DEPARTMENT OF NATURAL RESOURCES
Madison, Wisconsin 53701

Division of Fish, Game and Enforcement
Bureau of Fish Management
Management Report No. 32

Selective Chemical Fish Eradication of Mill Creek, Richland County

by

Clifford Brynildson

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BUREAU OF FISH MANAGEMENT

MANAGEMENT REPORT NO. 32

SELECTIVE CHEMICAL FISH ERADICATION OF MILL CREEK, RICHLAND COUNTY

by Clifford Brynildson
DISTRICT BIOLOGIST

INTRODUCTION

Mill Creek, Richland County (see attached map) is one of several warm water streams that flows into the lower Wisconsin River. The stream did not produce much of a game fish crop; and results of stocking catfish were not very rewarding. Thus, a stream rehabilitation project was planned. This report covers the results of rehabilitation. The headwaters of these streams are spring fed and are managed for trout. The lower reaches, however, because of insufficient gradient, clay-silt bottom materials and turbidity are relatively barren of warm water fish and harbor significant rough fish species.

CATFISH MANAGEMENT

The initial management decision was to stock lower Mill Creek with channel catfish after a preliminary investigation indicated that the game fish population was low.

Channel catfish were obtained from a commercial source in Osage Park, Missouri. On May 17, 1967, 2,028 catfish averaging 40 grams in weight and ranging from 5.3 - 10.0 inches in total length, were stocked at the four lower bridges on Mill Creek. These fish had their adipose fin removed for future identification. An investigation with the 230 volt D.C. shocker in September 1967 captured a few of the stocked catfish. There were also reports that the local youth were catching catfish during the summer.

Three slat traps were fished at each of the two lower bridges from May 13, 1968, to July 22, 1968. The traps were pulled out for two weeks in late June when torrential rains occurred. Nineteen stocked channel catfish and seven brown bullheads were captured in the traps (Table 1). None of the catfish were recaptured a second time. The survival of the stocked catfish based on the 1968 survey was low. The low catch may have been influenced by unstable water levels, poor success attracting the small catfish to the baited slat traps and wide distribution of the catfish.

The mean increase in length and weight of the catfish the 12-14 months they lived in Mill Creek was 3.3 inches and 227 grams.

Fish sampling with the electric shocker and slat traps revealed that a large carp population existed in the lower part of Mill Creek. A chemical treatment of these waters was therefore planned to eliminate existing poor quality species and to favor valuable species. Antimycin was chosen as the toxicant because of its tendency to favor desirable stream species and kill undesirable species. Research conducted by other agencies indicated that scaleless fish such as catfish could tolerate higher concentrations of antimycin than carp and suckers, fish with scales. Planning for selective chemical fish eradication at Mill Creek preceded in 1968.

BIOASSAYS WITH TARGET FISH SPECIES

Antimycin bioassays using carp and channel catfish were conducted at Mill Creek, October 2-4, 1968. Both species averaged about 12 inches in total length and were obtained from the Rock River by the Newville Rough Fish Control personnel.

The site of the bioassays was above the Hwy. 171 bridge at Boaz. Twenty-gallon plastic trash cans filled with 15 gallons of stream water were used as test containers. The containers were wired to steel fence posts and two oxygen tanks with rubber hoses aerated each test unit. The bioassays (Table 2) conducted with carp on October 2 had exposure times of 6 to 25 hours. Two concentrations of antimycin, 5.0 and 7.5 p.p.b. were used. The water temperature ranged from 50 to 57° F. and the pH 7.8 to 8.5 during the first series of tests. Three carp were placed in each container. The surviving carp identified with a fin clip were placed in recovery cages at the end of the exposure period.

Periodic observations made at designated intervals showed that a concentration of 7.5 p.p.b. at temperatures over 50° F. was lethal to carp at an exposure of 15 hours. Delayed mortality occurred at the lower exposures. Mortality at a concentration of 5.0 p.p.b. required at least 23 hours exposure but total kill did not occur until 12 hours had elapsed beyond the 25 hours exposure. A marked change in the pH occurred in Mill Creek during the first day's tests. The lower reading was obtained at 9:30 a.m.

