FISHERIES DIVISION

TECHNICAL REPORT

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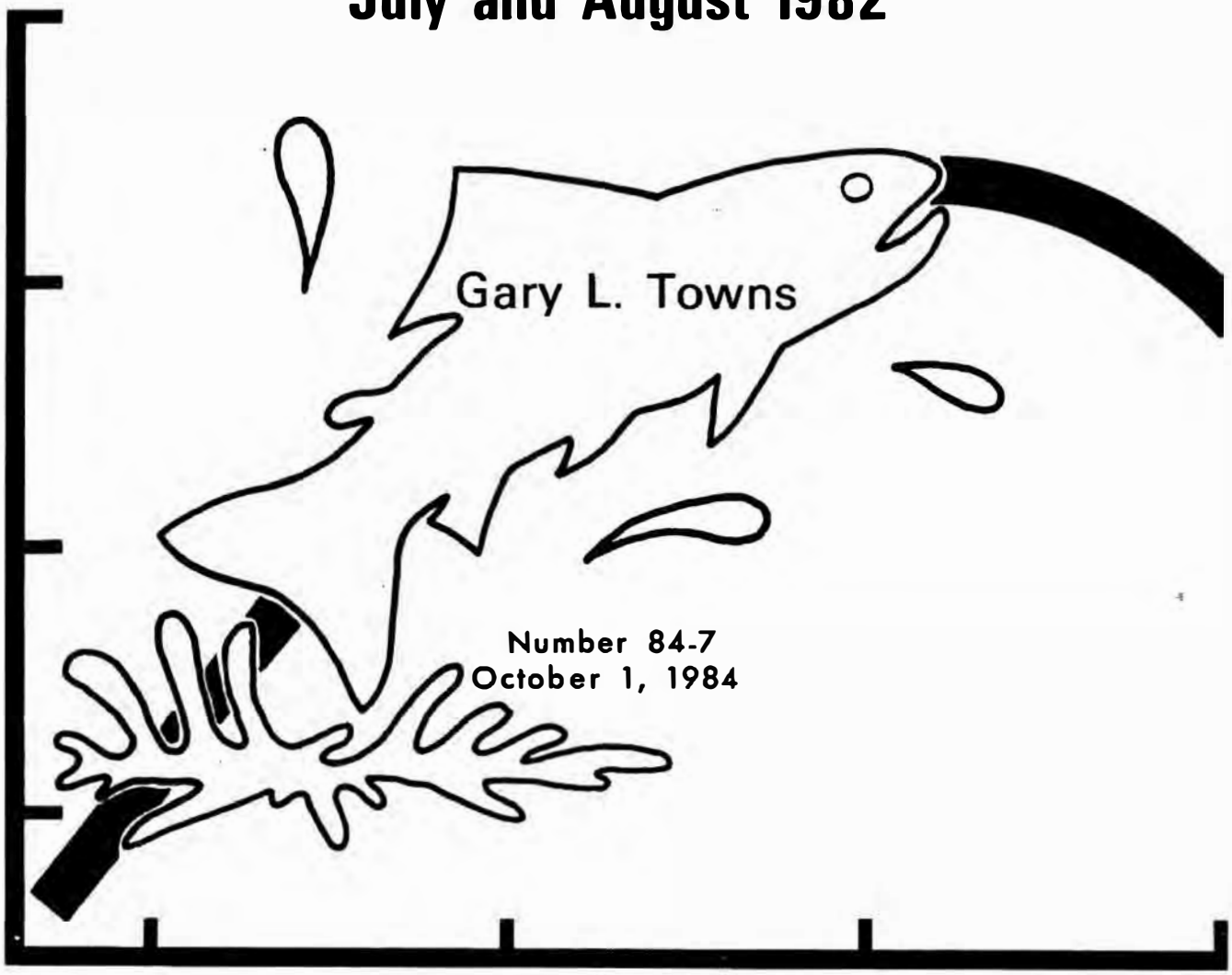

Gary L. Towns

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Michigan Department of
Natural Resources

MICHIGAN DEPARTMENT OF NATURAL RESOURCES
FISHERIES DIVISION

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Summary

A survey of the Kalamazoo River fishery was conducted by the Fisheries Division of the Michigan Department of Natural Resources during July and August of 1982. The project had two primary objectives: (1) to derive estimates of the total standing crop of fish throughout the Kalamazoo River, (2) to assess any changes in fish populations that had taken place since the last survey in 1971.

The three principle forms of fish sampling used were: rotenone treatment, electrofishing, and fyke netting. A comparison of the sampling techniques found rotenone to be qualitatively and quantitatively superior to the other methods of fish capture in the large riverine environment. Total fish numbers collected per sampling site with electrofishing were only 0.6 to 9.5% of those taken with rotenone. Likewise, total fish weight per station collected with electrofishing was only 0.6 to 8.3% of that collected with rotenone.

A total of 62 species of fish were captured during the survey. Eighteen of these were found only below Allegan Dam, the last downstream fish barrier. Carp were the most abundant single species in the river, comprising 67.5% by weight and 18.2% by number of the total catch. Game fish made up 12.8% by weight and 30.1% by number of the catch. Estimates of total standing crop at the 14 rotenone sampling sites ranged from 55.7 to 576.2 pounds per acre.

Generally, total estimated standing crop and species diversity decreased immediately downstream of large metropolitan areas. These fishery changes were the most dramatic below the city of Kalamazoo. Although fish habitat is very good throughout the river from Kalamazoo to Allegan Dam, poor water quality has severely restricted the development of a good sport fishery.

