	8	14	3.6
13	4	6	1.0	4	27	13.9	12	33	14.9
14	4	7	3.1	4	20	16.4	13	27	19.5
15	1	2	0.1	1	1	0.4	6	3	0.5
16	2	3	1.7	1	27	15.3	9	30	17.0
17	0	0	0	1	13	4.3	3	13	4.3
18	2	3	6.8	1	7	4.5	7	10	11.3
19	5	23	8.7	4	10	12.4	12	33	21.1
20	2	2	0.6	3	11	5.9	10	13	6.5
21	3	36	6.1	4	30	14.1	10	66	20.2
22	5	98	4.8	4	23	4.3	15	121	9.1
23	7	2	2.1	4	12	19.3	14	14	21.4
24	5	75	13.7	5	147	299.2	16	222	312.9
25	4	45	10.7	6	87	49.5	14	132	60.2
26	3	8	3.1	3	15	18.9	8	23	22.0
27	2	2	0.2	3	25	51.0	7	27	51.2
Average	4	23	3.6	3	26	23.4	11	49	27.0
Totals		620	98.3		712	632.4		1332	730.7

The numbers and weights of fish does not include YOY or forage species. The numbers of species does include these fish.

TABLE # 3

FISH POPULATION SURVEY
SUMMARY SHEET

STATION	FISH SPECIES				WATER QUALITY		
	S.M.Bass	Wh.Suckers	Carp	N.Pike	DO	cfs.	Turbidity
1					9	2.3	C
2					9	7.0	C
3		X			8	1.1	C
4		X	X	X	9	10.0	C
5	X	X			8	12.5	C
6	X	X	X		9	18.0	S
7	X	X			6	19.7	C
8	X	X			7	21.5	S
9	X	X	X		8	25.0	S
10	X	X	X		6	39.6	M
11			X		7	Impdmt.	H
12	X	X			8	39.1	M
13	X	X	X		6	36.0	M
14	X	X	X	X	7	58.8	M
15		X			4	75.6	M
16		X		X	6	79.4	S
17		X			4	95.6	S
18	X	X		X	9	93.8	S
19	X	X	X	X	12	117.6	M
20		X	X		9	79.2	H
21	X	X	X		12	105.3	H
22	X	X	X	X	8	55.4	S
23	X	X	X	X	6	----	H
24	X	X	X		12	----	S
25	X	X	X		12	----	M
26	X	X	X		6	Impdmt.	H
27	X		X		7	----	H
TOTALS	18	23	16	7			

C = Clear
S = Slight Tur.
M = Moderate Tur.
H = Heavy Tur.

The data for each station was recorded in the field on a data collection sheet. The most pertinent field data and a map location was put on a fish population survey form for this report. These fish population survey forms for netting stations A and B plus electro-fishing stations 1 thru 27 are included in Part B of this report. The field data collection sheets are filed at the Jackson District Office.

R E S U L T S

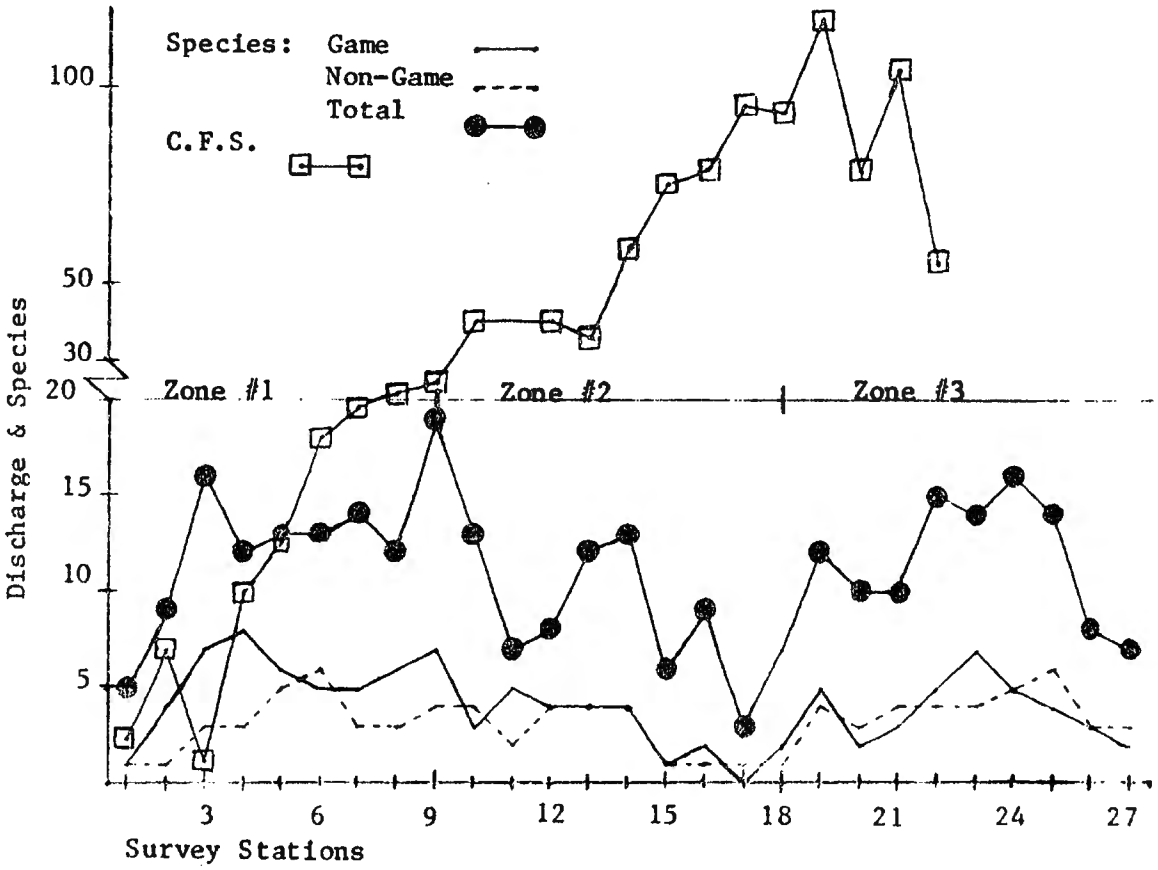
Tables #2 and #3 are a summary of a major portion of the data from electro-fishing station #1 thru #27. The number of species, number of fish, and weight of fish are recorded separately in Table #1 for game and non-game species. The species column under game and non-game fish include YOY; the number and weight columns do not. The species column under totals includes game and non-game fish (YOY included) plus forage species. Table #2 summarizes the occurrence of smallmouth bass, white suckers, carp and northern pike. Also included in Table #2 are dissolved oxygen, water discharge and turbidity values. Turbidity values are clear (C), slightly turbid (S), moderately turbid (M), and heavily turbid (H).

Graph #1 represents the number of species (game, non-game and total) per station. The discharge of water is also plotted on this graph.

Station #3 had the least recorded volume of water, 1.1 cfs, on the survey. Yet at station #3, a total of 16 species of fish were found, second highest on the survey. The water temperature at station #3 was 56°F., coldest on the survey and the water was very clear. The water at station #3 comes from springs and ground water and is relatively free from pollution. The situation at station #3, with 16 species of fish concurs with an old biological axiom that an environment unaffected by pollution is

RIVER RAISIN SURVEY

GRAPH # 1
WATER DISCHARGE & NUMBER OF SPECIES PER STATION



one that supports a greater number of species. The highest number of species recorded was 19 at Station #9, but there the water volume was approximately 23 times greater than at Station #3.

Referring to the aforementioned axiom and looking at the line representing total species on Graph #1, the greatest variety of species occurs at Stations #1 through #9 (Zone #1). The average number of species for Zone #1 is 12.8 per station, and the water volume ranged from 1.1 to 25.0 cfs. Zone #2 averaged 8.7 species per station, and the water volume ranged from 39.6 to 95.6 cfs. Zone #2 includes Lenawee County and a major portion of the River Raisin watershed. Major portions of the population and industry are also within this zone. The lowest number of species on the survey but one of the highest water flows (95.6 cfs) was recorded at Station #17. A substantial increase in water quantity exists in Zone #2 but apparently the water quality is somewhat degraded.

The lowest dissolved oxygen values, 4 ppm, on the survey were recorded at Stations #15 and #17 in Zone #2 (see Table #2). The water quality standards set by the Michigan Water Resources Commission states that for intolerant warmwater species (bass, pike and panfish) the average DO be not less than 4 ppm. The National Technical Advisory Committee recommends that DO concentrations be above 5 ppm and that, under extreme conditions, concentrations may range between 4 and 5 ppm for short periods providing that water quality is favorable in all other respects.

Low concentrations of dissolved oxygen can be attributed usually to introduction of organic wastes which are acted upon immediately by bacteria. The following process of decomposition consumes oxygen from the water. Zone #2 appears to have areas of water degradation, followed by areas of active decomposition.

Zone #3 appears to be a recovery area up to Station #24 which is below the village of Dundee and just below the mouths of the Macon and Saline Rivers. From here the number of species decreases rapidly (area of degradation) towards the city of Monroe and Lake Erie. Zone #3 averaged 11.8 species per station, and the water volume ranged from 55.4 to 117.6 cfs.

The numbers of game and non-game species per station are represented by lines on Graph #1. These lines exhibit the same pattern as the total species configuration, with highs in Zone #2. The number of game species per station appears, as one would expect, to be a better indicator of water quality. The line representing game species has almost the same pattern, highs and lows, as the line representing the total number of species.

