MONTANA DEPARTMENT OF FISH AND GAME
FISHERIES DIVISION

JOB PROGRESS REPORT

State: Montana

Project No.: F-9-R-20 Title: Inventory of the Waters of the Project Area

Job No.: I-c

Period Covered: July 1, 1971 to June 30, 1972

ABSTRACT

Game fish population estimates on Armstrong Spring Creek reveal a standing crop of 1,739 brown trout (Salmo trutta) and rainbow trout (Salmo gairdneri) with a combined weight of 661 pounds per 1,000 feet of stream.

A rancher reported a fish kill on Sixteenmile Creek in October, 1969. A study begun in February, 1970, reveals a potentially productive trout stream with 83.0% fewer game fish below the poison effluent than in the control, two miles upstream. A continuing study of four sections of Sixteenmile Creek shows an interesting pattern of recovery of the game fish population in the affected portion of the stream.

Population estimates on the Carter's Bridge section of the Yellowstone River indicate a standing crop of 449 wild rainbow and brown trout, weighing 364 pounds, per 1,000 feet of stream. Tag returns by fishermen suggest a small trout harvest in relation to the total population.

BACKGROUND

The United States provides six percent of the world's population with 35 percent of the world's produced goods and services. From man's earliest beginnings, technology has enabled him to take advantage of a situation, a discovery, or a resource and use it to enhance his ability to cope with nature's harshness. Simple forms of technology have been noted in other species but man's large brain enabled him to become highly sophisticated and mechanized.

In the United States, man has been blessed with vast quantities of natural resources upon which he has drawn, with no apparent forethought, to advance technology and produce huge quantities of material goods. The technology and material goods have been designed to make life easier and provide more leisure time - time to enjoy nature. In many states, the natural environment has been so drastically altered that there is little enjoyment in seeing or experiencing what remains; the solution has become the problem. In Montana, we have the opportunity to experience nature in as near pristine conditions as exist anywhere in America. The future of Montana's environment depends on forethought and wise management decisions - decisions based on knowledge of the resources and what affects them.

OBJECTIVES

The purpose of this job is to add to the knowledge of the physical, chemical and biological characteristics of the sport fishery in the project area.

PROCEDURES

Fish populations were sampled using 0-500 variable voltage direct current electrofishing equipment. Electrofishing was conducted from a fiberglas boat with the negative electrode permanently attached to the bottom. The sampling procedures and data analysis were those described by Vincent (1971).

Captured fish were anesthetized, measured, weighed and marked with a partial fin clip or Floy T tag; scale samples were collected, and the fish were released near the capture site.

Armstrong Spring Creek Fish Population Study

Armstrong Spring Creek is a small spring-fed tributary to the Yellowstone River, rising approximately 10 miles south of Livingston. The creek, fed by one large, spectacular spring and many smaller ones, has a constant flow and temperature and is rich in aquatic vegetation and insect life (Elser and Marcoux, 1971). The stream is nationally known for its clear, smooth water and its challenge to fly fishermen. The Joe Brooks Chapter of Trout Unlimited leased the fishing rights when public access was threatened by lease to private individuals. Fishing was restricted to flies only, and a two-fish limit. Funds for the $6,000 annual lease have been contributed by conservation-minded businesses and individuals.

Trout population estimates were computed for one section of stream 2,100 feet long with an average width of 63 feet (Elser and Marcoux, 1971). The percent species composition in 1971 was approximately 80% brown trout and 20% rainbow trout. In the spring of 1971, the brown trout population of age class I and older fish was 1,400, weighting 480 pounds, per 1,000 feet of stream. The rainbow population was 338, weighing 181 pounds, per 1,000 feet of stream, for a total standing crop of 1,739 trout, weighing 661 pounds, per 1,000 feet of stream (Table 1). Fall estimates were 1,269 trout weighing 799 pounds per 1,000 feet of stream.

The brown trout age distribution, shown in Table 1, indicates the possibility of errors in aging brown trout in the spring. The disproportionately high number of age II brown trout in the spring suggests that some yearlings may have been aged as two years old. The 24.5% difference between the spring and fall total numbers of brown trout as compared to the mortality rates for the individual age classes suggests possible errors in aging other year classes of brown trout in 1971. The data will be reviewed to determine the specific problems.

During the general fishing season, in 1971, a voluntary creel census was conducted with cards to be filled out by each fisherman. Information requested was amount of time spent fishing, number of each species caught, and number of each species kept. Spot checks were made in the field to determine what percentage of the fishermen actually filled out cards. These checks indicated that card returns in June, July and August represented 32, 5 and 20 percent, respectively of the total number of fishermen using the stream; no checks were made in May.