Many factors made direct comparisons between the 1971 and 1982 surveys difficult. However, generally, from the

headwaters to Lake Allegan, the fishery characteristics observed in 1982 were similar to those observed in 1971. Channel catfish, black crappie, and carp populations have increased in Lake Allegan. Good populations of channel catfish and walleye are available to anglers below Allegan Dam. Game fish populations in and below Lake Allegan are underutilized.

The most serious management problem is the continued degradation of water quality in the metropolitan areas. A solution to the PCB contamination in the middle and lower sections of the river would do a great deal to increase angler usage and fishery management activities. The elimination of several old dams between Plainwell and Allegan or the construction of fish ladders over them would greatly accelerate anadromous fishery management.

Introduction

The Kalamazoo River is located in the southwestern portion of Michigan's lower peninsula. Flowing in a generally northwesterly direction, it drains approximately 2,060 square miles. Its basin is about 100 miles long, 15 to 30 miles wide, and includes portions of 10 counties (Fig. 1). Major tributaries of the Kalamazoo River include: Rice Creek, Battle Creek, Wabascon Creek, Portage Creek, Gun River, Swan Creek, and Rabbit River. This report contains survey results from the North Branch and South Branch of the Kalamazoo River as well as the mainstream from the confluence of these two branches to the mouth of the river at Lake Michigan.

Presently, most of the sportfishing on the Kalamazoo River takes place from the headwaters downstream to Morrow Pond (Segment A, Fig. 1) and from Allegan Dam to the river mouth (Segment C). Fishing in the upper section is mostly for smallmouth bass, northern pike, and rock bass. In addition, a portion of the South Branch in Hillsdale County

is a good trout stream with a naturally reproducing population of brown trout. Fishing in Segment B is almost nonexistent. Fish habitat is very good through this section, however, water quality is poor as a result of effluents from wastewater treatment plants, paper mills, and other industries. Farther downstream below Allegan Dam, anglers fish mainly for walleyes, salmon, steelhead, northern pike, largemouth bass, channel catfish, and carp. Allegan Dam is the first fish barrier upstream from Lake Michigan.

Methods

Three principle forms of fish sampling were employed during the survey: electrofishing, fyke netting, and rotenone treatment. Electrofishing and netting dates were designed to closely coincide with sampling dates used during the 1971 survey. Rotenone sampling was accomplished 1 to 2 weeks after a given river reach was electrofished and netted. This procedure was continued from the headwaters downstream.

Electrofishing and netting

An extensive fisheries survey of the Kalamazoo River was conducted in 1971. During that project fish were collected exclusively with electrofishing gear and fyke nets. To grossly assess any major changes since that time, similar sampling methods were used in 1982 in about 60% of the same sampling locations. For example, if four sampling sites were used in a given river section in 1971, attempts were made to sample at least two of those sites in 1982 with similar effort. However, due to river access changes, the same equipment and effort used in a given river section in 1971 could not be duplicated in all instances. In all, 26 sites were sampled by electrofishing in 1982 compared to 48 in 1971. A total of 20 net-nights were used in 1982 compared to 26 in 1971. Fyke nets used were standard 4-

x 6-foot framed nets made with 2-inch stretch mesh. Nets were used only where it was practical based on water depth and flow. The majority of netting (70%) took place in river impoundments. These included the Marshall Impoundment, Morrow Pond, Allegan City Dam Impoundment, and Lake Allegan.

A variety of electrofishing gear was used depending upon water depths. A 110-v, ac, 6-amp generator towed in a small boat was used in waters that could be waded. This same generator was used in a 14-foot fiberglass boat for intermediate waters that were too deep to wade and too shallow to maneuver a larger 16-foot boat. A 16-foot boat, equipped with a 240-v, ac, 10-amp generator, was used to survey the deeper waters where a launching site was available. Electrofishing time periods were either 20 or 27 minutes per station depending on what was done in 1971.

Fish passing through the electrical field were stunned temporarily and retrieved with a scap net. These fish, including those trapped in fyke nets, were measured, weighed in aggregate by species, and returned to the water.

Rotenone sampling

The rotenone sampling techniques used in this study were similar to those used in the Grand River survey in 1978 (Nelson and Smith 1980, 1981). Based on time and monetary considerations, a total of 14 sampling stations were selected (Table 1). These included one station on each of the North Branch and the South Branch of the Kalamazoo River, and 12 more stations from the confluence of these branches to Lake Michigan (Fig. 1).

Station lengths averaged 710 feet, but ranged between 460 and 1,000 feet. These lengths varied to accommodate unusual channel structure or habitat. Station widths and lengths were measured with an optical range finder. Stream flows were measured with the aid of a Gurley current meter.

At the downstream end of each station a barrier net (blocking seine) was placed across the river to collect the fish sample. Net mesh size, methods of net placement, and

net materials used were similar to those described by Nelson and Smith (1980). To estimate the number of small fish that passed through the barrier net, from two to five subsampler nets were placed just downstream from the barrier net. These small nets were standard Michigan mini-fyke nets with the forward frame measuring 2 x 3 feet. They were constructed with knotless nylon netting having a maximum diagonal opening of 3/16 inch.

Fish were identified, measured, and weighted to the nearest 0.1 pound in aggregate by species. To save time and storage space, large fish were measured at the sample site while smaller fish were often frozen and measured later in the laboratory. Since growth analysis was not one of the major objectives of the survey, few scale samples were taken.

Results

A total of 62 species of fish were captured (Table 2). Only smallmouth bass, rock bass, white sucker, and carp were found throughout the entire river system. A few species were found nearly everywhere except in the areas apparently having the poorest water quality. These species were northern pike, golden redhorse, northern hog sucker, striped shiner, bluntnose minnow, yellow bullhead, stonecat, blackside darter, and johnny darter. Eighteen species were found only below the last downstream dam (Stations 13 and 14). Some of these species were undoubtedly migrants from Lake Michigan.