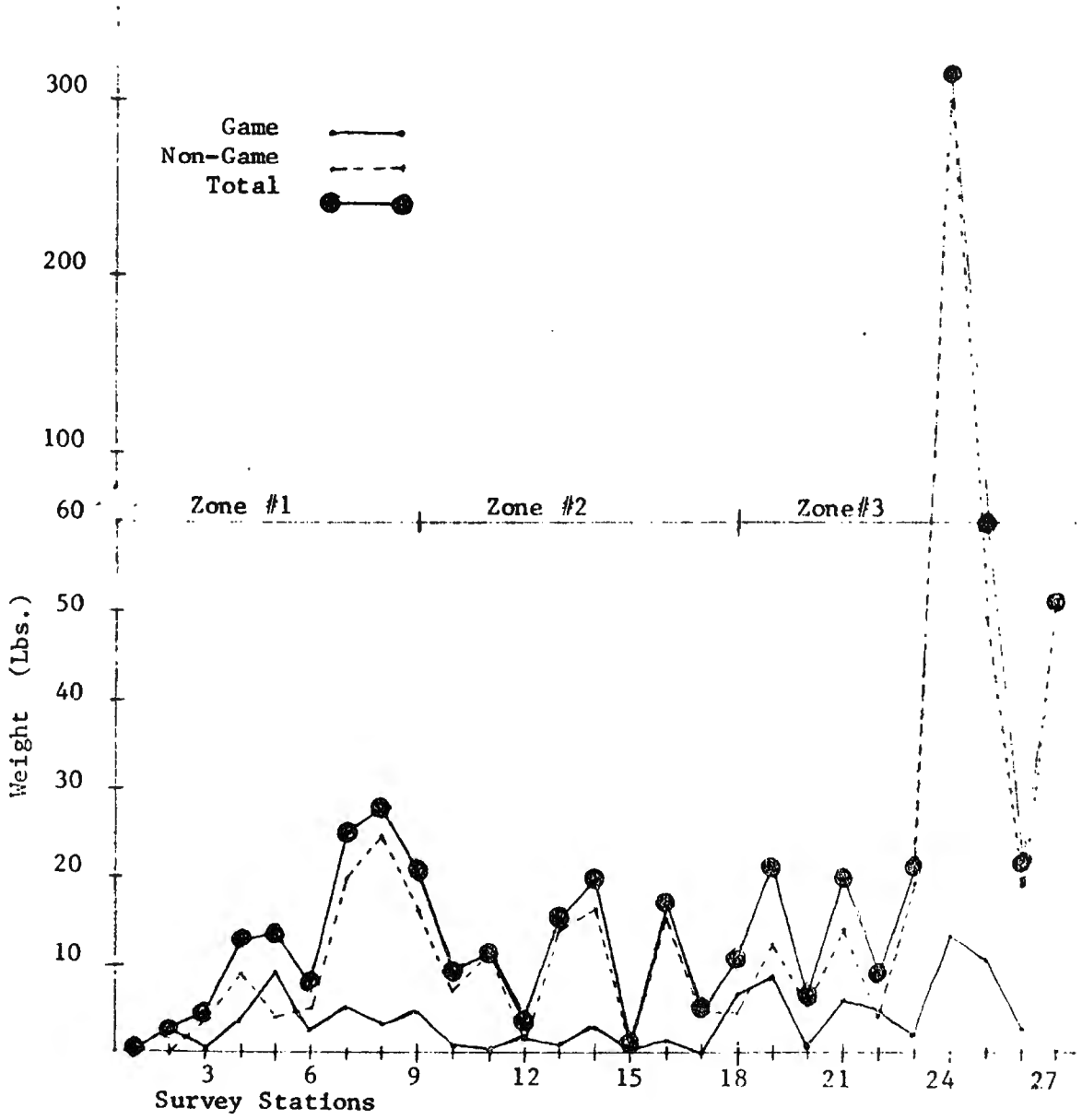
Graph #2 represents the weight of fish per station on the survey. The two highest weights of game fish occurred in Zone #3 at Station #24 (13.7 lbs) and #25 (10.7 lbs). The third highest weight of game fish occurred at Station #5 (9.3 lbs) in Zone #1. The weight of game fish remains low throughout Zone #2. The weight of game fish also drops off sharply in Zone #3 and Station #27, below the city of Monroe.

The weight of non-game fish in contrast takes a sharp rise. The lines representing total weight, and weight of non-game fish, have strong resemblence. The total weight of fish throughout the survey seems to reflect the weight of the non-game fish. The three highest weights of non-game fish occurred in Zone #3. The fourth highest occurred in Zone #1 at Station #8. The weight of non-game fish in Zone #2, although erratic, demonstrated much higher values than the weight of game fish. From the standpoint of weight, the non-game fish expressed more compatibility, as one might expect, with

RIVER RAISIN SURVEY

GRAPH # 2

WEIGHT OF FISH PER STATION



the water quality in Zone #2. The total weight of fish captured on the survey was 730.7 lbs, of which 13% or 98.3 lbs were game fish.

Game fish weighed more than non-game fish at only four stations. Two of these Stations (#2 and #5) were in Zone #1 (see Table #2). Adult non-game fish were not found at Station #2 which is just above Lake Columbia. Here the game fish weighed a total of 2.7 lbs, with the bulk of the weight being 16 rock bass (probably native to Lake Columbia) which weighed 1.0 lbs. The game fish at Station #5 weighed 9.3 lbs of which 5.3 lbs were bluegills. This station is just below Norvell Pond which has a thriving population of bluegills (Part B, netting Station B, Norvell Pond). The non-game fish at Station #5 weighed 4.2 lbs. The game fish at Station #22 in Zone #3 weighed 4.8 lbs opposed to 4.3 lbs for non-game fish. This station also was just below a dam. Eighty-nine immature smallmouth bass, which weighed 3.6 lbs comprised the bulk of the game fish at this station.

The fourth station where game fish weighed more than non-game fish was at Station #18. This station was not below a dam or just above a lake, and was more of a typical river situation. The game fish at Station #18 weighed 6.8 lbs and the non-game fish 4.5 lbs. The two northern pike at this station weighed 6.7 lbs.

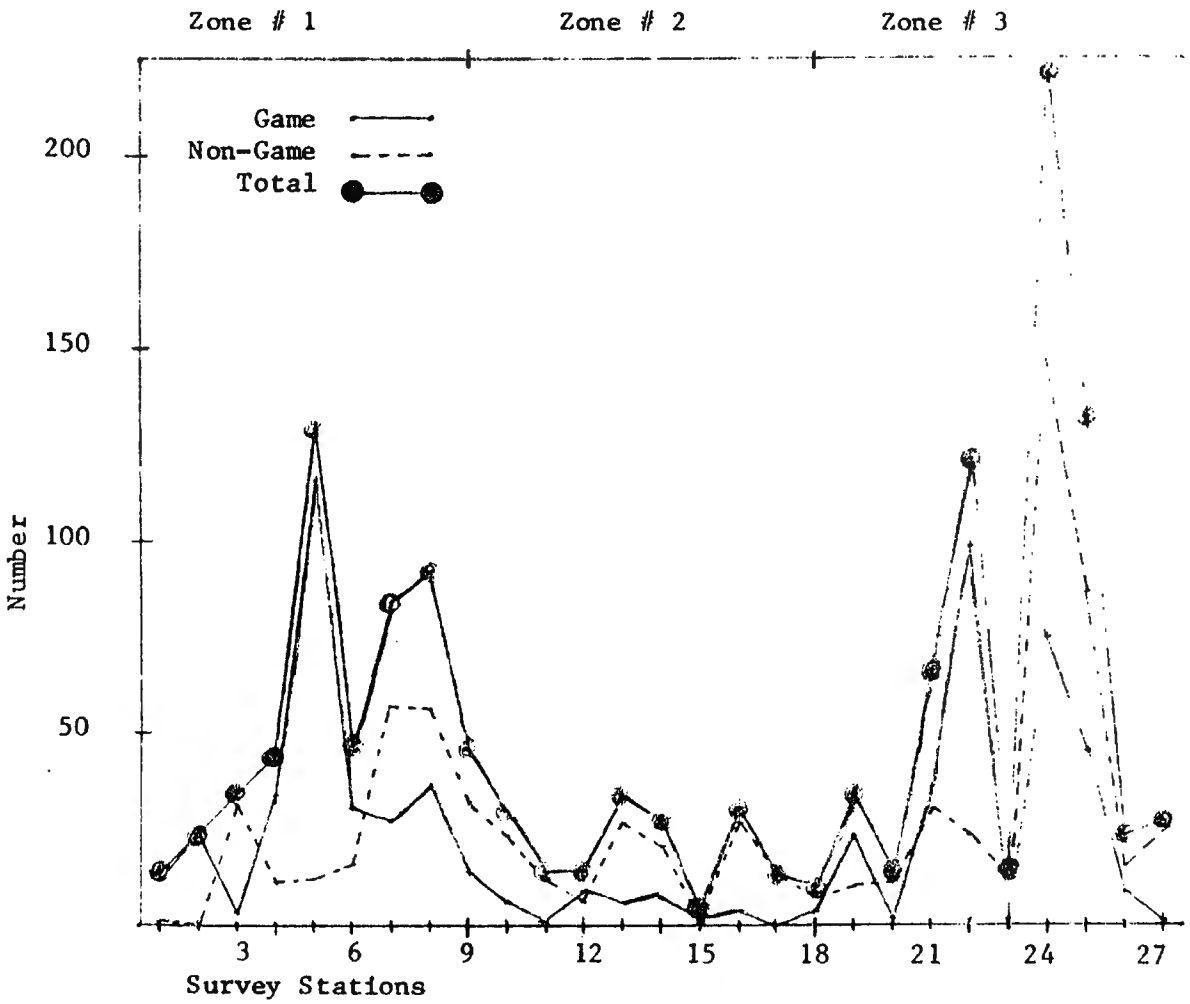
The total weight of fish, or standing crop, (Graph #2) appears to have little relationship to the volume of water. Total weight at Station #8 in Zone #1 was higher than weights in Zone #2 where the flow of water is 2 to 5 times greater. In an ideal situation, without outside effects, standing crop would normally increase as the water volume increased.

Graph #3 is a representation of the number of fish per station. The greatest numbers of fish were captured in Zones #1 and #3. The greatest numbers of game fish were captured at Stations #5, #22, and #24 which were

RIVER RAISIN SURVEY

GRAPH # 3

NUMBER OF FISH PER STATION



all located below dams. A total of 1332 fish were captured on the survey of which 47% or 620 were game fish. Only 111, or 18%, of the game fish were of catchable size. This amounts to only 8% of the total 1332 fish. Smallmouth bass accounted for 185 of the game fish (30%). Only 17 or 9% of these were of catchable size.

T U R B I D I T Y

Turbidity of the River Raisin increased from the headwaters to the mouth. Zone #1 was relatively clear; Zone #2 was moderately turbid; and Zone #3 was heavily turbid. The stations with heavily turbid waters were above dams or just below villages. Netting Station B (Norvell Pond) is situated just above electro-fishing Station #5. The river was clear at all stations above Norvell Dam but the impoundment was extremely turbid. Large carp were prominent in the pond. At six survey stations turbidity was very light, and carp were collected at only one of these stations. Eight stations were slightly turbid and carp were found at four of these sites. Carp were found at 5 of the 7 stations that were moderately turbid and at all 6 of the stations that were extremely turbid. Pike were captured at two stations that were heavily turbid (#B and #23). At Station B, Norvell Pond, 4 northern pike between 25.0 and 27.4 inches were netted. Each of these pike were one pound less than the Michigan average weight for pike of that length. One northern pike was captured at Station #23 which was 24.3 inches in length and 2.0 lbs in weight. This is a pound less than the Michigan average for pike of that length. The water was lightly turbid at Station #18. Two northern pike 19.3 and 29.5 inches in length were captured here. These pike weighed more than the Michigan average for pike that length.

p H

The pH values on this survey varied from 7.0 to 9.5. The most common value 8.5 was found at 18 of the 27 stations. Values of pH between 5.0 and 9.0 are not lethal for most fully developed freshwater fish, provided that other conditions are favorable. There is a gradual deterioration of fish habitat as pH values diverge further from this range. Five stations had a pH of 9.5. These were in Zone #3 where the river flows over bedrock. This bedrock is of the Dundee formation, a cherty or dolomitic limestone, which could account for pH values outside this normal range.