TABLE 1. Number and weight in pounds (in parentheses) of rainbow and brown trout per 1,000 feet of stream in Section One of Armstrong Spring Creek, 1971

Species	Age Class I	II	III	IV	Totals
			Spring		
Brown Trout	386 (33)	884 (320)	117 (100)	14 (27)	1401 (480)
			Fall		
Brown Trout	593 (229)	392 (266)	67 (118)	5 (13)	1057 (626)
% Mortality	-	55.7	42.7	64.3	
			Spring		
Rainbow Trout	95 (12)	195 (112)	48 (57)	-	338 (181)
			Fall		
Rainbow Trout	59 (16)	121 (106)	32 (51)	-	212 (173)
% Mortality	37.9	38.1	33.3		

An unusually small number of spot checks in July made the 5 percent return figure unreliable. A total of 317 fishermen filled out cards, indicating that 2,049 trout had been caught in 1,232.2 man-hours of fishing. Sixty-two brown trout and 55 rainbow were reportedly creeled (Table 2).

TABLE 2. Summary of information collected from creel census card returns by fishermen each month in the summer of 1971

Category	May	June	July	August
Fishermen	46	71	102	98
Man-hours	93.7	295.5	498.5	344.5
			CATCH (including fish released)	
Brown Trout	259	263	583	286
Rainbow Trout	116	132	267	139
Cutthroat Trout	4	4	0	0
Trout/hour	4.04	1.35	1.71	1.23
			HARVEST (fish kept)	
Brown Trout	12	17	20	13
Rainbow Trout	6	25	14	10
Cutthroat Trout	0	0	0	0

Armstrong Spring Creek is a unique stream in its stable physical characteristics and high biological productivity. It is recommended that spring and fall

trout population estimates be made and creel census be conducted for at least two more years to gain a better understanding of the dynamics of that fishery.

Sixteenmile Creek

Rachel Carson's Silent Spring marked the beginning of an era of increasing public interest in the widespread use of pesticides. Chemicals such as DDT, Endrin, Dieldrin and Toxaphene are persistent, broad spectrum poisons which affect both target and nontarget species. Due to the increased awareness of pesticide problems, an extensive fish kill was reported on Sixteenmile Creek in October, 1969. The rancher suspected cattle dip solution, which had been dumped into the stream, as the causative agent. The solution was composed of 44.15% Toxaphene; 1.32% Lindane; 10.00% petroleum distillate; 28.00% aromatic petroleum derivates; and 16.53% inert ingredients. Toxaphene and Lindane are both insecticides which have been proven to be toxic to fish in low concentrations (Pimentel, 1971).

Sixteenmile Creek originates in the Crazy Mountains, approximately 40 miles north of Livingston. It flows approximately 60 miles southwesterly through semi-arid rangeland and rocky hills to the Missouri River near Toston, Montana.

In February, 1970, four study sections were established to monitor fish populations in Sixteenmile Creek. One was a 3,000 foot long control section established about two miles upstream from the dip tank. Study sections to determine the effects of the poison were established at the dip tank effluent and five and 15 miles downstream from the dip tank (Table 3).

TABLE 3. Length, average width, average depth and approximate distance from the source of poison for each study section on Sixteenmile Creek

Section	Length (feet)	Average Width	Average Depth	Distance from Source
1	3,000	31.5	1.23	2 miles upstream
2	3,700	32.4	1.24	0
3	6,300	32.2	1.05	5 miles downstream
4	8,800	38.6	1.12	15 miles downstream

Electrofishing was conducted spring and fall on Sections One and Two and in summer on Sections Three and Four in 1970 and 1971.

The control (Section One) has stable banks and provides excellent trout habitat. In the spring of 1970 and 1971, it supported 210 and 270 pounds of game fish, respectively, per 1,000 feet of stream. The species composition of the combined 1970 and 1971 spring population was 71 percent rainbow trout, 26 percent brown trout and 3 percent mountain whitefish (Prosopium williamsoni). Table 4 shows population numbers and weights in Section One of Sixteenmile Creek.

In the spring of 1970, yearlings made up 57.0 percent of the total number of rainbows and 42.3 percent of all brown trout (Table 5).

Low numbers of trout in the 1970 year class precluded making a complete age distribution analysis in the spring of 1971. In the fall, yearling rainbows made up only 19.4 percent of the total number while two-year-old rainbows made up 56.6 percent (Table 5). The same general age breakdown was seen in brown trout at that time. This substantiates the assumption of poor survival of the 1970 year class in both species. Whitefish age breakdown was not possible in the fall of 1970 or 1971.