Carp were the most numerous single species in the river comprising 67.5% of the total catch by weight and 18.2% by number (Table 3). All species of redhorse combined accounted for 7.5% of the catch by weight and 7.5% by number. By comparison, in the Grand River, (Nelson and Smith 1981) carp and goldfish comprised 45.6% by weight and 16.0% by number of the total catch, but redhorse were much more prevalent and contributed 35.4% by weight and 51.7% by

number to the total catch. In the Kalamazoo River, game fish comprised 12.8% by weight and 30.1% by number. In contrast, game fish in the Grand River made up 9.6% by weight and 22.0% by number of the total catch.

It is believed that the rotenone technique collected nearly all of the fish at each station. Therefore, total weight of the sample can be considered as a conservative estimate of standing crop. Such estimates are somewhat less than the true standing crop since some fish probably escaped capture by traveling upstream out of the station during rotenone application, while others undoubtedly fell to the bottom of the stream, become entangled in the substrate, and so were not collected in the downstream blocking seine.

In the present study, estimates of standing crop ranged from 55.7 pounds/acre at Station 3 to 576.2 pounds/acre at Station 13 (Fig. 2). The average was 185.6 pounds/acre. In 1978, estimates of the standing crop in the Grand River, ranged between 17.0 and 1,148.4 pounds/acre and averaged 159.9 pounds/acre.

Discussion

Rotenone sampling proved once again to be an excellent method of capturing fish in a medium to large stream. In comparison, electrofishing produced poor results. Total species captured at various sampling locations using different gear are compared in Figure 3. In many cases nearly the identical stream sections which were electrofished were sampled with rotenone methods 2 weeks later. In all but one case a previous electrofishing site was within 1 river mile of a subsequent rotenone station. Lack of access prevented an electrofishing site to be located within 1 mile of rotenone Station 11. In every instance, the number of species captured with rotenone far exceeded the number of species captured with electrofishing (Stations 1-10) or electrofishing and netting combined (Stations 12-14). Thuemler (1984) found similar results

when comparing fish collection methods on the Oconto River in Wisconsin. In that study, a section of river was electrofished for 1 hour producing 7 species and 95 individuals. Later the same day the same reach was sampled using rotenone techniques. The latter method produced 19 species and 8,780 individuals.

During the entire Kalamazoo River survey, 60 different species were collected with rotenone. Electrofishing and netting combined produced only 42 species. Rotenone methods produced 18 species not taken with other methods, while netting and electrofishing took only 2 species not collected with rotenone. These two species (longear sunfish and spotted sucker) were apparently rare in the river as only a single individual of each species was collected in the entire survey.

As stream flows increased, electrofishing efficiency decreased. This was very evident at the lowest two stations where the river was wide, deep, and somewhat turbid (Fig. 2).

Catch results clearly favored rotenone methods. Total fish numbers collected per station with electrofishing ranged from 0.6% to 9.5% of those taken with rotenone. Total fish weight per station taken with electrofishing were only 0.6% to 8.3% of that collected with rotenone. When the fyke net catch was included with electrofishing these figures increase substantially, however, due to shallow or swift water or both, fyke nets were not used in close proximity to rotenone stations except in the last three stations.

Many factors have made direct comparisons between 1971 and 1982 survey results difficult and only speculative at best. Some of these factors are as follows: (1) only a portion of the stream sections sampled in 1971 were resampled in 1982 with equal effort, (2) access changes in some areas did not always allow the same gear used in 1971 to be used again in 1982, (3) survey results of several

sampling sites in 1971 were grouped and catch data from specific stations are unknown, (4) catch comparisons between electrofishing and rotenone methods have displayed the gross inaccuracy of electrofishing data. For these reasons catch summaries of electrofishing and netting will not be included in the report. However, general trends in the fishery which can be derived by comparison with 1971 survey results will be discussed.

The 1982 netting and electrofishing data from the surveys of the river impoundments such as Morrow Pond and Lake Allegan, will be retained in Fisheries Division files. Also, catch summaries of all individual rotenone sampling stations will be retained. The balance of this report, unless otherwise indicated, will concern catch data from the rotenone sampling stations.

It should be noted that while electrofishing was inefficient it was also much less costly than rotenone sampling. For example, each electrofishing station accounted for one man-day of labor, while rotenone stations demanded from 5 to 15 man-days depending on station size and river flows.

Fishery description

The Kalamazoo River fishery can be divided into three distinctly different segments based on species diversity, standing crop, and composition of the fish population. These are: Segment A, from the headwaters to just above the city of Kalamazoo; Segment B, from Kalamazoo downstream to Allegan Dam; and Segment C, from Allegan Dam to the mouth of the river at Saugatuck (Fig. 1).

Segment A, Stations 1-8

In the 1982 survey, Segment A was found to have a diverse fish population with good numbers of catchable sportfish (Tables 2 and 4). Station 1 on the North Branch of the river supported a higher standing crop of game fish and carp than did Station 2 on the South Branch (Fig. 2).