H A R D N E S S

Water hardness varied on the survey from 205 ppm in Zone #1 to 479 ppm in Zone #3. The values tend to increase somewhat from the headwaters to the mouth. Waters of hardness between 121 and 180 ppm are considered hard. Values above 180 ppm are considered very hard. The extreme hardness of water at some stations in Zone #3 may reflect the presence of the Dundee Bedrock Formation. Hardness is usually associated with calcium and magnesium, which are dissolved principally from gypsum, or limestone and dolomite, as in the Dundee Formation.

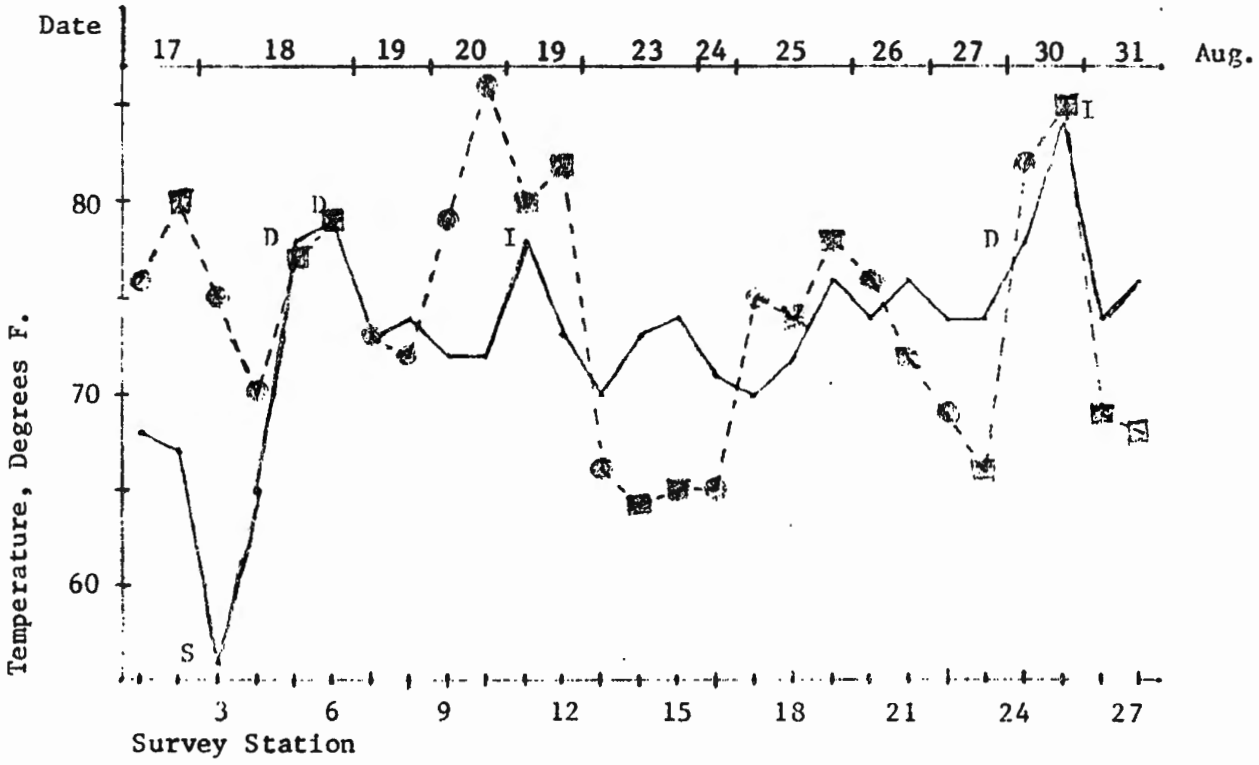
Hardness is often times correlated with productivity. Hard-water streams are usually more productive than soft-water streams.

The extreme hardness of the water on this survey was probably an aid to the electro-fishing success, especially in Zone #3 at Stations #24 through #27. Specific conductance usually increases with hardness. The specific conductance indicates the degree of mineralization and is a measure of the capacity of the water to conduct an electric current. These characteristics associated with water hardness, among other things, may explain the high weights of fish captured at Stations #24 through #27. The water

RIVER RAISIN SURVEY

GRAPH #4

AIR & WATER TEMPERATURE PER STATION



Air ——— AM PM

Water ——

Below Dam D

Spring S

Impoundment I

hardness here varied from 378 to 479 ppm. The weight of fish captured at these four stations was 446.3 lbs, or 61% of the total weight of fish on the survey.

TEMPERATURE

The five highest water temperatures were recorded at or below impoundments. The lowest water temperature, of 56°F, was recorded at Station #3. Water temperature on the survey reflected air temperatures. Water temperatures, for the most part, followed air temperatures, except at Stations #13, #14, and #15 (Graph #4). Station #13 was surveyed in the AM and #14 and #15 were surveyed in the PM. The air temperature at Station #13 was 66°F, and at Station #14 and #15 it dropped to 64°F and 65°F, respectively. The water temperature at Station #13 was 69°F, but it rose at Stations #14 and #15 to 73°F and 74°F. The South Branch of the River Raisin enters the main branch just above Station #14 and may explain why water temperatures in the main stream increased at Stations #14 and #15 while air temperatures were falling.

BOTTOM TYPES

Bottom types varied on the survey. Bottom types in Zone #1 are mostly sand and gravel, and rubble with thin layers of silt cover at some stations. Silt was thicker and more predominant in Zones #2 and #3. A clay bottom was found at Station #17 and #18. The river bottom at Station #24 and #25 was bare bedrock.

IMMEDIATE SHORE

The immediate shore of the river at most stations are wooded. The surrounding country along the river is mostly farmland except near settlements. The immediate bank and surrounding country on the last four stations of the survey are primarily residential.

AQUATIC VEGETATION

Rooted aquatic vegetation was most predominant in Zone #1 and occurred at every station except #9. Rooted vegetation in Zone #2 occurred only at the impoundment at Tecumseh (Station #11). Heavy strings of algae were found from Station #14 (below the confluence of the South Branch) to Station #18. Aquatic vegetation was not found in Zone #3 at Stations below the villages of Blissfield, Deerfield, and Petersburg. Heavy strings of algae were found below the village of Dundee (Station #22) and at Station #23 below the confluence of the Macon and Saline Rivers. Rooted aquatic vegetation was sparse in the reminder of Zone #3. Fish cover was moderate in occurrence in Zones #1 and #2 but sparse in Zone #3.

C O N C L U S I O N S

Poor water quality is a problem of the River Raisin. This is especially apparent in Zones #2 and #3 of this survey.

One factor, evident on this survey, which contributes to the poor quality of water is sedimentation. The River Raisin watershed was once covered with mature hardwoods. Now the basin is mostly cleared (70% of Lenawee and Monroe Counties are cropped) and the area contains some of the richest farmlands in the nation. This change in land use, from forest to farmland, has increased water run-off and erosion, which in turn has increased sedimentation and enrichment of the river. Waters of the River Raisin are among the most heavily sediment-laden in the state during flood and freshet. By conservative estimate, thousands of tons of sediment enter the river system each year. Sediment that is deposited on the river bed covers and destroys spawning grounds and benthic organisms. Excessive sediment load also increases turbidity which, in turn, decreases production and hinders sight-feeding game fish such as bass, pike, and panfish. Turbid waters are more suitable for bottom feeding rough fish such as carp, redhorse and suckers.

Waste disposal into the river contributes to the poor quality of water. A survey in July of 1971 (a month prior to this survey) by the Water Resources Commission revealed that a very substantial load of solids and nutrients are added to the South Branch below the city of Adrian. Adrian's east side drain was also reported to contribute a significant nitrogen load to the South Branch. Bio-chemical oxygen demand concentrations on the River Raisin according to the W.R.C. survey, were twice as high below the confluence of the South Branch than above. Also, dissolved oxygen concentrations on the South Branch below Adrian were below values designated for pollution-tolerant fish such as carp, bullheads, and suckers. The results of our fishery survey

revealed a substantial reduction in the numbers and species of game and non-game fish from below the confluence of the South Branch to Blissfield. The two lowest dissolved oxygen concentrations (4 ppm) on our survey were recorded in this section.

The flow characteristics of the River Raisin affect both water quality and the fisheries. The discharge of the River Raisin near Monroe has varied during the period 1937 to 1963 from 9 to 12,900 cubic feet per second. This is a considerable fluctuation. The minimum discharge of a river is an indication of its usefulness, and the maximum discharge is an indication of its flooding potential. The River Raisin has a natural low-flow characteristic during late summer which was evident during the survey. This low-flow characteristic limits the fishery and the waste assimilating capabilities of the river. Waste loading on a river, which is fairly constant throughout the year, is dependent upon low stream flows for adequate assimilation and dilution. This low-flow period is also the lowest common denominator for fisheries management. The number of fish that live through this low-flow period becomes the carrying capacity of the river. The lower the stream flow, and the longer the duration of this low-flow period, the fewer the fish held over.

Low stream flows can be augmented by water storage facilities. However, this may not be practical on the River Raisin. Stations surveyed on impoundments and above low-head dams revealed extremely turbid waters, a thick silty substrate and a predominant population of bottom-feeding rough fish. Fertile and sediment-laden streams are the least desirable for impounding.

Zones #2 and #3 (specifically, waters below Tecumseh to the mouth) pose problems for game fish management. This is the area on the river where sedimentation, turbidity, pollution, and flow fluctuation are the greatest,

and thus is the area which would present the most strenuous environment for game fishes.

Results of the PCB's, pesticide and heavy metals analysis by the by the Water Resources Commission revealed some high concentrations of PCB's and heavy metals in Zones #2 and #3 (see part C). Sharp increases of PCB's were noted in Zone #2. At Station #14 a concentration of 4.71 mg/kg was found in a 14-inch smallmouth and 6.45 mg/kg in a 20-inch northern pike. A concentration of 5.00 mg/kg of PCB's is the limit established by the U.S. Food and Drug Administration for concentration in fish for human consumption. Concentrations of dieldrin and DDT were found to be low, although concentration of dieldrin in Zone #3 of the River Raisin was considerably greater than that observed elsewhere including the upper portions of the river. Two fish samples had mercury concentrations either equal to, or exceeding the 0.5 mg/kg tolerance limit established by the U.S. Food and Drug Administration. The two fish were from Zone #3. A 6.5-inch rock bass at Station #19 (below Blissfield W.W.T.P.) contained 0.50 mg/kg of mercury; and a 23.5-inch northern pike at Station #23 (below the confluence of the Macon and Saline rivers) contained 0.65 mg/kg of mercury.