TABLE 4. Estimated number and weight of game fish over 5.9 inches total length per 1,000 feet of Section One on Sixteenmile Creek in 1970 and 1971

Category Year	Season	Rainbow	Brown	Whitefish	Totals
Number 1970	Spring	350 (118)*	130 (36)	15 (5)	495
	Fall	198 (32)	102 (16)	-	300
Weight 1970	Spring	137 (12)	58 (9)	15 (5)	210
	Fall	150 (20)	97 (20)	19 (10)	266
Number 1971	Spring	225 (35)	80 (22)	11 (4)	313
	Fall	180 (32)	75 (22)	-	254
Weight 1971	Spring	191 (32)	65 (14)	14 (5)	270
	Fall	145 (26)	81 (25)	-	226

* Confidence interval at the 95% level in parentheses.

TABLE 5. Rainbow, brown trout and whitefish numbers and over-summer mortality in each age class per 1,000 feet of stream in Section One, Sixteenmile Creek, 1970 and 1971

Species Year	Season	Age Class I	II	III	IV	V	Totals
Rainbow 1970	Spring	199	41	69	34	6	349
	Fall	91	67	30	8	2	198
% Mortality		54.8	-	56.5	76.5	66.7	
Rainbow 1971	Spring	-	77	132	16	-	225
	Fall	35	84	51	10	-	180
% Mortality		-	-	61.4	37.5	-	
Brown 1970	Spring	55	39	25	8	3	130
	Fall	28	40	24	10	-	102
% Mortality		49.0	-	4.0	-	-	
Brown 1971	Spring	-	31	48	-	-	79
	Fall	6	39	29	-	-	74
% Mortality		-	-	39.6	-	-	
Whitefish 1970	Spring	5	7	3	-	-	15
	Fall	-	-	-	-	-	
Whitefish 1971	Spring	-	1	10	-	-	11
	Fall	-	-	-	-	-	

Sixteenmile Creek, Section Two

Section Two is the first 3,700 feet of stream which was poisoned. It is physically similar to the control section (Table 3) and also provides excellent trout habitat. In February, 1970, four months after the reported fish kill, it supported only 84 game fish, weighing only a quarter as much as the population present at the same time in the control section. The fish population in Section Two was composed of 47.6 percent rainbow, 47.6 percent browns, and 4.8 percent whitefish in February, 1970 (Table 6).

TABLE 6. Estimated number and weight of game fish per 1,000 feet of Section Two on Sixteenmile Creek in 1970 and 1971

Category Year	Season	Rainbow *	Brown	Whitefish	Total
Number 1970	Spring	40 (18)	40 (6)	4 (0)	84
	Fall	127 (22)	54 (16)	6 (5)	187
Weight 1970	Spring	20 (5)	26 (3)	5 (0)	51
	Fall	69 (12)	48 (17)	5 (4)	122
Number 1971	Spring	186 (41)	140 (37)	33 (25)	359
	Fall	174 (71)	142 (57)	11 (7)	327
Weight 1971	Spring	90 (22)	36 (9)	19 (14)	145
	Fall	102 (36)	79 (24)	9 (6)	190

* Confidence interval at the 95% level in parentheses.

In sampling Section Two, it was noted that vacant habitat became more abundant the farther downstream the sampling was done indicating that repopulation was coming from unaffected areas upstream from the source of the poison. Statistics in Table 7 indicate that age class I and II fish are a mobile segment of the population and represent the portion of the population which changed significantly between sampling periods.

Sixteenmile Creek, Section Three

Section Three begins at the confluence of the South Fork and main Sixteenmile Creek (Table 3). The physical condition of the stream is poorer than Sections One and Two due to several eroding banks. Siltation could become a factor in the speed of population recovery and the magnitude of the carrying capacity in the section.

Electrofishing was conducted in the summer of 1970 and 1971. Small sample sizes precluded making age class analysis on the population in 1970 and allowed only partial analysis in 1971. It was observed that a large quantity of trout habitat was vacant. However, unlike Section Two there was no tapering off of fish numbers in the sample going downstream.