South Branch had a higher standing crop of white suckers, a species tolerant of rather poor water quality. In 1971, the South Branch was found to have higher nutrient, chloride, total coliform, and fecal coliform concentrations than the North Branch (Hesse and Willson 1972). Runoff from an oil well field was considered to be the probable cause of the increased chloride concentrations. Although good fisheries habitat was found immediately below the confluence of the North and South branches (Station 3), total standing crop was low (Fig. 2) and species diversity was lower than in either branch (Fig. 3). This same situation existed in 1971. At that time, the probable cause was reported to be poor water quality resulting from the Albion Waste Water Treatment Plant (WWTP) effluent. Results from a more recent study (Wuycheck 1982) indicated severe degradation in stream quality immediately downstream of the Albion WWTP. Catch results farther downstream were similar to those in 1971 in that the fishery quickly recovered. Standing crop estimates at Stations 4 and 5 were much higher (Fig. 2). Northern hog suckers dominated the catch at Station 5. This species is associated with good water quality and is typically found in headwater streams. Very few carp were taken at Station 5, however, that site had little cover and a limited amount of deep water. Standing crop decreased significantly at Station 6, just below the city of Battle Creek, although species diversity remained relatively constant. Fewer legal game fish were available to anglers at that station (Table 4). The same general conditions occurred at Station 7, however, 12 channel catfish were collected at that site. This was the only site above Allegan Dam, where channel catfish were found. These fish were probably associated with Morrow Pond, immediately downstream, where the Fisheries Division has planted channel catfish.

In Morrow Pond, an equal netting effort in 1982, produced less than 1% of the number of black crappies taken in 1971. These nets also caught fewer total fish in 1982.

Electrofishing in both studies revealed large numbers of young-of-the-year smallmouth bass. Station 8 had the highest smallmouth bass population of all sampled sites although the majority were sublegals (Table 4). Anglers interviewed during the survey reported good fishing success for smallmouth bass. That station also had the second highest standing crop of game fish in the entire survey. Based on catch results, a good fishery existed just upstream from Kalamazoo.

Segment B

A dramatic decrease in standing crop and species diversity occurred between stations 8 and 9. Station 9 was located approximately one-half mile below the effluent of the Kalamazoo Waste Water Treatment Plant (WWTP). This section of river has historically been plagued with poor water quality. Average dissolved oxygen concentrations in that area in 1971 were approximately 2.0 mg/l (Hesse and Willson 1972). These low concentrations were caused by the discharge of large quantities of organic materials in the treated municipal and industrial waste from the Kalamazoo and Parchment areas. Massive filamentous algae growth, observed in 1982, even in swift water areas, indicated that excessive nutrient loading is still taking place probably from the Kalamazoo WWTP. A recent stream quality study (Creal 1982) documented stream conditions typical of organic enrichment beginning 0.6 miles below the Kalamazoo WWTP and extending 9.6 miles downstream.

Many of the carp in the same area of the river exhibited eroded fins. Some of these fish had very little fin surface remaining. The condition was most pronounced directly downstream from the Kalamazoo WWTP. The cause of this condition was unknown.

Carp and white suckers were the dominant fish at stations 9 through 12. However, a remnant game fish population was present. Fishery habitat in that area of the river is very good and it appeared the only factor keeping

game fish populations depressed was poor water quality. A significant amount of this problem may be alleviated when the upgraded Kalamazoo WWTP begins operation in the near future. Control of limiting nutrients such as phosphorous should be very beneficial to the fishery.

Large numbers of young-of-the-year smallmouth bass, largemouth bass, and carp were found at Station 10. Young-of-the-year carp were also found in abundance at Station 11 (and in lower numbers at Station 9 and in Lake Allegan). These areas were the only sites where young-of-the-year carp were found during the survey.

Lake Allegan, in the lower part of Segment B, presents an excellent opportunity for fishery development. Water quality problems, specifically high concentrations of polychlorinated biphenyl (PCB) have prevented any large scale public use of the fishery. Fishery management has also been minimal due to this condition. Electrofishing and netting in Lake Allegan indicated that channel catfish, black crappie, and carp populations have greatly increased since 1971 (Schrouder 1972). For example, only one channel catfish was collected in 1971 and 30 were captured in 1982 with equal effort. These fish all appeared to be in good condition.

Segment C

Station 13, approximately 2 miles below Allegan Dam, had the highest standing crop of any station sampled while Station 14 had the highest species diversity. Carp still made up the vast majority of total fish weight in the catch, yet there were good numbers of catchable game fish at both stations (Table 4). Walleyes were found only at these two stations. Of the 30 walleyes captured, only one was less than the legal size of 15 inches. Fishing reports and survey results indicated that substantial walleye fishery exists in the river from Allegan Dam to Saugatuck. The fishery appeared to be underutilized in at least the upstream portion of this area. In the 1971 survey of the

Kalamazoo River only two small walleyes were collected both in Lake Allegan (above Allegan Dam). The increased numbers of walleyes observed in this survey indicated a better fishery available to anglers in 1982. The DNR Fisheries Division has been stocking walleye fry in the river since 1971.

A good population of channel catfish was found at both sampling sites below Allegan Dam. The best collection occurred at Station 13, where 221 channel catfish were collected, with over 86% longer than 7 inches. These fish ranged from 6.5 to 22.5 inches.

Flathead catfish were captured for the first time in the Kalamazoo River by DNR Fisheries Division personnel during the 1982 study. This species was found at both stations below the Allegan Dam. Natural reproduction was evident as many young-of-the-year fish were collected. Captured fish ranged from 1.3 inches up to 12.8 pounds.

Future Surveys

Efforts should be made to sample the same river sites in the late 1980's or early 1990's with equal effort using rotenone methods. This future survey should reflect an improved sport fishery corresponding to the anticipated improvements in water quality, especially in Segment B, the middle part of the river.

Electrofishing in the Kalamazoo River as a general survey method should be discontinued as it fails to provide either reliable quantitative or qualitative results.

Small fish subsampling methods should be improved to prevent bias and arrive at a more reliable estimate of escapement. In the present study, depending on station width and stream flow, from two to five mini-fyke nets were used for subsampling downstream escapement of small fish. More of these nets, perhaps double the number, would reduce the extrapolation factor when estimating the standing crop

of these small fish. Some nets should also be suspended from the surface, some at mid-depth, and others on the bottom to better sample the entire water column.