Bioassays using channel catfish were conducted on October 3-4, 1968. Two concentrations of antimycin, 12.5 and 18.0 p.p.b., and exposure times of 15 and 24 hours were used. No mortality of the channel catfish occurred. Additional bioassays were run with carp using 8.0 and 8.5 p.p.b. during the same period. The exposure time was 25.5 hours. Arrival of a cold front had reduced the water temperature to 47° F. by the morning of October 4.

A slight drop in water temperature affected the toxicity of the antimycin dramatically. The first mortality of the carp exposed to 8.0 p.p.b. antimycin did not occur until 22.5 hours later in the recovery cage. The two carp exposed at 8.5 p.p.b. were still alive at the same exposure. The resistance of individual fish to the antimycin varies considerably and it helps explain the inconsistent results that can occur in chemical fish eradication projects. The pH was in the same range as the previous day.

Mill Creek was treated at 20.8 to 8 p.p.b. which was based on the results of the bioassays. Temperatures were 10 to 15 degrees warmer during the actual application. The bioassays did provide data on the relationship of water temperatures, pH and dosages of antimycin with two species of fish, carp and channel catfish. Based on the results of the bioassays, selective chemical fish eradication involving channel catfish and carp is possible.

DYE TESTS

One of the problems in stream chemical fish eradication projects is maintaining a lethal concentration of the toxicant throughout the stream. All of the warm water streams in the unglaciated area of the state have a dendritic watershed which characteristically recruit substantial amounts of water from tributaries and springs.

The extent of the dilution of the toxicant as it flows downstream from the injection sites determines the number of stations required. Frankenburger and Fernholz attained some success using salt blocks and then measuring the specific conductivity at downstream stations. Rotenone was the fish toxicant used. Some difficulty occurred because of the high electrolyte content of the water. Phil Gilderhus of the Federal Fish Control Laboratory at LaCrosse has done some experimental work using dyes in determining dilution rates for antimycin.

A fluorescent dye like rhodomine B or pontacyl pink is required that can be detected with a fluorometer. Rhodomine B in a granular form and a fluorometer were purchased in the summer of 1968. Preliminary dye tests were conducted by Mr. Gilderhus at a one-mile station in Mill Creek in June 1968. The results were inconclusive because of clogging of the fuel pump that was calibrated to inject the dye at the rate of 6 liters per hour. Dr. Paul Uttormark of the University of Wisconsin Water Resources Center, who played a key role as technical consultant in the Mill Creek project, devised a single station approach to the dye application.

The dye injection site for Mill Creek was located above the cunetta near the junction of Hwy. 14 and E. Stream flow readings (Table 3) were taken at the injection site and at the last bridge 12 miles downstream. The rhodomine B granules were diluted with methyl alcohol to make a concentration of 200 grams/liter. An application rate of 20 p.p.b. and a stream flow of 21.7 c.f.s. required 886 grams of dye. The dye application was made for 20 hours starting at 1:30 p.m. on October 8 and continuing until 9:30 a.m. October 9.

Two 20-gallon plastic trash barrels were filled with 60 liters of the diluted dye solution and the fuel pump calibrated to pump 6 liters per hour. Some difficulty was encountered with the pump in maintaining a constant output but periodic calibration and readjustment between two pumps produced an accurate output of the dye. Two men were assigned to the pumps on eight hour shifts. Collection of water samples at the lower bridge started at 12:30 a.m. on October 9 and continued until 1:00 a.m. October 10. Samples were collected in 16 ml. vials with the time indicated on each vial. Similar two-man shifts were utilized in collecting water samples.

The 99 samples were taken back to Nevin and with the supervision of Paul Degurse, were run through the fluorometer. The results of the fluorometer tests are summarized in Table 4. No dye was detected until 4:45 a.m., establishing that it took 15 hours for the dye to reach the collection site instead of 11 hours as was anticipated. Unfortunately between 6:00 a.m. and 10:00 a.m. on October 9, about one inch of rain fell in the Mill Creek Watershed. A flow reading taken below the injection site at 11:00 a.m. revealed that the flow increased 7 c.f.s. from the previous day. We estimated that the flow reached 70 to 80 c.f.s. at the collection site.