The upper portion of the River Raisin has water qualities more suitable for the management of game fish, i.e., from Station #3 (below the dam at Lake Columbia) thru Station #11 (Tecumseh Impoundment). Access to the river in this area may be a problem because it flows thru private land. But there are five impoundments (Norval, Sharonville, Ford at the village of Manchester, Clinton, and Tecumseh) in this section which have some degree of access, with a total of over 100 surface acres of water. A fishery renovation within this area may be necessary because of rough fish (carp, suckers, and redhorse). First, if a need for such improvement project should develop, a more detailed survey of

this section would need to be conducted.

It is intended that the information derived from this survey will provide a better understanding of the fisheries and related problems of the River Raisin and also serve as a benchmark for future surveys.

TABLE #4

SPECIE LIST

GAME FISH

Northern pike	Esox lucius
Yellow perch	Perca flavescens
Smallmouth bass	Micropterus dolomieui
Largemouth bass	" salmoides
Warmouth bass	Chaenobryttus gulosus
Green sunfish	Lepomis cyanellus
Pumpkinseed sunfish	" gibbosus
Bluegill sunfish	" macrochirus
Longear sunfish	" megalotis
Rock bass	Ambloplites rupestris
Black crappie	Pomoxis nigromaculatus

NON-GAME FISH

Dogfish	Amia calva
White sucker	Catostomus commersonnii
Hog sucker	Hypentelium nigricans
Lake chubsucker	Erimyzon sucetta
Silver redhorse	Moxostoma anisurum
Carp	Cyrinus carpio
Goldfish	Carassius auratus
Black bullhead	Ictalurus melas
Brown bullhead	" nebulosus
Yellow bullhead	" natalis
Stonecat	Noturus flavus
Mud pickerel	Esox americanus

FORAGE FISH

Alewife	Alosa pseudoharengus
Creek chub	Semotilus atromaculatus
Golden shiner	Notemigonus crysoleucas
Lake emerald shiner	Notropis atherinoides
Common shiner	" cornutus
Spottail shiner	" hudsonius
Satinfin shiner	" analostanus
Spotfin shiner	" spilopterus
Fathead minnow	Pimephales promelas
Bluntnose minnow	" notatus
Stoneroller	Campostoma anomalum
Mudminnow	Umbra limi
Blackside darter	Percina maculata
Johnny darter	Etheostoma nigrum
Rainbow darter	" caeruleum
Fantail darter	" flabellare
Greenside darter	" blennioides
Mottled sculpin	Cottus bairdi

Species identification by Edward H. Bacon and Raymond E. Shepherd, Fisheries Division, District #13, Jackson.

SUMMARY OF CONCLUSIONS

1. Zone #1, headwaters to the village of Clinton (stations 1-9), recorded the highest average number of fish species, 12.8 per station. Zone #2, below the village of Clinton to Blissfield (stations 10-18), recorded the lowest average number of fish species, 8.7 per station. Zone #3, below Blissfield to Lake Erie (stations 19-27), recorded an average of 11.8 species per station. The number of fish species ranged from 3 at Station #17 (Gorman Rd., below Adrian) to 19 species at Station #9 (US-12 at Clinton).
2. Numbers of game fish collected at each station ranged from zero at Station #17 to 116 at Station #5 (Mill Rd., Norvell). The weight of game fish ranged from zero at Station #17 to 13.7 lbs. at Station #24 (Ida - Maybee Rd.). Six hundred twenty or 47% of the collection were game fish. Game fish accounted for only 13% (98.3 lbs.) of the total weight of game and non-game fish.
3. Numbers of non-game fish collected at each station ranged from zero at Station #2 (County Line Rd., Cement City) to 147 at Station #24. Weights of non-game fish ranged from zero at Station #2 to 299.2 lbs. at Station #24. Seven hundred twelve or 53% of the collection were non-game fish. These fish, though, accounted for 87% (632.4 lbs.) of the total weight of game and non-game fish.
4. White suckers, the most common species captured on the survey, were collected at 23 of the 27 stations. Smallmouth bass were the most common game fish collected and were found at 18 stations. Carp were captured at 16 stations.
5. Only 111, or 18% of the game fish collected were of catchable size. This amounts to only 8% of the total 1332 fish collected. Smallmouth bass accounted for 30% (185) of the game fish collected but only 9% (17) of these fish were of catchable size.

6. The lowest dissolved oxygen values on the survey, 4 ppm, was recorded at Station #15, Deerfield Rd., and Station #17, E. Gorman Rd. Four ppm is the minimum requirements set by the Michigan Water Resources Commission, for intolerant warmwater species (bass, pike and panfish).

7. Turbidity in the river increased from the headwaters, which was relatively clear, to the mouth where turbidity was heavy. Carp were found at all stations heavy with turbidity. These stations were at impoundments or below settlements. Northern pike collected at 2 stations that had heavily turbid waters were one pound less in weight than the Michigan average for pike of their size.

8. Water temperatures at most stations reflected the influence of air temperatures. The lowest water temperature, 56°F, was recorded at Station #3 (Jefferson Rd., Brooklyn). The lowest water discharge, 1.1 cubic feet per second, and the second highest number of fish species captured also occurred at Station #3. The five highest water temperatures were recorded at or below impoundments.

9. Results of the PCB's, pesticide and heavy metal analysis revealed some high concentrations in Zones #2 and #3. High concentrations of PCB's were found in a smallmouth bass and a northern pike at Station #14 (Laberdee Rd.). A high concentration of mercury was found in a rock bass at Station #19 (below Blissfield) and a northern pike at Station #23 (below mouth of Saline River). DDT concentrations did not appear any higher than concentrations observed in other watersheds of the state. Dieldrin concentrations, though below tolerance limits, were considerably greater below Station #23 than have been observed elsewhere.

10. Zone #1, has water qualities more suitable for the management of game fishes. Zone #2 and #3 (specifically, waters below Tecumseh to the mouth) pose problems for game fish management. Sedimentation, turbidity and pollution reduces the quality of water in this area. The river's natural low-flow characteristic in late summer and its tremendous fluctuation in volume (9-12,900 cfs fluctuation at Monroe in the period from 1937-1963) reduces its usefulness.

11. Some areas with fair fish populations:

Bluegills: Norvell Pond

Largemouth bass: Norvell Pond

Northern pike: Norvell Pond and Beamer Road above Blissfield

Smallmouth bass: Clinton area, and Ida-Maybee Road to Waterloo Dam

Rock bass: Austin Road, below Manchester to Staib Pond below Clinton, below Petersburg, and Ida-Maybee Road to Rainsinville Hwy.

RIVER RAISIN SURVEY

LIST OF REFERENCES

U.S. Department of The Interior Federal Water Pollution Control Administration. The Practice of Water Pollution Biology. U.S. Government Printing Office, Washington, D.C., 1969.

U.S. Department of The Interior Federal Water Pollution Control Administration. Biology of Water Pollution., 1967.

U.S. Department of The Interior Geological Survey, Flow Characteristics of Michigan Streams. In cooperation with the Michigan Department of Natural Resources, Water Resource Division Geological Survey, Lansing, Mich., 1967.

U.S. Department of The Interior Geological Survey, Water Resource Data For Michigan, Part 1., Surface Water Records. In cooperation with the Michigan Department of Natural Resources, Water Resource Division Geological Survey, Lansing, Mich., 1970.

U.S. Department of The Interior Geological Survey, Water Resource Data For Michigan, Part 2., Water Quality Records. In cooperation with the Michigan Department of Natural Resources, Water Resource Division Geological Survey, Lansing, Mich., 1969.

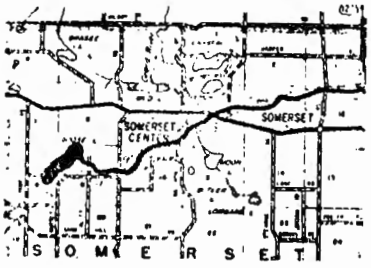
Water Resource Conditions and Uses in the River Raisin Basin. Michigan Water Resource Commission, Lansing, Mich., 1965.

PART B: River Raisin Fish Population Sheets

Netting Stations A & B, pp. 29 & 30

Electro-Fishing Stations #1-27, pp. 31-57

Sta.#A, 8-17-71
Goose Lake

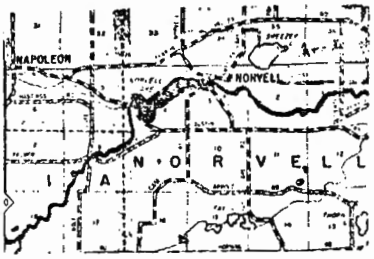


Weather: Clear
Temperature: Air 78°F. at 10:00 AM
Water 75°F. & Clear
D.O.: 9 ppm
pH.: 9.5
Hardness: 188 ppm

Species	Number of Fish Fyke Nets	Length of Fish (inches)			Weight (lbs.)	
Game Fish	Total Catch	Min.	Max.	Avg.	Total	Avg.
Largemouth bass	1	9.3			0.5	
Bluegills	2	5.2	8.3		0.6	
Pumpkinseeds	5	4.7	6.0		0.9	
Rock bass	2	6.4	7.1		0.6	
Black crappies	6	7.9	8.7		1.7	
Subtotal	16				4.3	
Non-Game Fish						
Black bullhead	8	8.4	11.7		3.7	
Lake chubsucker	1	8.4			0.5	
Subtotal	9				4.2	

Total Sample: 25 Fish (64% Game Fish)
8.5 Lbs. (51% Game Fish)
7 Species (71% Game Fish)

Sta. #B, 8-17-71
Norvall Lake



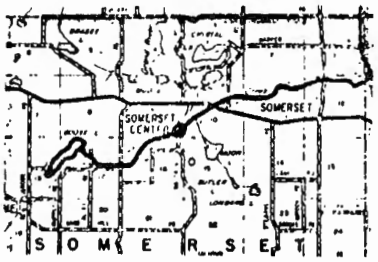
Weather: Clear
Temperature: Air 82°F. at 4:30 P.M.
Water 79°F. & moderately turbid

D.O.: 10 ppm
pH.: 9.0
Hardness: 222 ppm

Species	Number of Fish Fyke Nets Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Bluegills	213	3.9	7.9	5.6	18.3	0.1
Pumpkinseeds	12	4.5	6.5	5.4	1.3	0.1
Black crappie	153	4.7	6.4	5.5	11.3	0.1
Largemouth bass	3	7.1	12.9		1.5	
Northern pike	4	25.0	27.4		12.9	
Subtotal	385				45.3	
Non-Game Fish						
Black bullhead	2	8.5	8.9		0.9	
Carp	9	15.9	27.0		27.9	
Dogfish	2	12.0	16.9		2.3	
White sucker	2	18.0	19.2		3.1	
Subtotal	15				34.2	

Total Sample: 400 Fish (96% Game Fish)
79.5 Lbs. (57% Game Fish)
9 Species (56% Game Fish)

Sta. #1 8-17-71
Waldron Rd.