Management Considerations

The major factor limiting game fish populations in the Kalamazoo River is water quality. Every effort should be made to continue water quality improvement programs as well as establish new ones. Segment B of the river contains very good fishery habitat and provides an excellent opportunity for sport fishery development. In the near future, after the upgraded Kalamazoo Waste Water Treatment Plant begins operation, a stream treatment to eradicate carp and other coarse fish from Kalamazoo to Allegan Dam is recommended. This should be followed by the stocking of walleye, northern pike, and smallmouth bass.

Recent studies (Horvath and Greminger 1982) have indicated that the historical polychlorinated biphenyl (PCB) contamination in fish downstream from Kalamazoo has decreased in intensity. However, in these same studies, some fish in certain downstream areas of the river were found to contain PCB concentrations above the USDA "action level" of 2 ppm. Creal (1983) found high concentrations of PCB's in stream sediments behind three old dams in Segment B. High concentrations were also found in exposed shoreline sediments in the old dewatered impoundments above Plainwell and Trowbridge dams. Current plans by private interests to reflood these impoundments could resuspend much of this PCB and cause accelerated fish contamination in the lower Kalamazoo River and Lake Michigan. This could result in reduced fishery.

Plans are being made to pass trout and salmon to Kalamazoo and possible as far as Battle Creek. Several old dams in Segment B presently act as fish migration barriers.

The elimination of these dams or the construction of fish ladders over them will make an anadromous fishery possible.

The development of an attractive anadromous fishery could have the synergistic effect of stimulating water quality improvement efforts as more attention is given to the river as a recreational resource.

A 4 to 6 mile reach of the upper river in Segment A should be considered for a quality smallmouth bass fishery. Slot limits or a large minimum legal size (15 inches for example) could be employed. Public support for such a fishery would have to be sought prior to implementing such a program.

The stocking of walleye fingerlings in Segment C should continue in order to further develop the walleye fishery there.

Acknowledgments

The author wishes to thank the numerous Michigan Department of Natural Resources Fisheries Division personnel who made the survey possible. A special thanks is extended to Dr. Gerry Smith and The University of Michigan Museum Fishery Section for the identification of redhorse species and small fish.

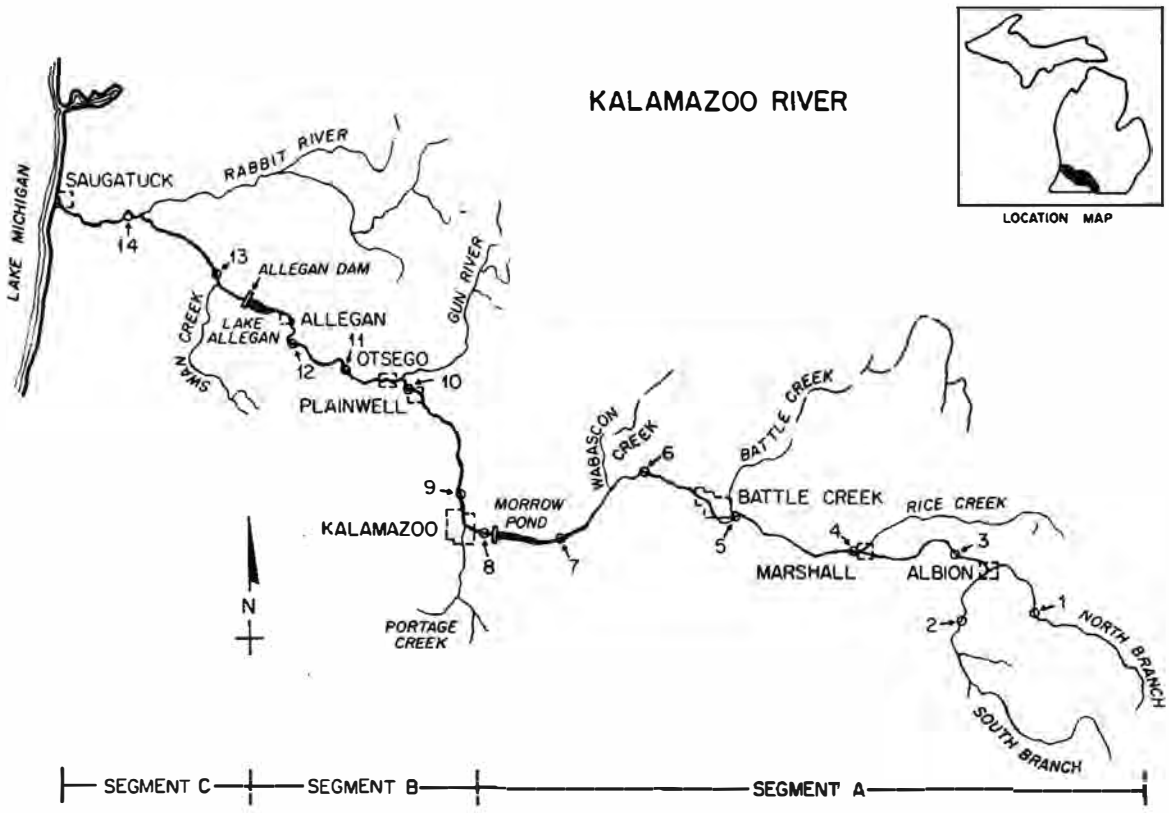

Figure 1. Locations of rotenone treatment sampling stations during the 1982 Kalamazoo River fishery survey.