With stable flows the concentration of dye should have had a minimum reading of 8.7 p.p.b. The dilution of the dye created by the rainfall probably equalled 50 percent. It appears, however, that the dilution did not account for all the loss in the dye. We suspect that some of the dye adhered to the vegetation and the maximum amount would never be present even under the most ideal water levels.

The greatest concentration of dye occurred 23 to 25 hours after injection. Another high was reached 32 hours after injection. The drop in water levels may have favored this situation. The results of the dye tests did not provide the data expected for the antimycin application, but some valuable information on dye application was obtained.

LIQUID ANTIMYCIN APPLICATION

The primary objectives of the chemical fish eradication project in Mill Creek were (1) eradicate the carp and other undesirable fish species, (2) preserve the channel catfish population, and (3) develop more effective eradication techniques.

The Bureau of Fish Management personnel had contacted the Muscoda Utility Company in the spring of 1968 requesting their cooperation in lowering the water level of the Balmoral Pond in event a project was initiated. We were informed that the pond which is approximately 60 acres in size could be drained to stream level in a few days. Most of the planning of the project revolved around the selective nature of the treatment. Personnel from the Federal Fish Control Lab., Ayerst Co., WARF, S.C.S., University of Wisconsin and Dept. of Natural Resources had been consulted. Dr. Paul Uttormark of the University of Wisconsin Water Resources Center and Phil Gilderhus of the Federal Fish Control Laboratory cooperated actively throughout the project.

The utility company started to lower the Balmoral pond on October 6 and continued until the morning of October 17. Very little success was achieved in lowering the pond. All the water had to be drained through the wheel used in producing hydroelectric power which allowed for only a slow release. This factor, coupled with above normal precipitation and huge backwaters above the pond, prevented the water from being drained to the desired level.

It was necessary to conduct the fish eradication project during the week of October 14-18 because of falling water temperatures and availability of manpower. If the impoundment could have been drained to stream level, two injection stations - above Hwy. 14 and at the lower bridge - would have been used. Two-man crews kept the grates of the dam clean for 48 hours but it was necessary to treat the impoundment separately from the stream.

Stream flow readings were determined at the injection site above Hwy. 14 and at the lower bridge. These readings were 18.2 and 47.5 c.f.s. respectively.

Our bioassays revealed that 7.5 p.p.b. would kill carp (Table 2) in 15 hours exposure if the water temperature was in 50-57° F. range. Also 18 p.p.b. did not kill channel catfish in 24 hours. We wanted 8.0 p.p.b. at the lower bridge for at least 8 hours duration which meant that the antimycin had to be injected for 20 hours. The injection concentration of the antimycin was calculated by using the formula: conc. upstream = $\frac{\text{flow downstream}}{\text{flow upstream}}$ x (conc. downstream) or $\frac{47.5}{18.2} = 2.6$ (8.0) = 20.8 p.p.b. The amount of antimycin required was obtained from the equation (18.2 c.f.s.) (20 hrs.) (20.8 p.p.b.) (.102)* = 774 grams. As there are 48 grams of antimycin per unit (10%), 16 units or 768 grams were required. The 768 grams of antimycin was diluted to 60 liters in each of two plastic containers so a 20-hour application period would be possible. The water temperature of the stream ranged from 65-70° F.

The fuel pumps were calibrated at the injection site and recalibrated as the situation dictated. The application of the chemical began at 12:45 p.m. on October 16 and continued until 8:45 a.m. October 17.

The filters on the fuel pumps had to be cleaned frequently because a paraffin-type residue reduced the output of the antimycin. This problem can be alleviated partially by diluting the antimycin more and pumping at a faster rate. Well water or stream water strained through a chamois or cheesecloth is necessary to keep the pumps free of debris.

Originally we planned to set up a pump at the lower bridge to treat the remainder of the stream to the dam. When the pond failed to drain in the time allotted for the treatment, a new approach had to be adopted. Balmoral Lake was treated at the rate of 1-5 p.p.b. based on 105 A./Ft. (70A x 1.5' deep). The water temperatures ranged between 67 and 68° F. On October 17, 1968, and the pH was 8.2. The bulk of the antimycin was applied with a fuel pump from a boat - the remainder had to be applied by wading in the shallow areas. A strong southwest wind tended to provide good north-south distribution of the antimycin. *To introduce 1 p.p.b. of a substance to a stream, it is necessary to add .102 grams for each c.f.s. of streamflow. Calculated by Dr. Paul Uttormark.