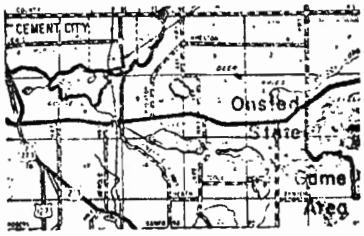


Weather: Clear
Temperature: Air 76°F. at 12:30 P.M.
Water 68°F. & clear
D.O.: 9 ppm
pH.: 8.0
Hardness: 308 ppm
Discharge: 2.3 cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Pumpkinseeds	12	1.9	3.5	2.8	0.1	0.1
Subtotal	12				0.1	
Non-Game Fish						
Black bullhead	1			5.0	0.1	
Subtotal	1				0.1	

Total Sample: 13 Fish (92% Game Fish)
0.2 Lbs. (50% Game Fish)
2 Species (50% Game Fish)

Sta. #2 8-17-71
County Line Rd.

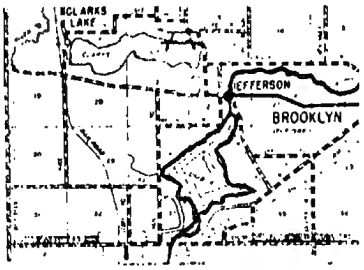


Weather: Clear
Temperature: Air 80°F. at 1:30 P.M.
Water 67°F. & clear
D.O.: 9 ppm
pH.: 8.5
Hardness: 205 ppm
Discharge: 7.0 cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Bluegills	6	4.0	6.8		0.7	
Rock bass	16	3.8	8.6	5.5	1.9	0.1
Longear sunfish	1	4.3			0.1	
Y.O.Y. Pumpkinseed sunfish						
Subtotal	23				2.7	
Non-Game Fish						
Y.O.Y. Black bullhead						

Total Sample: 23 Fish (100% Game Fish)
2.7 Lbs. (100% Game Fish)
4 Species (75% Game Fish)

Sta. #3 8-18-71
Jefferson Rd.



Weather: Clear
Temperature: Air 75°F. at 9:30 A.M.
Water 56°F. & clear
D.O.: 8 ppm
pH.: 7.0
Hardness: 308 ppm
Discharge: 1.1 cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Yellow perch	1	5.0			0.1	
Rock bass	1	5.3			0.1	
Warmouth bass	1	4.6			0.1	
Y.O.Y. Bluegill sunfish						
Pumpkinseed sunfish						
Black crappie						
Largemouth bass						
Subtotal	3				0.3	
Non-Game Fish						
White sucker	29	5.6	9.9	6.9	3.1	0.1
Dogfish	1	12.6			0.7	
Stonecat	1	5.9			0.1	
Subtotal	31				3.9	

Total Sample: 34 Fish (9% Game Fish)
4.2 Lbs. (7% Game Fish)
10 Species (70% Game Fish)

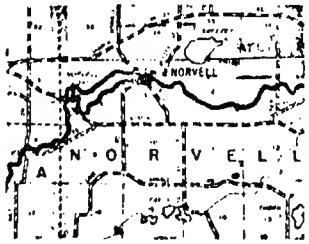
Sta. #4 8-18-71
Brooklyn Rd.

Weather: Clear
Temperature: Air 70°F. at 11:00 A.M.
Water 65°F. & clear
D.O.: 9 ppm
pH.: 8.0
Hardness: 222 ppm
Discharge: 10.0 cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Bluegills	5	3.9	6.0		0.4	
Pumpkinseeds	4	5.2	6.5		0.6	
Longear Sunfish	3	3.2	4.8		0.1	
Rock bass	16	4.8	7.0	5.5	1.9	0.1
Yellow perch	1	4.8			0.1	
Northern pike	1	13.7			0.6	
Warmouth bass	3	4.6	5.3		0.2	
Y.O.Y. Largemouth bass						
Subtotal	33				3.9	
Non-Game Fish						
Whtie suckers	5	9.5	12.9		2.9	
Carp	3	10.6	14.5		3.4	
Dogfish	3	12.6	14.5		2.4	
Subtotal	11				8.7	

Total Sample: 44 Fish (75% Game Fish)
12.6 Lbs. (31 % Game Fish)
11 Species (73% Game Fish)

Sta. #5 8-18-71
Mill Rd. (Below Dam)



Weather: Clear
Temperature: Air 77°F. at 1:15 P.M.
Water 78°F. & clear
D.O.: 8 ppm
pH.: 9.0
Hardness: 205 ppm.
Discharge: 12.5 cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Bluegills	85	3.5	5.2	4.3	5.3	0.1
Pumpkinseeds	1	4.3			0.1	
Rock bass	16	5.4	7.3		2.3	0.1
Black crappie	1	5.1			0.1	
Smallmouth bass	10	3.5	7.7		1.3	0.1
Largemouth bass	3	4.1	4.2		0.2	
Subtotal	116				9.3	
Non-Game Fish						
White sucker	1	9.2			0.3	
Hog suckers	5	6.6	10.1		2.3	
Black Bullhead	3	8.2	9.4		1.3	
Stonecat	2	6.1	6.7		0.2	
Mud pickerel	1	9.2			0.1	
Subtotal	12				4.2	

Total Sample:
128 Fish (91% Game Fish)
13.5 Lbs. (68% Game Fish)
11 Species (55% Game Fish)

Sta. #7 8-19-71
Austin Rd.

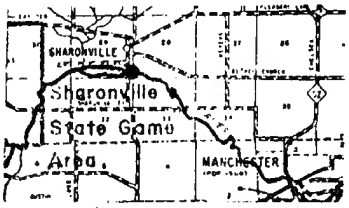
Weather: Clear
Temperature: Air 73°F. at 9:30 A.M.
Water 73°F. & slightly turbid

D.O.: 6 ppm
pH.: 8.5
Hardness: 222 ppm
Discharge: 19.7 cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Bluegill	1	4.1			0.1	
Black crappie	1	5.9			0.1	
Rock bass	11	4.5	9.5	6.5	3.5	0.3
Smallmouth bass	14	3.4	8.7	5.4	1.4	0.1
Y.O.Y. Largemouth bass						
Subtotal	27				5.1	
Non-Game Fish						
Hogsuckers	18	5.9	12.8	8.3	5.3	0.3
Redhorse	10	6.7	13.8	9.0	3.9	0.4
Whitesuckers	29	6.6	14.5	9.5	10.6	0.4
Subtotal	57				19.8	

Total Sample: 84 Fish (32% Game Fish)
24.9Lbs. (20% Game Fish)
8 Species (62% Game Fish)

Sta. #6 8-18-71
Sharon Hollow Rd. (below dam)

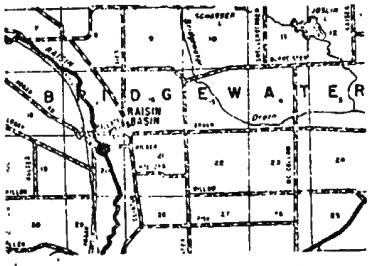


Weather: Clear
Temperature: Air 79°F. at 3:00 P.M.
Water 79°F. & slightly turbid
D.O.: 9 ppm
pH.; 8.5
Hardness: 239 ppm
Discharge: 18.0 cfs.

Species	NUMBER OF FISH Electro-Fishing	LENGTH OF FISH (inches)			WEIGHT (lbs.)	
Game Fish	Total Catch	Min.	Max.	Avg.	Total	Avg.
Bluegills	19	3.5	5.9	4.5	1.3	0.1
Pumpkinseeds	3	4.7	5.1		0.3	
Longear Sunfish	5	3.8	4.2		0.3	
Rock bass	3	5.5	7.4		0.6	
Y.O.Y. Smallmouth bass						
Subtotal	30				2.5	
Non-Game Fish						
Carp	1	5.9			0.1	
Black bullheads	3	8.0	8.7		0.6	
Mud pickerel	2	6.1	6.2		0.3	
Redhorse	1	9.8			0.4	
Hog suckers	7	5.8	12.6		3.0	
White suckers	2	10.1	11.3		0.9	
Subtotal	16				5.3	

Total Sample: 46 Fish (65% Game Fish)
7.8 Lbs. (32% Game Fish)
11 Species (45% Game Fish)

Sta. #8. 8-19-71
Wilbur Rd.



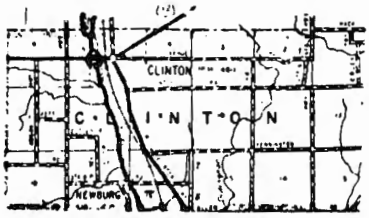
Weather: Partly Cloudy
Temperature: Air 72°F. at 11:00 A.M.
Water 74° & slightly turbid

D.O.: 7 ppm
pH.: 8.5
Hardness: 308 ppm
Discharge: 21.5 cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Bluegills	21	3.4	6.6	4.5	1.6	0.1
Black crappie	1	5.2			0.1	
Pumpkinseeds	3	4.5	5.0		0.4	
Rock bass	8	3.9	6.7		0.7	
Largemouth bass	2	6.5	6.9		0.4	
Smallmouth bass	1	6.7			0.3	
Subtotal	36				3.5	
Non-Game Fish						
Hogsuckers	12	6.1	13.4	11.5	7.9	0.7
Redhorse	36	6.2	12.5	9.1	11.5	0.3
White suckers	8	8.8	14.5		5.0	
Subtotal	56				24.4	

Total Sample: 92 Fish (39% Game Fish)
27.9 Lbs. (13% Game Fish)
9 Species (67% Game Fish)

Sta. #9 8- 20-71
U.S. 12 (Clinton)

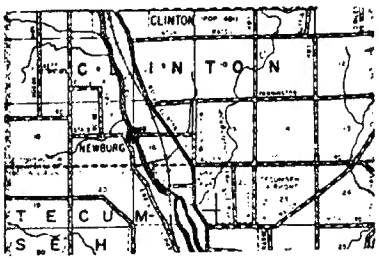


Weather: Partly Cloudy
Temperatuee: Air 79^{0}F. at 9:00 A.M.
Water 72^0 F. & slightly turbid
D.O.: 8 ppm
pH.: 8.5
Hardness: 308 ppm
Discharge: 25.0 cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Black Crappie	3	4.3	5.0		0.3	
Longear sunfish	1	3.5			0.1	
Pumpkinseed	1	3.7			0.1	
Rock bass	4	5.2	8.0		0.7	
Largemouth bass	1	8.5			0.3	
Smallmouth bass	3	10.8	14.8		3.1	
Y.O.Y. Bluegill sunfish						
Subtotal	13				4.6	
Non-Game Fish						
Carp	2	13.5	25.5		7.0	
Hogsuckers	9	4.6	10.6		1.7	
Redhorse	18	4.5	13.4	8.9	5.4	0. 3
White suckers	3	10.6	13.7		2.0	
Subtotal	32				16.1	

Total Sample:
45 Fish (29% Game Fish)
20.7 Lbs. (22% Game Fish)
11 Species (64% Game Fish)

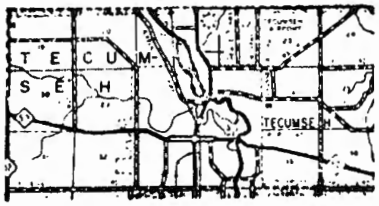
Sta. #10 8-20-71
Staib Rd.