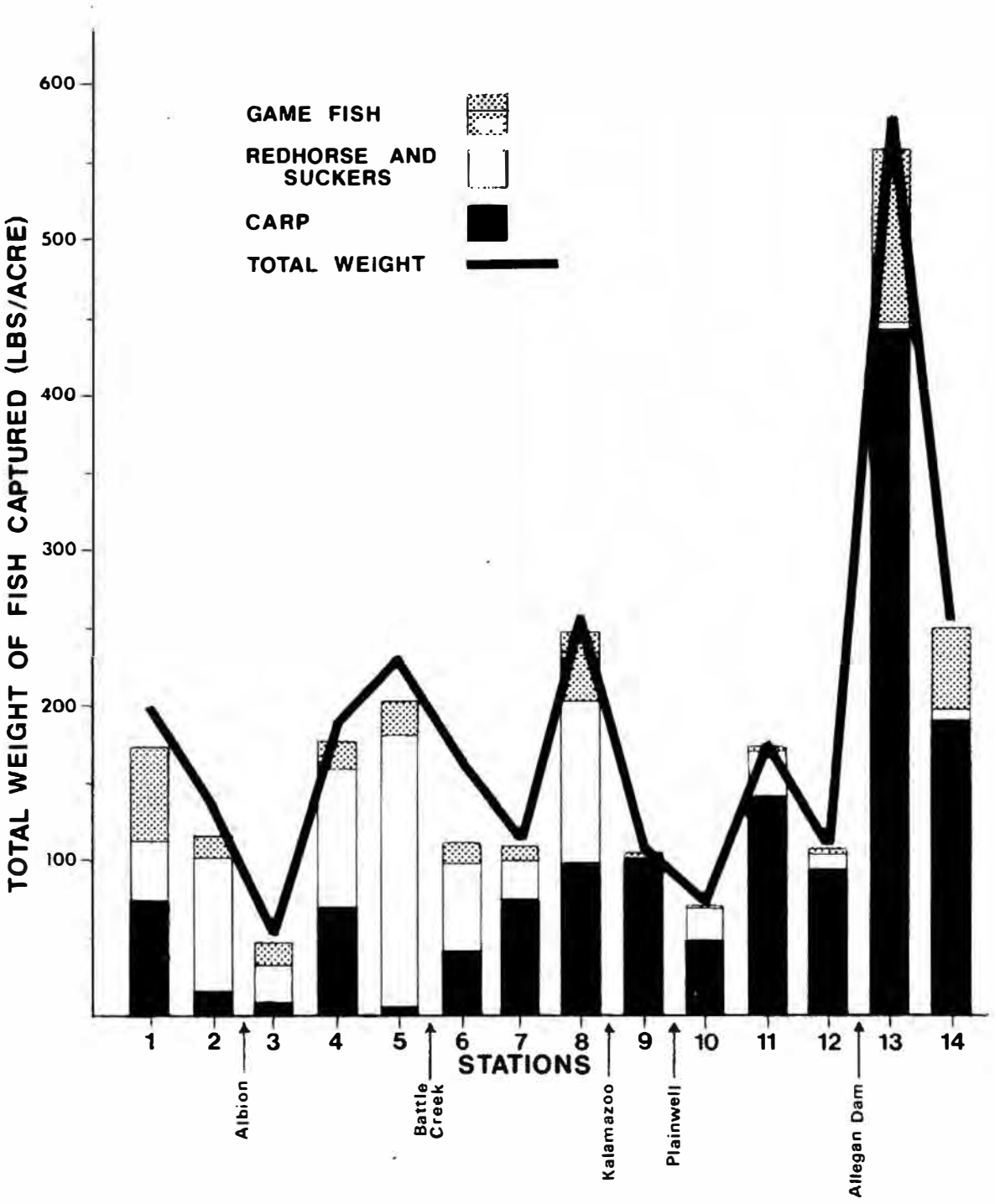

Figure 2. The weight of game fish, redhorse and suckers (combined) and carp captured at each station during the 1982 Kalamazoo River fishery survey. The solid line represents the total weight of all captured fish.