RESULTS

An inspection of the area on October 18, 1968 revealed that numerous small carp, suckers, green sunfish and assorted minnows had been killed in Balmoral Lake (Fi-327). A cold front had moved through on the night of October 17. The water temperature was 53° F. and the pH 8.4. Water was also flowing over the spillway and a few dead fish were noted downstream. Additional investigations of the stream and impoundment established that suckers and other forage fish were killed in expected densities to the lower bridge and the kill in the impoundment consisted of carp of several year classes.

Live carp were observed in the stream at the lower bridge swimming upstream the following week. These carp apparently were from backwaters located adjacent to the stream above the impoundment. No additional attempts were made to treat the lower two miles of stream because many of the channel catfish were located here.

It is logical to assume that the surviving carp will repopulate the stream and impoundment again. The extent of carp infestation will be investigated in 1969. Further chemical fish eradication in Mill Creek will require better manipulation of the water levels so the impoundment can be lowered to stream level. Direct treatment of the larger backwaters will also be required. Two of the primary objectives of the project, developing more efficient stream treatment techniques and selective treatment (no catfish were killed), were attained. We believe that the first objective, eliminating the carp, could have been more effective if the water in the impoundment had been reduced to stream level. Greater application of the antimycin to the backwaters would have also provided a more extensive kill.

SUMMARY

The Mill Creek chemical fish eradication project had three primary objectives: (1) develop more effective stream eradication techniques, (2) preserve the channel catfish population, and (3) eradicate the carp and other undesirable fish species. The first two objectives were attained. The third objective failed because of the failure to lower the impoundment to stream level. High rainfall in 1968 filled all the backwater areas which not only supported a large carp population but provided a reservoir of water to the impoundment.

One injection site with a fuel pump was made above Hwy. 14. The concentration of the antimycin based on the two stream flow readings made about 12 miles apart, was 20.8 p.p.b. The concentration at the lower bridge would be 8 p.p.b., ample to kill carp at the temperatures prevailing. The antimycin was injected for 20 hours.

The water cleared in both the stream and impoundment following the chemical treatment. The clarity will undoubtedly revert to its former condition as the remaining carp distribute throughout the stream system.

If any future chemical fish eradication is conducted in Mill Creek, better water level control at the dam will be required. Also direct toxicant application to the large backwaters above the Balmoral Pond is necessary.

LITERATURE CITED

Fernholz, Willis and Ludwig Frankenburger.
1966. Stream Reclamation Procedures. Wis. Cons. Dept. Fish Mgt. Div. Mgt. Rept. No. 5, 8 pp.

Table 1

Number and Size of Channel Catfish and Brown Bullhead Caught in Mill Creek - 1968

Number Caught	Total Length (In.) Av.	Range	Wt. in Grams Av.	Range
		Channel Catfish		
19	11.8	9.7-13.1	267	115-445
		Brown Bullhead		
7	7.5	6.3-8.5	131	75-200

Table 2

Antimycin Bioassays with Carp - Mill Creek, October 2-3, 1968*

Test Container No.	Concentration	Amount of Antimycin	Exposure Time	Comments
1.	5 ppb.	28.4 ml.	6 hrs.	All alive after 6 hrs. One dead in recovery cage after 18 hrs.
2.	" "	"	10 hrs.	All alive after 6 hrs. Weak condition after 10 hrs. exposure. One dead in recovery cage after 18 hrs.
3.	" "	"	15 hrs.	Still swimming after 6 hrs. All very sick in recovery cage after 23 hrs. Two dead after 37 hrs.
4.	" "	"	25 hrs.	One dead after 23 hrs. exposure. All dead after 37 hrs.
5.	7.5 ppb.	43.0 ml.	6 hrs.	All alive. Two carp very sick in recovery cage after 15 hrs. One dead after 18 hrs. Two dead after 23 hrs. All dead after 37 hrs.
6.	" "	" "	10 hrs.	All carp very ill after 10 hrs. exposure. All dead after 18 hrs.
7.	" "	" "	15 hrs.	All dead.
8.	" "	" "	25 hrs.	" "
9.	" "	" "	Control	All alive.