Weather: Partly Cloudy
Temperature: Air 86°F. at 10:45 A.M.
Water 72°F. &moderately turbid
D.O.: 6 ppm
pH.: 8.5
Hardness: 274 ppm
Discharge: 39.6 cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Rock bass	3	7.7	8.3		1.0	
Smallmouth bass	3	6.5	9.4		0.7	
Y.O.Y. Bluegill sunfish						
Subtotal	6				1.7	
Non-Game Fish						
Carp	2	13.4	15.3		2.9	
Hog suckers	13	5.3	10.3	8.2	2.7	0.2
Redhorse	8	6.5	12.9		1.7	
Y.O.Y. Whitesucker						
Subtotal	23				7.3	
Total Sample:	29 Fish (21% Game Fish)					
	9.0 Lbs. (19% Game Fish)					
	7 Species (43% Game Fish)					

Sta. #11 8- 19-71
Tecumseh Inpoundment

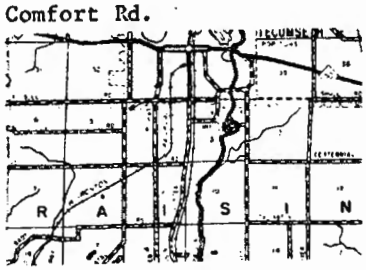


Weather: Cloudy
Temperature: Air 80^{0}F. at 1:15 P.M.
Water 78^0 & heavy turbidity
D.O.: 7 ppm
pH.: 8.5
Hardness: 274 ppm
Discharge: - cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Pumpkinseed	1	4.5			0.1	
Y.O.Y. Bluegill sunfish						
Black crappie						
Largemouth bass						
Smallmouth bass						
Subtotal	1				0.1	
Non-Game Fish						
Carp	6	13.8	16.5		9.4	
Redhorse	6	6.0	11.1		2.0	
Subtotal	12				11.4	

Total Sample:
13 Fish (8% Game Fish)
11.5 Lbs. (1% Game Fish)
7 Species (71% Game Fish)

Sta. #12 8-19-71
Comfort Rd.

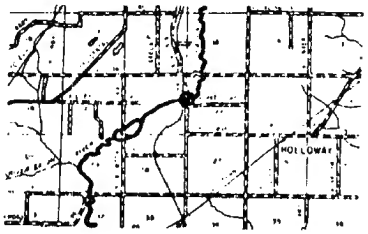


Weather: Partly Cloudy
Temperature: Air 82°F. at 3:05 P.M.
Water 73°F. & moderatly turbid

D.O.: 8 ppm
pH.: 8.5
Hardness: 410 ppm
Discharge: 39.1 cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Green sunfish	3	3.5	5.6		0.5	
Pumpkinseed	1	4.3			0.1	
Rock bass	3	5.5	7.5		1.1	
Smallmouth bass	1	5.6			0.1	
Subtotal	8				1.8	
Non-Game Fish						
Black Bullhead	1	6.3			0.1	
Hog suckers	4	5.8	11.0		1.5	
Stonecat	1	7.8			0.2	
Y.O.Y. White suckers						
Subtotal	6				1.8	
Total Sample:	14 Fish (57% Game Fish) 3.6 Lbs. (50% Game Fish) 8 Species (50% Game Fish)					

Sta. #13 8-23-71
Raisen Center Hwy.



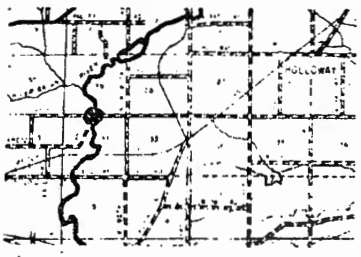
Weather: Clear
Temperature: Air 66°F. at 10:45 A.M.
Water 70°F. & moderately turbid

D.O.: 6 ppm
pH.: 8.5
Hardness: 325 ppm
Discharge: 36.0 cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Green sunfish	2	3.9	4.0		0.1	
Rock bass	1	6.9			0.3	
Largemouth bass	1	4.1			0.1	
Smallmouth bass	2	6.3	7.5		0.5	
Subtotal	6				1.0	
Non-Game Fish						
Carp	5	13.2	19.1		11.4	
Redhorse	17	3.1	14.0	6.4	2.1	0.1
White suckers	4	4.2	6.3		0.3	
Mud pickerel	1	5.2			0.1	
Subtotal	27				13.9	

Total Sample: 33 Fish (18% Game Fish)
14.0 Lbs. (1% Game Fish)
8 Species (50% Game Fish)

Sta. #14 8-23-71
Laberdee Rd.



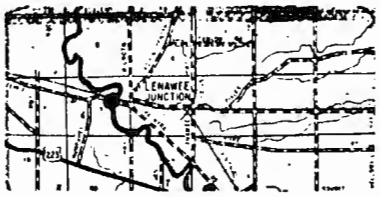
Weather: Clear
Temperature: Air 64°F. at 1:00 P.M.
Water 73°F. & moderately turbid

D.O.: 7 ppm
pH.: 8.5
Hardness: 291 ppm
Discharge: 58.8 cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Bluegills	2	3.0	5.0		0.3	
Green sunfish	3	3.4	4.1		0.3	
Smallmouth bass	1		14.6		1.7	
Northern pike	1		21.4		1.8	
Subtotal	7				3.1	
Non-Game Fish						
Black bullhead	1	5.3			0.1	
Carp	4	18.5	19.5		14.4	
Hog suckers	2	6.2	7.8		0.5	
White suckers	13	3.0	11.9	8.0	1.4	0.1
Subtotal	20				16.4	

Total Sample: 27 Fish (26% Game Fish)
19.7 Lbs. (17% Game Fish)
8 Species (50% Game Fish)

Sta. #15 8-23-71
Deerfield Rd.



Weather: Clear
Temperature: Air 65°F. at 3:00 P.M.
Water 74°F. & moderately turbid

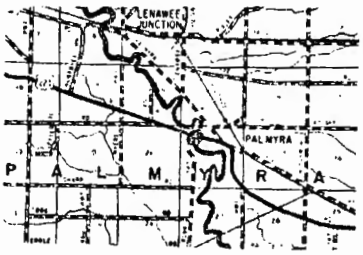
D.O. : 4 ppm
pH.: 8.5
Hardness: 308 ppm
Discharge: 75.6 cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Green sunfish	2	3.3	4.8		0.1	
Non-Game Fish						
White sucker	1		9.6		0.4	

Total Sample:

3 Fish (67% Game Fish)
0.5 Lbs. (20% Game Fish)
2 Species (50% Game Fish)

Sta.#16 8-24-71
U.S.-223, Cadmus Rd.



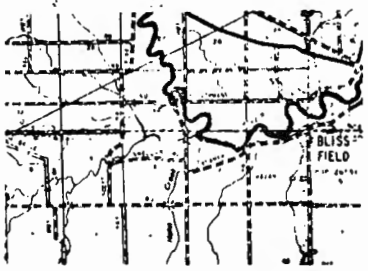
Weather: Partly Cloudy
Temperature: Air 65°F. at 10:30 A.M.
Water: 71°F. & slightly turbid

D.O.: 6 ppm
pH.: 8.5
Hardness: 308 ppm
Discharge: 79.4 cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Green sunfish	1	3.4			0.1	
Norhtern pike	2	15.0	17.3		1.6	
Subtotal	3				1.7	
Non-Game Fish						
White suckers	27	6.5	15.6	10.8	15.3	0.6

Total Sample: 30 Fish (10% Game Fish)
17.0 Lbs. (10% Game Fish)
3 Species (67% Game Fish)

Sta. #17 8-25- 71
E. Gorham Rd.

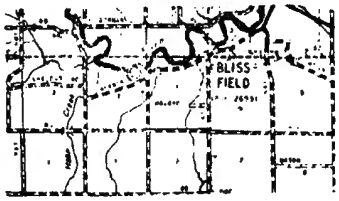


Weather: Clear
Temperature: Air 75°F. at 10:15 A.M.
Water 70°F. & slightly turbid
D.O.: 4 ppm
pH.: 8.5
Hardness: 342 ppm
Discharge: 95.6 cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
None						
Non-Game Fish						
White suckers	13	3.1	13.1	8.4	4.3	0.3

Total Sample: 13 Fish (0% Game Fish)
4.3 Lbs. (0% Game Fish)
1 Species (0% Game Fish)

Sta. # 18 8-25-71
Beamer Rd.



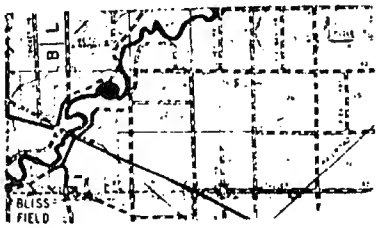
Weather: Clear
Temperature: Air 74°F. at 12:45 PM.
Water 72°F. & slightly turbid

D.O.: 9 ppm
pH.; 8.5
Hardness: 325 ppm
Discharge: 79.9 cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Smallmouth bass	1	3.2			0.1	
Northern pike	2	19.3	29.5		6.7	
Subtotal	3				6.8	
Non-Game Fish						
White suckers	7	5.1	15.2		4.5	

Total Sample: 10 Fish (30% Game Fish)
11.3 Lbs. (60% Game Fish)
3 Species (67% Game Fish)

Sta. #19 8-25-71
Below Blissfield W.W.T.P.

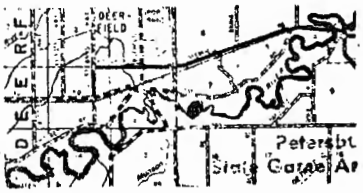


Weather: Clear
Temperature: Air 78°F. at 2:35 P.M.
Water 76°F. & moderately turbid
D.O.: 12 ppm
pH.: 9.5
Hardness: 308 ppm
Discharge: 117.6

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Pumpkinseeds	2	5.4			0.5	
Green sunfish	7	3.1	4.2		0.7	
Rock bass	9	4.0	8.5		1.9	
Largemouth bass	1		11.0		1.0	
Northern pike	4	14.9	17.0		4.6	
Subtotal	23				8.7	
Non-Game Fish						
Carp	5	14.2	19.0		10.4	
Hog suckers	1		10.3		0.9	
White suckers	4	7.8	10.8		1.1	
Y.O.Y. Black bullhead						
Subtotal	10				12.4	

Total Sample:
33 Fish (70% Game Fish)
21.1 Lbs. (41% Game Fish)
9 Species (56% Game Fish)

Sta. # 20 8-26-71
Below Deerfield W.W.T.P.