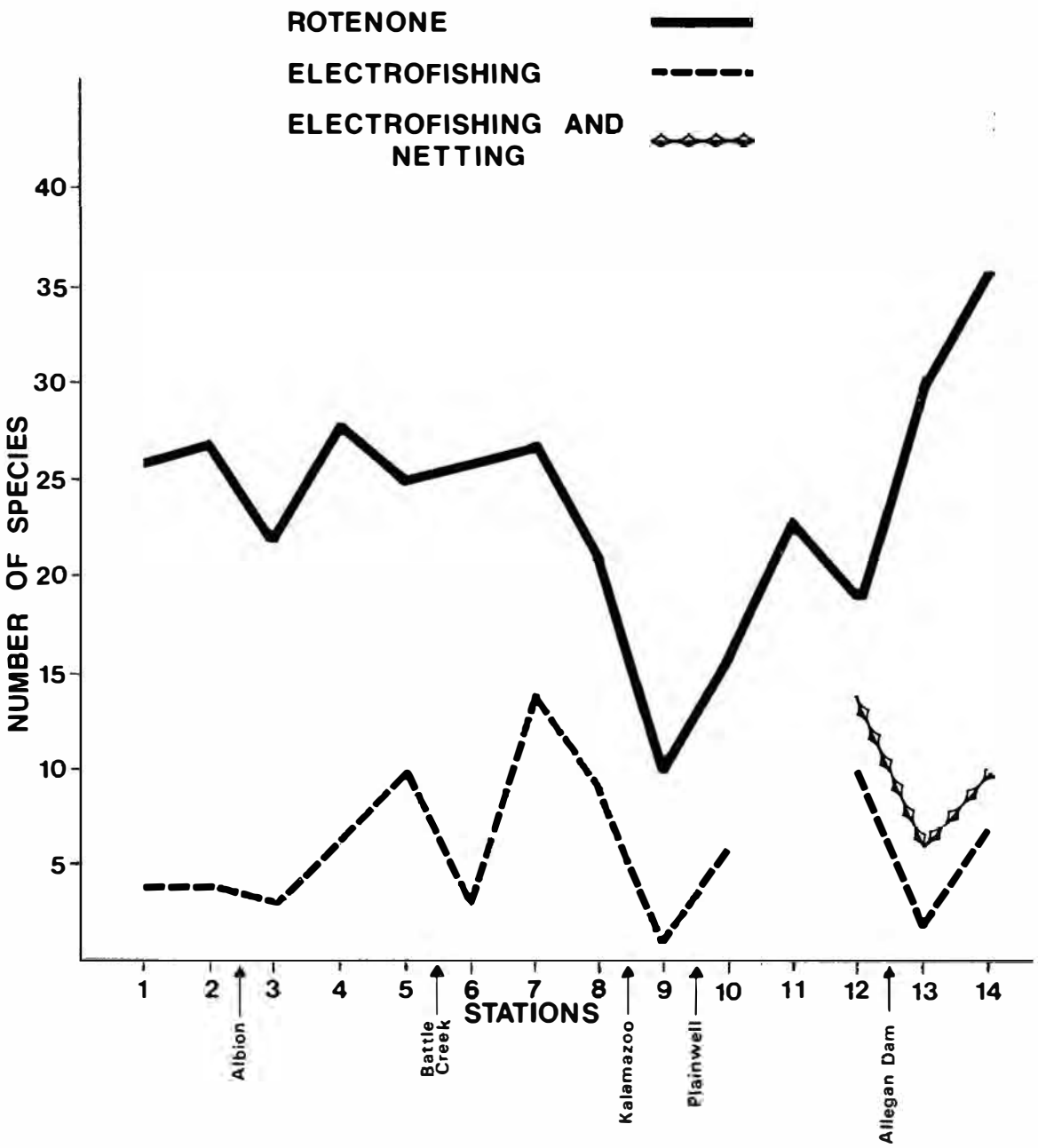

Figure 3. The number of fish species captured with rotenone, electrofishing, and electrofishing and netting (combined) at various sampling stations on the Kalamazoo River in 1982. No electrofishing data were available for Station 11. Electrofishing sites were within 1 river mile from corresponding rotenone stations.

Table 1. Locations of rotenone treatment stations used during the 1982 Kalamazoo River fishery survey.

Station	County	Location	Upstream limit and description
1	Jackson	T3S,R3W,Sec.21	0.1 mile upstream from Warner Rd (North Branch)
2	Calhoun	T3S,R4W,Sec.21	0.1 mile upstream from 26 Mile Rd (South Branch)
3	Calhoun	T2S,R4W,Sec.29,32	300 ft upstream from B Drive North
4	Calhoun	T2S,R6W,Sec.34	300 ft upstream from 15 1/2 Mile Rd
5	Calhoun	T2S,R7W,Sec.8	100 ft upstream from Raymond Rd
6	Calhoun	T1S,R8W,Sec.30	0.5 mile below Custer Rd (on south side of island)
7	Kalamazoo	T2S,R9W,Sec.19	0.4 mile upstream from private access (behind a tool & die company in Galesburg)
8	Kalamazoo	T2S,R10W,Sec.19	220 ft upstream from Sprinkle Rd (south side of island)
9	Kalamazoo	T2S,R11W,Sec.3	0.5 mile upstream from Mosel Ave
10	Allegan	T1N,R11W,Sec.19	400 ft upstream from Plainwell municipal waste water outlet
11	Allegan	T1N,R12W,Sec.17	1.0 mile downstream from old Otsego Power Dam
12	Allegan	T2N,R13W,Sec.33	0.5 mile downstream from Bridge St
13	Allegan	T2N,R14W,Sec.4	0.5 mile downstream from M-89 (east side of island)
14	Allegan	T3N,R15W,Sec.17	1.0 mile downstream from 57th St

Table 2. List of species captured at each station during the 1982 Kalamazoo River fishery survey.

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Chestnut lamprey *Ichtyomyzon castaneus*	x					x								
Bowfin *Amia calva*						x	x							
Alewife *Alosa pseudoharengus*														x
Gizzard shad *Dorosoma cepedianum*													x	x
Central mudminnow *Umbra limi*	x	x	x	x						x	x	x		
Mud pickerel *Esox americanus*	x	x		x	x					x	x	x		
Northern pike *Esox lucius*	x	x	x	x	x	x	x			x	x	x	x	x
Quillback *Carpiodes cyprinus*														x
Shorthead redhorse *Moxostoma breviceps*				x	x		x						x	x
Black redhorse *Moxostoma duquesnei*														x
Golden redhorse *Moxostoma erythrurum*	x	x	x	x	x	x	x	x			x		x	x
Silver redhorse *Moxostoma anisurum*														x
Nothern redhorse *Moxostoma macrolepidotum*													x	x
Greater redhorse *Moxostoma valenciennesi*				x										
Northern hog sucker *Hypentelium nigricans*	x	x	x	x	x	x	x	x				x		
White sucker *Catostomus commersoni*	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Spotted sucker* *Minytrema melanops*														x
Creek chubsucker *Erimyzon oblongus*	x	x												x

Table 2. Continued:

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Carp Cyprinus carpio	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Central stoneroller Campostoma anomalum		x	x			x								
Golden shiner Notemigonus crysoleucas					x									x
Creek chub Semotilus atromaculatus	x	x	x	x	x	x	x	x	x	x	x	x		x
Hornyhead chub Nocomis biguttatus	x	x	x	x	x	x	x					x		
River chub Nocomis micropogon	x		x		x									
Blacknose dace Rhinichthys atratulus										x				
Emerald shiner Notropis atherinoides													x	x
Rosyface shiner Notropis rubellus	x		x	x	x	x								
Common shiner Notropis cornutus	x	x	x	x	x	x	x	x	x	x	x	x		
Mimic shiner Notropis volucellus														x
Spottail shiner Notropis hudsonius													x	x
Spotfin shiner Notropis spilopterus								x			x	x	x	x
Striped shiner Notropis chrysocephalus	x	x	x	x	x	x	x	x						
Sand shiner Notropis stramineus				x	x	x	x				x	x	x	x
Bluntnose minnow Pimephales notatus	x	x	x	x	x	x	x	x		x	x	x	x	x
Bullhead sp. Ictalurus spp.	x	x												
Black bullhead Ictalurus melas			x				x						x	
Brown bullhead Ictalurus nebulosus											x	x		

Table 2. Continued:

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Yellow bullhead *Ictalurus natalis*		x		x	x	x	x	x		x	x	x	x	x
Channel catfish *Ictalurus punctatus*							x						x	x
Flathead catfish *Pylodictis olivaris*													x	x
Stonecat *Noturus flavus*	x	x	x	x	x	x	x	x						
Tadpole madtom *Noturus gyrinus*								x						x
Burbot *Lota lota*														x
Pirate perch *Aphredoderus sayanus*													x	
Brook silverside *Labidesthes sicculus*														x
Mottled sculpin *Cottus bairdi*				x										
Smallmouth bass *Micropterus dolomieui*	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Largemouth bass *Micropterus salmoides*		x		x		x	x		x	x	x	x	x	x
Green sunfish *Lepomis cyanellus*	x	x		x	x	x	x	x	x	x	x	x	x	x
Pumpkinseed *Lepomis gibbosus*	x	x		x	x	x	x	x	x	x	x	x	x	x
Bluegill *Lepomis macrochirus*		x		x		x	x	x	x		x		x	
Longear sunfish* *Lepomis megalotis*													x	
Rock bass *Ambloplites rupestris*	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Black crappie *Pomoxis nigromaculatus*					x		x	x		x	x		x	x
Walleye *Stizostedion vitreum*													x	x
Yellow perch *Perca flavescens*							x				x		x	x

Table 2. Continued:

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Blackside darter *Percina maculata*	x	x	x	x	x	x	x	x			x	x	x	x
Logperch *Percina caprodes*													x	x
Johnny darter *Etheostoma nigrum*	x	x	x	x	x	x	x	x					x	
Rainbow darter *Etheostoma caeruleum*	x	x	x	x		x								
Iowa darter *Etheostoma exile*			x					x						
Freshwater drum *Aplodinotus grunniens*													x	x
Brook stickleback *Culaea inconstans*	x	x												
Number of species per station	26	27	22	28	25	26	27	21	10	16	23	19	31	37

*These species taken only with electrofishing or netting.

Table 3. The percent of catch by weight and number for various species of fish larger than 3 inches collected with rotenone during the 1982 Kalamazoo River fishery survey.

Species	Percent	
	Weight	Number
Gizzard shad	0.8	6.8
Northern pike	0.6	1.2
White sucker	6.0	14.8
Northern hog sucker	3.8	8.0
Redhorse sp.	7.5	7.5
Carp	67.5	18.2
Bullhead	0.5	2.6
Channel catfish	3.9	3.7
Flathead catfish	2.3	0.6
Stonecat	0.9	8.8
Smallmouth bass	2.1	6.8
Largemouth bass	0.1	0.8
Bluegill	0.1	0.5
Pumpkinseed	0.1	1.3
Rock bass	1.4	11.8
Black crappie	0.1	0.4
Walleye	1.6	0.4
Freshwater drum	0.2	0.4
Others	0.6	5.4

Table 4. The number of common fish per surface acre of river collected at each station during the 1982 Kalamazoo River fishery survey. The value in parentheses indicates the number of legal- or acceptable-sized fish collected. Young-of-the-year fish are not included.

	Station													
	Segment A								Segment B				Segment C	
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Game fish														
Smallmouth bass	73 (3)	3 (1)	8 (2)	32 (1)	61 (2)	8 (0)	12 (0)	120 (4)	4 (1)	6 (0)	2 (0)	1 (0)	14 (1)	4 (1)
Northern pike	...	7 (0)	2 (2)	9 (1)	2 (1)	4 (0)	5 (0)	...	...	1 (0)	5 (0)	5 (0)	1 (1)	2 (0)
Rock bass	488 (8)	110 (24)	30 (2)	32 (16)	74 (8)	18 (8)	12 (2)	49 (11)	1 (0)	1 (0)	2 (0)	6 (1)	12 (6)	29 (7)
Walleye	...	...	...	...	...	...	...	...	...	...	...	...	5 (4)	6 (6)
Channel catfish	...	...	...	...	...	...	3 (3)	...	...	...	...	...	35 (32)	7 (6)
Flathead catfish	...	...	...	...	...	...	...	...	...	...	...	...	8 (8)	6 (3)
Bullhead	82 (23)	5 (1)	5 (0)	4 (1)	7 (3)	20 (10)	8 (2)	23 (5)	...	1 (0)	3 (1)	5 (1)	4 (1)	...
Coarse fish														
Carp	18	1	3	14	1	13	16	31	25	7	26	38	199	46
Redhorse	25	7	8	37	157	36	22	28	...	...	1	...	2	3
White sucker	5	109	22	4	...	33	31	58	...	17	118	28	...	...
Hog sucker	28	44	64	82	132	20	8	14	...	...	...	...	...	...
Stonecat	35	122	10	12	249	3	5	38	...	...	...	...	...	...

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