*Water temperature 50-57° F. on October 2-3.

Time	pH	M.O.A.	Chlorides
2:00 p.m.	8.5	256 mg./l. $CaCO_3$	12.6 mg./l.
9:30 a.m.	7.8	282 " "	--

Table 2 (cont.)

Antimycin Bioassays with Carp and Channel Catfish - Mill Creek, October 3-4. 1968*

Test Container No. (Carp)	Concentration	Amount of Antimycin	Exposure Time	Comments
7.	8 ppb.	45.2 ml.	25.5 hrs.	Alive after 6 and 12 hours. exposure. One very sick after 24 hrs. Both dead after 48 hrs. Transferred to recovery cage after 25.5 hrs.
8.	8.5 ppb.	48.5 ml.	" "	Still alive after 48 hrs.
1. (Catfish)	12.5 ppb.	71.3 ml.	15 hrs.	All alive after 48 hrs.
2.	" "	" "	24 hrs.	" " " " "
3.	18.0 ppb.	102.6 "	15 hrs.	" " " " "
5.	" "	" "	24 hrs.	" " " " "
6.	--	--	Control	" " " " "

*Water temperature 47° F. at 9:30 a.m. on October 4.

Time	pH	M.O.A.
10:00 a.m.	8.0	274 mg./l. $CaCO_3$

Table 3

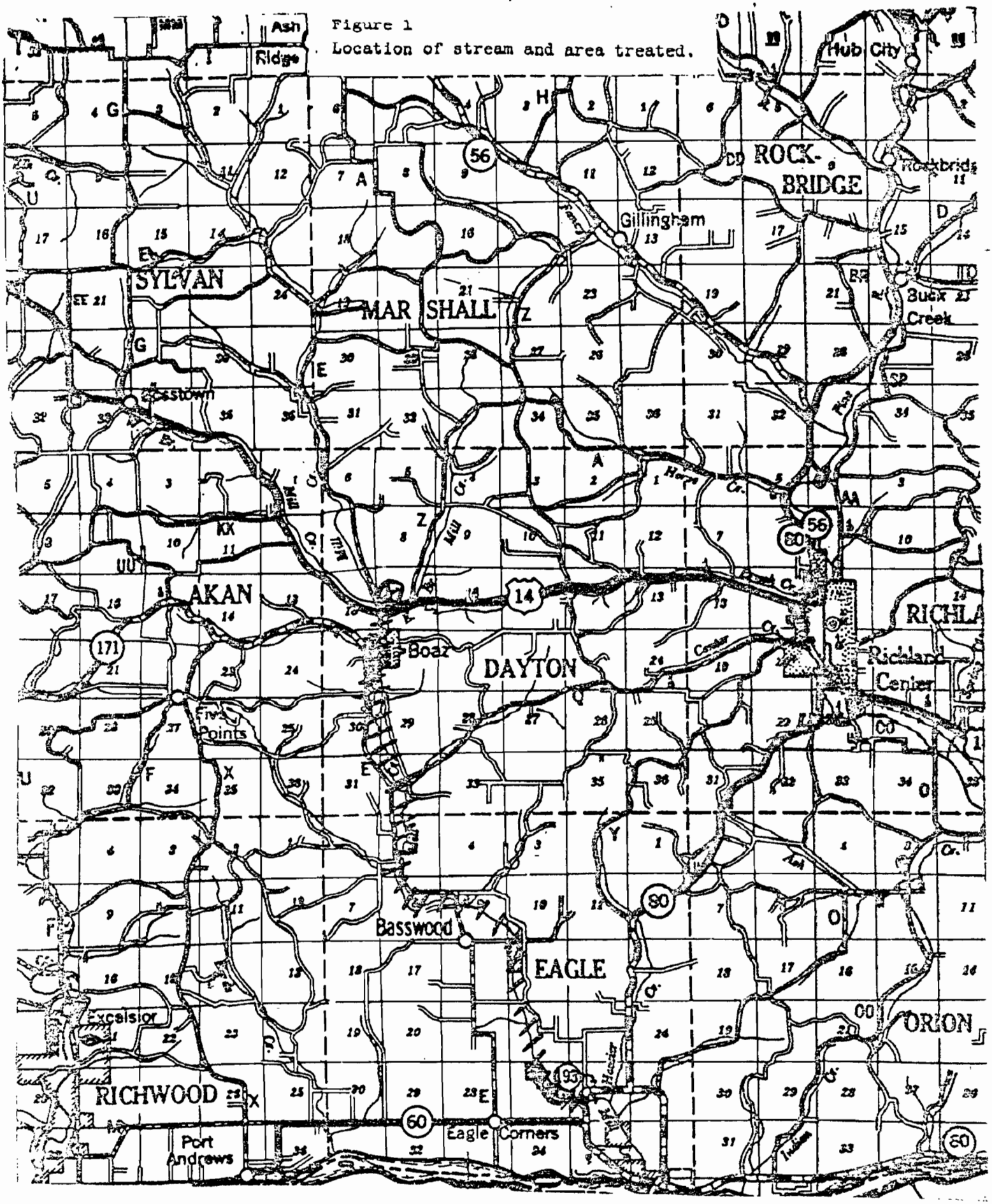
Summary of the Flow Data Collected in Mill Creek, Richland County in 1968