In 1970, Section Three supported 61 game fish, weighing 46 pounds, per 1,000 feet of stream. The population was composed of 45.9 percent rainbow trout, 13.1 percent brown trout, and 41.0 percent mountain whitefish. In 1971, the standing

TABLE 7. Rainbow, brown trout and whitefish numbers and over-summer mortality in each age class per 1,000 feet of stream in Section Two, Sixteenmile Creek, 1970 and 1971

Species Year	Season	Age Class I	II	III	IV	V	Totals
Rainbow 1970	Spring	19	6	9	3	3	40
	Fall	101	15	5	6	-	127
% Mortality		-	-	44.4	-	-	
Rainbow 1971	Spring	38	124	22	-	-	184
	Fall	67	93	10	2	-	172
% Mortality		-	25.0	54.5	-	-	
Brown 1970	Spring	4	17	14	3	1	39
	Fall	14	25	10	4	-	53
% Mortality		-	-	28.6	-	100.0	
Brown 1971	Spring	97	23	17	2	-	139
	Fall	103	27	12	-	-	142
% Mortality		-	-	29.4	100.0	-	
Whitefish 1970	Spring	2	2	1	-	-	5
	Fall		Insufficient data				
Whitefish 1971	Spring	19	14	-	-	-	33
	Fall		Insufficient data				

crop of game fish had increased to 104 fish weighing 65 pounds, per 1,000 feet of stream. The percent species composition had changed to 53.6 percent rainbow trout, 21.8 percent brown trout, and 24.6 percent mountain whitefish (Table 8).

TABLE 8. Number and weight per 1,000 feet of stream for each species in 1970 and 1971 in Section Three of Sixteenmile Creek

Species	1970 Number	1970 Weight	1971 Number	1971 Weight
Rainbow Trout	28 (17)*	16 (8)	59 (29)	33 (18)
Brown Trout	8 (4)	9 (6)	24 (11)	11 (6)
Mountain Whitefish	25 (20)	21 (17)	27 (10)	21 (9)
TOTALS	61	46	110	65

* Confidence interval at the 95% level in parentheses.

Sixteenmile Creek, Section Four

Section Four is located five miles from the mouth of Sixteenmile Creek (Table 3). It flows through very dry, sage-covered hills which suffer from overgrazing. The creek banks have also been overgrazed and there is some bank erosion. The Milwaukee