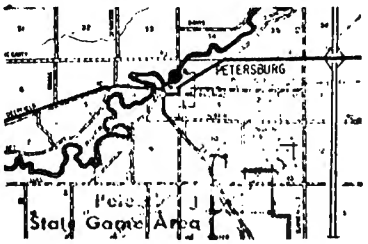


Weather: Partly Cloudy
Temperature: Air 76°F. at 11:35 A.M.
Water 74°F. & heavy turbidity
D.O.: 9 ppm
pH.; 9.5
Hardness: 308 ppm
Discharge: 79.2 cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Pumpkinseed	1	5.5			0.2	
Rock bass	1	6.5			0.4	
Subtotal	2				0.6	
Non-Game Fish						
Carp	2	12.8	15.3		3.0	
Hog suckers	1	9.2			0.4	
White suckers	8	3.1	12.7		2.5	
Subtotal	11				5.9	

Total Sample: 13 Fish (15% Game Fish)
6.5 Lbs. (9% Game Fish)
5 Species (40% Game Fish)

Sta. #21 8-26-71
Below Petersburg W.W.T.P.



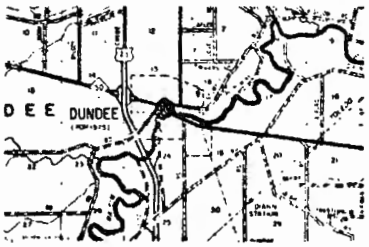
Weather: Partly Cloudy
Temperature: Air 72°F. at 1:45 P.M.
Water 76°F. & heavy turbidity

D.O.: 12 ppm
pH.: 9.5
Hardness: 291 ppm
Discharge: 105.3 cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Pumpkinseed	1	5.9			0.4	
Rock bass	34	3.4	7.8	5.8	5.6	0.2
Smallmouth bass	1	4.2			0.1	
Subtotal	36				6.1	
Non-Game Fish						
Carp	8	3.9	19.3		5.2	
Redhorse	1		12.1		0.7	
White suckers	20	3.0	12.6	10.1	7.5	0.4
Brown bullhead	1		10.2		0.7	
Subtotal	30				14.1	

Total Sample; 66 Fish (55% Game Fish)
20.2 Lbs. (30% Game Fish)
7 Species (43% Game Fish)

Sta. #22 8-27-71
M-50 at Dundee(below dam)



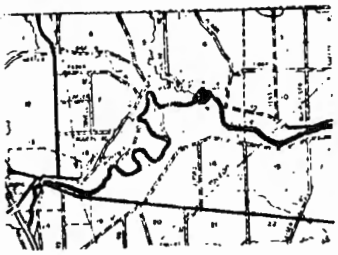
Weather: Partly Cloudy
Temperature: Air 69°F. at 11:30 A.M.
Water 74°F. & slightly turbid

D.O.: 8 ppm
pH.; 8.5
Hardness: 308 ppm
Discharge: 55.4 cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Rock bass	9	4.3	6.3		1.2	
Smallmouth bass	89	3.2	7.2	4.4	3.6	0.1
Y.O.Y. Bluegill sunfish						
Pumpkin sunfish						
Green sunfish						
Subtotal	98				4.8	
Non-Game Fish						
Carp	18	4.3	7.4	6.1	2.5	0.1
Hog sucker	1		11.2		0.7	
White sucker	3	8.5	12.4		1.0	
Black bullhead	1	3.9			0.1	
Subtotal	23				4.3	

Total Sample: 121 Fish(81% Game Fish)
9.1 Lbs, (53% Game Fish)
9 Species (56% Game Fish)

Sta. #23 8-27-71
Bleow mouth of Saline Riv.



Weather: Cloudy & light rain
Temperature: Air 66°F. at 3:05 P.M.
Water 74°F. & heavy turbidity

D.O.: 6 ppm
pH.: 8.5
Hardness: 308 ppm
Discharge: - cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Rock bass	1	5.2			0.1	
Northern pike	1		24.3		2.0	
Y.O.Y Bluegill sunfish						
Longear sunfish						
Green sunfish						
Pumpkinseed sunfish						
Smallmouth bass						
Subtotals:	2				2.1	
Non-Game Fish						
Carp	7	4.5	23.0		17.7	
Hog suckers	3	6.0	6.2		0.3	
Redhorse	2	11.7	13.0		1.3	
Y.O.Y. White suckers						
Subtotals	12				19.3	

Total Sample: 14 Fish (14% Game Fish)
21.4 Lbs. (10% Game Fish)
11 Species (64% Game Fish)

Sta. # 24 :8-30-71
Ida-Maybee Rd. (below dam)

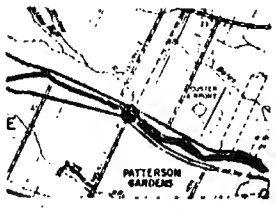
Weather: Clear
Temperature: Air 82°F. at 11:15 A.M.
Water 78°F. & slight turbidity

D.O.: 12 ppm
pH.: 9.5
Hardness: 378 ppm
Discharge: - cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Green sunfish	1	5.5			0.3	
Longear sunfish	1	5.8			0.4	
Black crappie	1		8.1		0.4	
Rock bass	31	4.9	8.1	6.5	7.5	0.2
Smallmouth bass	41	3.2	16.0	5.7	5.1	0.1
Subtotal	75				13.7	
Non-Game Fish						
Carp	24	17.2	24.8	20.2	111.5	4.6
Hog suckers	3	9.0	12.7		1.5	
Redhorse	79	8.6	23.5	16.8	162.1	2.1
White suckers	36	8.5	15.2	11.7	23.5	0.6
Stonecat	5	5.5	8.2		0.6	
Subtotal	147				299.2	

Total Sample: 222 Fish (34% Game Fish)
312.9 Lbs. (4% Game Fish)
10 Species (50% Game Fish)

Sta. #25 8-30-71
Raisenville Rd.

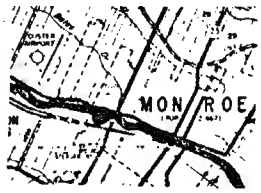


Weather: Clear
Temperature: Air 85°F. at 2:30 P.M.
Water 84°F. & moderately turbid
D.O.: 12 ppm
pH.: 9.5
Hardness: 462 ppm
Discharge: - cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Green sunfish	2	4.0	5.0		0.4	
Longear sunfish	1	5.1			0.3	
Rock bass	31	2.1	8.9	5.5	7.0	0.2
Smallmouth bass	11	3.5	10.8	7.0	3.0	0.3
Subtotal	45				10.7	
Non-Game Fish						
Carp	66	4.8	21.5	8.4	43.0	0.7
Hog suckers	2	10.4	11.2		1.0	
Redhorse	4	8.0	9.0		1.0	
White suckers	10	8.2	10.5	9.2	3.0	0.3
Stonecat	3	5.4	8.4		0.5	
Yellow bullhead	2	9.3	9.5		1.0	
Subtotal	87				49.5	

Total Sample : 132 Fish (34% Game Fish)
60.2 Lbs. (18% Game Fish)
10 Species (40% Game Fish)

Sta. # 26 8-31-71
Waterloo Dam (above)



Weather: Cloudy
Temperature: Air 69°F. at 12:30 P.M.
Water 74°F. & heavy turbidity

D.O.: 6 ppm
pH.: 8.5
Hardness: 479 ppm
Discharge: - cfs.

Species	Number of Fish Electro- Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Rock bass	1	4.7			0.1	
Smallmouth bass	7	4.5	12.4		3.0	
Y.O.Y. Longear sunfish						
Subtotal	8				3.1	
Non-Game Fish						
Carp	8	7.5	20.7		11.9	
Redhorse	5	8.4	16.9		4.5	
White suckers	2	14.0	16.1		2.5	
Subtotal	15				18.9	

Total Sample: 23 Fish (35% Game Fish)
22.0 Lbs. (21 % Game Fish)
6 Species (50% Game Fish)

Sta. #27 8-31-71
I-75 at Monroe

Weather: Cloudy
Temperature: Air 68°F. at 4:15 P.M.
Water 76°F. & heavy turbidity

D.O.: 7 ppm
pH.: 8.5
Hardness: 462 ppm
Discharge: - cfs.

Species	Number of Fish Electro-Fishing Total Catch	Length of Fish (inches) Min.	Max.	Avg.	Weight (lbs.) Total	Avg.
Game Fish						
Pumpkinseed	1	2.8			0.1	
Smallmouth bass	1	2.7			0.1	
Subtotal	2				0.2	
Non-Game Fish						
Carp	9	13.9	30.0		39.5	
Goldfish	9	8.7	13.3		6.5	
Redhorse	7	9.6	16.8		5.0	
Subtotal	25				51.0	

Total Sample: 27 Fish (7% Game Fish)
51.2 Lbs. (1% Game Fish)
5 Species (40% Game Fish)

PART C

WATER QUALITY CONTROL DIVISION

Heavy Metals, Polychlorinated Biphenyls, and Chlorinated Hydrocarbons in Fish from River Raisin, August 1971

HEAVY METALS

Twenty-five fish samples collected during August 1971 from 18 locations on the River Raisin were analyzed for the presence of Zn, Cu, Ni, Pb, Hg, Cr, Cd, and As (Table 1). Concentrations of these metals in the edible portion of the fish ranged from 4.0 to 13.0 mg/kg for Zn, less than 0.2 to 0.3 mg/kg for Cu, less than 0.01 to 0.65 mg/kg for Hg, and less than 0.1 to 0.5 for Cd. Ni, Pb, Cr, and As were not detected above their respective limits of detectability of 0.2, 1.0, 0.1, and 0.5 mg/kg.

Lucas et al. (1970)[1] reported concentrations of trace elements in fish from the Great Lakes. Average concentrations detected in that study were 1.3 mg/kg for copper, 0.09 mg/kg for Cd, 0.02 mg/kg for As, and 1 mg/kg for Cr. Uthe and Bligh (1971)[2], reporting on metals in fish from two inland lakes in a non-industrial area in Canada, found concentrations ranging from 12-19 mg/k for Zn, 0.50-0.94 mg/kg for Cu, less than 0.2 mg/kg for Ni, less than 0.5 mg/kg for Pb, 0.07-0.70 for Hg, less than 0.01 to 0.03 mg/kg for Cr, less than 0.05 mg/kg for Cd, and less than 0.05-0.70 for As.

Although analytical sensitivities were not comparable in all cases, concentrations of heavy metals in fish from the River Raisin were generally within or below the ranges of concentrations reported in the above studies. Two samples did have Hg concentrations either equal or

1 J. Res.Bd.of Canada, Vol. 24,No.4: 677-684.

2 J. Res.Bd.of Canada, Vol. 28,No.5: 786-788.

Table 1. Concentrations of heavy metals in fish from the Raisin River, August 1971. (concentrations in mg/kg; wet weight).