Location	Date	Water Temp. (°F.)	Total Width(Ft.)	Mean Depth(Ft.)	Mean Velocity	Discharge
Bosstown(W. Branch) Hwy. 14 bridge	Mar. 7, 1968	38	5	.33	1.4ft./sec.	2.3 cfs
East Branch Hwy. 14 bridge	"	39	6	.40	1.3ft./sec.	3.2 cfs
Mill Creek Sec. 36, T11N, R2W, below town road	"	38	10.5	.50	1.6ft./sec.	7.6 cfs
Above first cunetta above Hwy. 14	"	38	10	.77	3.3ft./sec.	22.6 cfs
Midway between cunetta and Hwy. 14 bridge	July 22, 1968	69	20.7	1.02	1.1ft./sec.	22.9 cfs
" " "	July 31, 1968	70	22.0	.78	1.1ft./sec.	18.8 cfs
" " "	Oct. 8, 1968	50	21.5	1.03	.86ft./sec.	21.7 cfs
" " "	Oct. 9, 1968	50	22.6	1.5	1.1ft./sec.	29.6 cfs
" " "	Oct. 16, 1968	67	21.5	1.2	.75ft./sec.	18.2 cfs
Below junction with E. branch - 80 yds.	April 2, 1968	46	25.0	.91	.99ft./sec.	21.8 cfs
" " "	June 4, 1968	80	23.0	.76	1.2ft./sec.	20.2 cfs
Above Boaz bridge 135 ft.	July 22, 1968	69	19.0	1.05	1.2ft./sec.	22.9 cfs
Above the Boaz bridge 200 ft.	July 31, 1968	70	20.0	.88	1.5ft./sec.	24.5 cfs
Midway between Boaz and Hwy. Q	"	74	25.0	.87	1.3ft./sec.	27.5 cfs
Above Hwy. Q bridge 150 ft.	"	71	26.0	1.5	.80ft./sec.	31.0 cfs
Below Hwy. E bridge 130 ft. N. of Jones Store	"	72	26.0	1.1	1.2 ft./sec.	34.8 cfs
Hwy. E bridge - N. of Basswood	Mar. 7, 1968	37	28.0	1.4	.91ft./sec.	34.6 cfs
" " "	Apr. 2, 1968	45	26.0	1.6	.72ft./sec.	31.4 cfs
" " "	July 22, 1968	70	26.0	1.4	1.0ft./sec.	39.2 cfs
Above bridge 40 ft. E. of Basswood	"	69	20.4	1.1	1.7ft./sec.	43.2 cfs
Below town road bridge (Coopers) 125 ft.	"	69	23.6	1.6	1.2ft./sec.	46.4 cfs
" " "	Oct. 8, 1968	54	24.0	1.9	1.2ft./sec.	50.2 cfs
" " "	Oct. 16, 1968	65	24.5	2.0	1.1ft./sec.	47.5 cfs