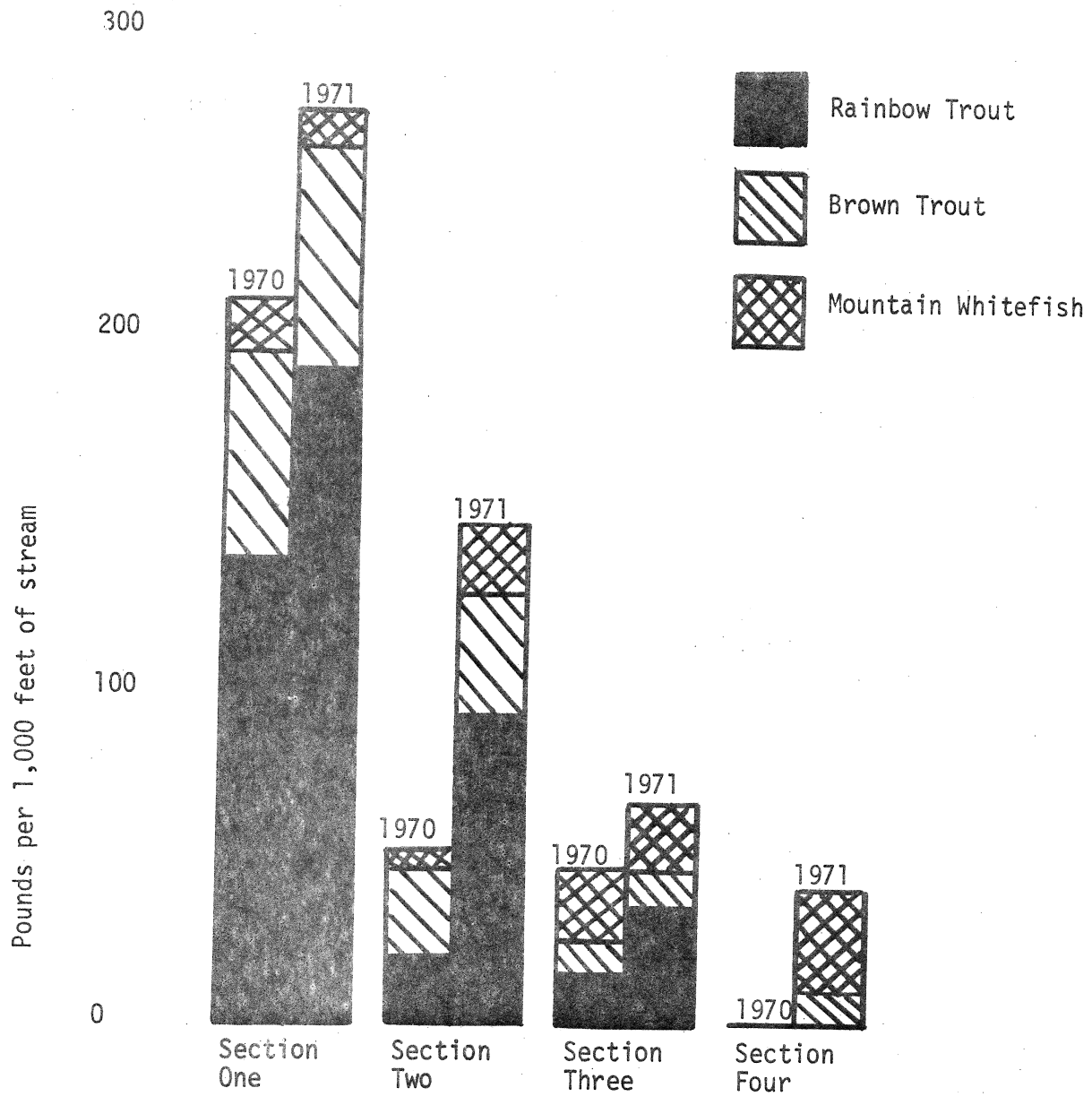

FIGURE 1. Standing crop of rainbow, brown trout and mountain whitefish in pounds per 1,000 feet of stream for four sections of Sixteenmile Creek in 1970 and 1971.

Railroad straightened a portion of this section many years ago.

Due to an almost complete lack of fish, no estimate could be made in 1970. In 1971, rainbow trout were still lacking; however, brown trout had increased to 23 per 1,000 feet and whitefish to 80 per 1,000 feet of stream, weighing 12 and 30 pounds, respectively.

The trend in standing crop estimates downstream from the control section points out the decreasing population the farther from the unaffected portion of the stream the estimate is made (Figure 1). This substantiates the theory that repopulation is progressing downstream from areas which produce a surplus of fish.

It is recommended that Section One be continued on a summer sampling shedule and that Section Three be sampled spring and fall. The study of all four sections should be continued until a leveling off of population growth is seen.

Yellowstone River, Carter's Bridge Section

A potential dam site on the Yellowstone River approximately four miles south of Livingston has posed a threat to the aquatic resources of the Upper Yellowstone River for many years. The threat has gained impetus in recent years from the huge coal deposits in Eastern Montana and the planned industiral development of that region. Because of the growing threat, a study of the trout populations in the Upper Yellowstone River was begun in April, 1970. The Carter's Bridge section was established to evaluate the trout fishery in the area of the potential dam site (Elser and Marcoux, 1971).

In 1971, rainbows were the predominant trout species in this section, making up 64.1% of the total numbers and 67.4% of the total weight. Brown trout made up 35.9% and 32.6% of the population by numbers and weight, respectively. Cutthroat trout were present in small numbers but were not included in the estimate. Spring and fall, 1971, estimates are shown in Table 9.

TABLE 9. Rainbow and brown trout population estimates in 1971 for the Carter's Bridge Section of the Yellowstone River. Numbers per 1,000 feet of stream with pounds in parentheses

Species	Season	I	II	III	IV	V	Totals	C.I.*
Rainbow Trout	Spring		101 (47)	112 (84)	54 (74)	21 (40)	288 (245)	28 (71)
	Fall	Insufficient data						
Brown Trout	Spring		97 (50)	54 (53)	10 (16)	- -	161 (119)	53 (43)
	Fall	56 (10)	36 (21)	48 (61)	9 (20)	- -	149 (112)	52 (40)

* Confidence interval at the 95% level.

Difficulty in sampling in high river flows resulted in an unreliable fall rainbow estimate. The section supported a total of 449 wild rainbow and brown

trout weighing 364 pounds, per 1,000 feet of stream, in the spring of 1971. These figures compare closely to findings of Elser and Marcoux (1971).

In the spring of 1971, 877 trout were tagged with numbers Floy T-tags. The tagged population consisted of 505 rainbow, 351 brown and 21 cutthroat trout. During the period from April through October, 44 (5.0%) of the tags were returned by fishermen. Tag returns for each species were 6.9, 2.3 and 4.8 percent for rainbow, brown and cutthroat, respectively. Assuming even small percentage return of tags by fishermen, this indicates a light trout harvest.

It is recommended that population studies be continued and creel census be conducted in the study section so that a better understanding of total harvest can be gained.

LITERATURE CITED

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Waters Referred To:

Armstrong Spring Creek	22-0140
Sixteenmile Creek	17-6736
Yellowstone River	22-7070