Station	Species	Length	Date	Zn	Cu	Ni	Pb	Hg	Cr	Cd	As
A	Crappie	8.3	8-17-71	6.2	< 0.2	< 0.2	<1.0	0.03	< 0.1	< 0.1	< 0.5
	Bullhead	10.0	8-17-71	7.0	< 0.2	< 0.2	<1.0	0.01	< 0.1	< 0.1	< 0.5
B	Northern Pike	27.0	8-17-71	5.1	< 0.2	< 0.2	<1.0	0.30	< 0.1	< 0.1	< 0.5
	Largemouth Bass	8.0	8-17-71	7.8	< 0.2	< 0.2	<1.0	< 0.01	< 0.1	< 0.1	< 0.5
2	Rock Bass	6.8	8-17-71	7.0	0.2	< 0.2	<1.0	0.35	< 0.1	< 0.1	< 0.5
6	Bullhead	8.0	8-18-71	6.0	< 0.2	< 0.2	<1.0	0.12	< 0.1	0.5	< 0.5
7	Rock Bass	7.0	8-18-71	6.0	< 0.2	< 0.2	<1.0	0.12	< 0.1	< 0.1	< 0.5
	Smallmouth Bass	8.0	8-18-71	5.7	< 0.2	< 0.2	<1.0	0.09	< 0.1	< 0.1	< 0.5
9	Smallmouth Bass	10.3	8-20-71	4.9	< 0.2	< 0.2	<1.0	0.03	< 0.1	< 0.1	< 0.5
10	Rock Bass	7.8	8-20-71	4.9	< 0.2	< 0.2	<1.0	0.06	< 0.1	< 0.1	< 0.5
	Smallmouth Bass	8.5	8-20-71	5.9	< 0.2	< 0.2	<1.0	0.03	< 0.1	< 0.1	< 0.5
11	Carp	16.0	8-18-71	7.0	0.2	< 0.2	<1.0	0.21	< 0.1	< 0.1	< 0.5
13	Carp	16.0	8-23-71	13.0	0.2	< 0.2	<1.0	0.13	< 0.1	< 0.1	< 0.5
14	Northern Pike	20.0	8-23-71	4.0	0.2	< 0.2	<1.0	0.38	< 0.1	< 0.1	< 0.5
	Smallmouth Bass	14.0	8-23-71	5.6	0.2	< 0.2	<1.0	0.38	< 0.1	< 0.1	< 0.5
16	Northern Pike	15.0	8-24-71	6.2	0.2	< 0.2	<1.0	0.18	< 0.1	< 0.1	< 0.5
18	Northern Pike	18.0	8-18-71	4.0	0.2	< 0.2	<1.0	0.38	< 0.1	< 0.1	< 0.5
19	Northern Pike	14.8	8-25-71	4.9	< 0.2	< 0.2	<1.0	0.02	< 0.1	< 0.1	< 0.5
	Rock Bass	6.5	8-25-71	5.4	< 0.2	< 0.2	<1.0	0.50	< 0.1	< 0.1	< 0.5
20	Carp	12.5	8-26-71	7.0	< 0.2	< 0.2	<1.0	0.04	< 0.1	< 0.1	< 0.5
21	Rock Bass	6.8	8-26-71	5.9	< 0.3	< 0.2	<1.0	0.03	< 0.1	< 0.1	< 0.5
23	Northern Pike	23.5	8-27-71	4.8	< 0.2	< 0.2	<1.0	0.65	< 0.1	< 0.1	< 0.5
24	Rock Bass	7.3	8-30-71	7.0	0.3	< 0.2	<1.0	0.18	< 0.1	< 0.1	< 0.5
	Smallmouth Bass	12.5	8-30-71	4.9	< 0.2	< 0.2	<1.0	0.41	< 0.1	< 0.1	< 0.5
26	Smallmouth Bass	10.5	8-31-71	5.8	< 0.2	< 0.2	<1.0	0.12	< 0.1	< 0.1	< 0.05

exceeding the 0.5 mg/kg tolerance limit established by the U.S. Food and Drug administration. These were found at stations 19 and 23. No tolerance limits have been established in the United States for any of the other heavy metals in fish tissue.

POLYCHLORINATED BIPHENYLS

Twenty-two fish samples from the River Raisin were analyzed for the presence of polychlorinated biphenyls (PCB'S). Concentrations ranged from 0.01 to 6.45 mg/kg in edible portions of fish tissue on a wet weight basis (Table 1). The majority of the samples contained less than 5.0 mg/kg, the limit established by the Food and Drug Administration for concentrations in fish for human consumption. Sharp increases above concentrations detected in fish from upstream locations were noted at stations 13, 14, 16, and 18. A carp analyzed from station 13 contained 3.08 mg/kg of PCB's which appeared to be primarily Aroclor 1254. This station is downstream from the City of Tecumseh but upstream from the confluence of the South Branch of the River Raisin. A carp from station 11 serves as a control above Tecumseh and showed a concentration of only 0.05 mg/kg. This suggests a source or sources of PCB contamination in Tecumseh. At station 14, downstream from the confluence of the South Branch, a concentration of 4.71 mg/kg was found in a smallmouth bass and 6.45 mg/kg in a northern pike. In contrast to the carp from station 13, both of these species contained PCB's in the form of Aroclor 1242 rather than 1254. The form of Aroclors present would reflect different industrial uses responsible for the contamination. It is very possible, therefore, that the PCB's in the fish from Station 14 are primarily the result of the influence of the South Branch rather than from sources in Tecumseh. Northern pike from stations 16 and 18, on the other hand, contained primarily Aroclor 1254 at concentrations

TABLE # 2

Chlorinated Hydrocarbon Insecticides and Polychlorinated Biphenyls (PCB's) in fish collected from Raisin River, August 1971. (Concentrations in mg/kg ; wet weight)

STATION	SPECIES	LENGTH	DATE	% FAT	DIELDRIN	DDE	TDE	o,p'-DDT	p,p'-DDT	TOTAL DDT	PCB's 1242	PCB's 1254
2	R. BASS	8.5"	8-17-71	0.50	<0.001	0.002	<0.001	<0.001	<0.001	0.002	- - -	0.01
7	R. BASS	9.0"	8-18-71	0.40	<0.001	0.008	0.001	<0.001	<0.001	0.009	- - -	0.58
	S. BASS	8.0"	8-18-71	0.79	0.003	0.011	<0.001	<0.001	0.011	0.023	- - -	0.76
9	S. BASS	14.5"	8-20-71	0.73	0.001	0.022	0.022	<0.001	0.017	0.062	- - -	0.13
10	R. BASS	7.8"	8-20-71	0.53	0.001	0.009	0.013	0.002	0.012	0.036	- - -	0.03
	S. BASS	9.0"	8-20-71	0.62	0.004	0.035	0.029	<0.001	0.023	0.088	- - -	0.02
11	CARP	16.0"	8-18-71	0.94	0.001	0.006	0.002	<0.001	0.016	0.025	- - -	0.05
13	CARP	16.0"	8-23-71	2.48	0.007	0.055	0.090	<0.001	0.026	0.171	- - -	3.08
14	S. BASS	14.0"	8-23-71	0.93	0.007	0.014	0.010	<0.001	0.013	0.037	4.71	- - -
	N. PIKE	20.0"	8-23-71	0.60	0.003	0.004	0.002	<0.001	0.003	0.009	6.45	- - -
16	N. PIKE	17.0"	8-24-71	0.41	0.001	0.018	0.007	<0.001	0.007	0.031	- - -	1.47
18	N. PIKE	28.0"	8-18-71	0.75	0.003	0.008	0.016	<0.001	0.010	0.034	- - -	1.18
19	R. BASS	7.0"	8-25-71	0.44	0.003	0.003	0.013	<0.001	0.018	0.034	- - -	0.13
	N. PIKE	15.5"	8-25-71	0.53	0.002	0.013	0.007	<0.001	0.006	0.027	- - -	0.59
20	CARP	12.5"	8-26-71	3.56	0.007	0.012	0.084	<0.001	0.032	0.128	- - -	0.42
21	R. BASS	7.5"	8-26-71	1.21	0.003	0.006	0.012	<0.001	0.045	0.063	- - -	0.03
23	N PIKE	23.5"	8-27-71	0.49	0.042	0.007	0.050	<0.001	0.033	0.090	- - -	0.31
24	R. BASS	7.5"	8-30-71	0.76	0.017	0.004	0.009	<0.001	<0.001	0.013	- - -	0.40
	S. BASS	15.0"	8-30-71	0.85	0.015	0.007	0.025	<0.001	0.026	0.058	- - -	0.12
26	S. BASS	11.5"	8-31-71	1.06	0.039	0.014	0.046	<0.001	0.042	0.101	- - -	0.19
B	L. BASS	12.0"	8-17-71	0.67	<0.001	0.005	0.003	<0.001	<0.001	0.008	- - -	<0.01
	N. PIKE	27.0"	8-17-71	0.33	<0.001	0.022	0.009	<0.001	0.015	0.046	- - -	0.05

of 1.47 and 1.18 mg/kg, respectively. It would be difficult to determine the source of contamination at these two locations but probably is a combination of all input from upstream sources. All samples farther downstream contained concentrations comparable to those upstream from Tecumseh.

CHLORINATED HYDROCARBON INSECTICIDES

Dieldrin and DDT were the only chlorinated hydrocarbon insecticides detected in fish samples from the River Raisin. Both were present in the majority of samples. Concentrations ranged from less than 0.001 to 0.042 mg/kg for dieldrin and 0.002 to 0.171 mg/kg for total DDT. While DDT concentrations do not appear any higher than observed in other watersheds of the state, dieldrin concentrations in the lower portion of the River Raisin are considerably greater than have been observed elsewhere and in the River Raisin upstream from the confluence of the Saline River. Concentrations of dieldrin in fish in the upper zone of the river range from less than 0.001 to 0.007 mg/kg while four samples from stations 23, 24, and 26 range from 0.015 to 0.042 mg/kg. While the lower zone does show somewhat elevated levels, none of the concentrations approach the 0.3 mg/kg FDA tolerance limit for fish intended for human consumption. A review should be conducted of the pesticide use in the lower watershed of the River Raisin in search for the cause of the higher dieldrin levels. Heavy treatments of dieldrin to control Japanese beetles in the lower portion of Monroe County during the early 1960's were suspected at first but further investigation revealed that most of the treatment area drains away from the River Raisin. It is also doubtful that residual effects would still be present after nearly 10 years.

TABLE # 3

List of Fish Analyzed for Heavy Metals and Pesticides Residues

STATION	SPECIES
A	6 crappies and 4 bullheads
B	3 largemouth bass and 2 northern pike
2	6 rock bass
4	3 dogfish
6	3 bullheads
7	6 smallmouth bass and 5 rock bass
9	2 smallmouth bass
10	2 smallmouth bass and 3 rock bass
11	2 carp
13	2 carp
14	1 smallmouth bass and 1 northern pike
16	2 northern pike
18	2 northern pike
19	3 northern pike and 6 rock bass
20	2 carp
21	10 rock bass
23	1 northern pike
24	4 smallmouth bass and 4 rock bass
26	3 smallmouth bass

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