Table 4
Mill Creek (Richland Co.) Dye Test
Concentration of Rhodomine-B in p.p.b.
Samples Collected 10-9-68 at Lower Bridge

Time	Concentration	Time	Concentration	Time	Concentration	Time	Concentration
0:00	--	6:00	4	12:00	5	18:00	4
	--		4		5		4
	0		3		6		4
	0		3		6		4
1:00	0	7:00	2	13:00	6	19:00	4
	0		2		6		4
	0		3		6		4
	0		3		6		4
2:00	0	8:00	4	14:00	6	20:00	4
	0		4		6		4
	0		4		6		5
	0		4		5		5
3:00	0	9:00	4	15:00	5	21:00	5
	0		4		5		5
	0		4		5		6
	0		4		5		6
4:00	0	10:00	5	16:00	5	22:00	6
	0		5		5		5
	0		5		4		5
	1		5		4		4
5:00	1	11:00	5	17:00	4	23:00	3
	2		5		4		3
	3		5		4		3
	3		5		4		2
						24:00	2
By Dr. Paul Uttormark						25:00	2

Figure 1
Location of stream and area treated.



Mill Creek, Richland County

Treated Portion 1111

Injection Site

Scale: 0.5" = 1 mile

Figure 2

Field Report on Results of Chemical Treatment of Mill Creek

DATE OF TREATMENT: October 16 & 17, 1968

NAME OF Water	LOCATION Section	Township	Range
Mill Creek and Balmoral Pond	--	9&10N	1&2W

ACRES	MAXIMUM DEPTH	ACRE FEET
Mill Creek = 17 Balmoral Pond = 70	6' 480 ml/4	130

CHEMICAL USED	AMOUNT USED -- Gallons	CONCENTRATION (ppb.)
Liquid Antimycin	5.4 43 units	5-20.8 ppb. stream; 5 ppb. pond

OPERATION BEGAN	OPERATION COMPLETED	WATER TEMPERATURE
____ A.M. 12:40 10/16 P.M.	____ A.M. 1:30 10/17 P.M.	65-70°F

M.O.A. = 282
pH = 8.2

PURPOSE OF TREATMENT

To improve the biological and physical conditions of the stream and lake environment for channel catfish by selectively eradicating the carp and other rough fish.

ROUGH FISH ESTIMATE

Species	Total Pounds	Average Length
Carp, Jumbo (7 lbs. up)		
Carp, No. 1 (5 to 7 lbs.)		
Carp, No. 2 (3 to 5 lbs.)	200	17
Carp, No. 3 (2 to 3 lbs.)	500	14
Carp (under 2 lbs.)	5,000	7
White Carp		
Buffalo Jumbo		
Buffalo No. 1		
Buffalo No. 2		
Buffalo No. 3		
Sheepshead		
Suckers	7,000	10
Bullheads No. 1		
Bullheads No. 2		
Bullheads No. 3		
Creek chubs	)	
Common shiner	)2,000	3.5
Barred fantail	)	
Darter other minnow	)	
Total Poundage Sp.	)14,700	

GAME FISH RECORD

Species	Total Number	Estimated Weight	Size Range	Average Length
Walleye				
Sauger				
Smallmouth Black Bass				
Largemouth Black Bass				
Northern Pike	6	3 lbs.	14-18	16
Muskellunge				
Catfish				
Sturgeon				
Bullheads				
Crappie				
White Bass				
Bluegill				
Perch				
Buffalo				
Suckers				
Green Sunfish	5,000	250	1-5	2
Total	5,006	253		

DISPOSITION OF FISH

How: Buried on site or left in the stream
Where: --
To Whom: --
Other:

REMARKS

Good kill of fish resulted in much of the stream and impoundment. Live carp noted in lower two miles of stream and large backwaters adjacent to the lower part of the stream.

NOTE:
Describe any unusual observations on game fish, lake developments, or any other occurrence of public interest on back of report.

NOTED: Area Supervisor — R. J. Miller

SIGNED: Treatment Supervisor — Clifford Byrnilsson
Clifford Byrnilsson

1st Copy – District Manager
2nd Copy – Area Files
3rd Copy – Madison Office
4th Copy – Engineering Division

REV. 9-68