Peters, Don
First year results of the evaluation of the effect of forest land management on tributaries in

PETERS, DON.

FIRST YEAR RESULTS OF THE EVALUATION OF THE EFFECT OF FOREST LAND MANAGEMENT ON TRIBUTARIES IN ROCK CREEK & THE BITTERROOT RIVER DRAINAGES.

FIRST YEAR RESULTS OF THE EVALUATION OF THE EFFECT OF FOREST LAND MANAGEMENT ON TRIBUTARIES IN ROCK CREEK AND THE BITTERROOT RIVER DRAINAGES

by

Montana Department of Fish, Wildlife and Parks

Don Peters

Abstract

Fish population estimates were completed in August and September on 13 sections in 10 streams in the Rock Creek and Bitterroot River drainages. Study sites were selected in the same area that U. S. Forest Service embeddedness work was completed. Trout standing crop estimates were highly variable between streams and within different sections of streams sampled. The abundance of westslope cutthroat greater than or equal to 6.0 inches total length was highest in Sleeping Child Creek, 138 fish per 300 m stream length and lowest in Gold Creek, 10 fish per 300 m. The West Fork of Rock Creek in the Sand Basin area and Tolan Creek had the second lowest population of westslope cutthroat greater than or equal to 6.0 inches total length, 30 fish per 300 meters. Habitat variables, fisherman harvest, and fish movement may all be involved in the measured variability in standing crops.

INTRODUCTION

This project is a long-term interagency cooperative study with the U. S. Forest Service. The Montana Department of Fish, Wildlife and Parks (MDFWP) portion of the effort will be to collect fish population data in the same areas in which the Forest Service is collecting sediment data. Sediment and fish population responses over a number of years and different ecological situations addressed in this effort will produce better interagency confidence in land-use practices and allocations.

OBJECTIVES

1) Compare fish population response to different levels of embeddedness on 12 study streams.

2) Evaluate other habitat components that may explain variation in fish populations between study streams.

3) Identify fish population spatial distribution and migration patterns

PROCEDURES

Fish populations were estimated with the mark and recapture method. We used Chapman's modification of the Peterson formula described by Ricker, 1975. Variance estimates were made with Chapman's formula also by Ricker, 1975. Due to the statistical consideration of acquiring an adequate sample size of fish for good population estimates, our study sections required greater length than the sediment stations selected by the Forest Service. Our sampling sections were permanently marked with steel fence posts on the lower boundary of the section. A narrative description of the location of the sections was prepared on most of the sections and appears in the appendix. All study section lengths were measured with a tape. We tagged most of the trout handled larger than 4 inches total length with fingerling tags (Floy).

Fish habitat parameters were not addressed this first season.

RESULTS

Fish population sampling began in August and September of 1985 with the completion of field collections on 13 stream sections on 10 streams. Two stream sections on Rock Creek were not completed but will be added next season, since this is the first year of a long-term effort.

In addition to the fish population estimates completed, we collected cutthroat trout on some of the Bitterroot drainage streams, from sections outside our population estimate sections, for westslope cutthroat genetic evaluation. The report of findings appear in Appendix A-1 of this report.

Westslope cutthroat trout dominated the fish populations in all 13 sections sampled. The number of westslope cutthroat larger than 6.0 inches total length per 300 meters of stream length in Figure 1 shows a highly variable nature of fish population density in the stream sampled. Of both concern and interest is the comparison of the West Fork of Rock Creek sections with other sections, while appearing capable of producing more larger fish, fail to equal some of the much smaller stream standing crops.

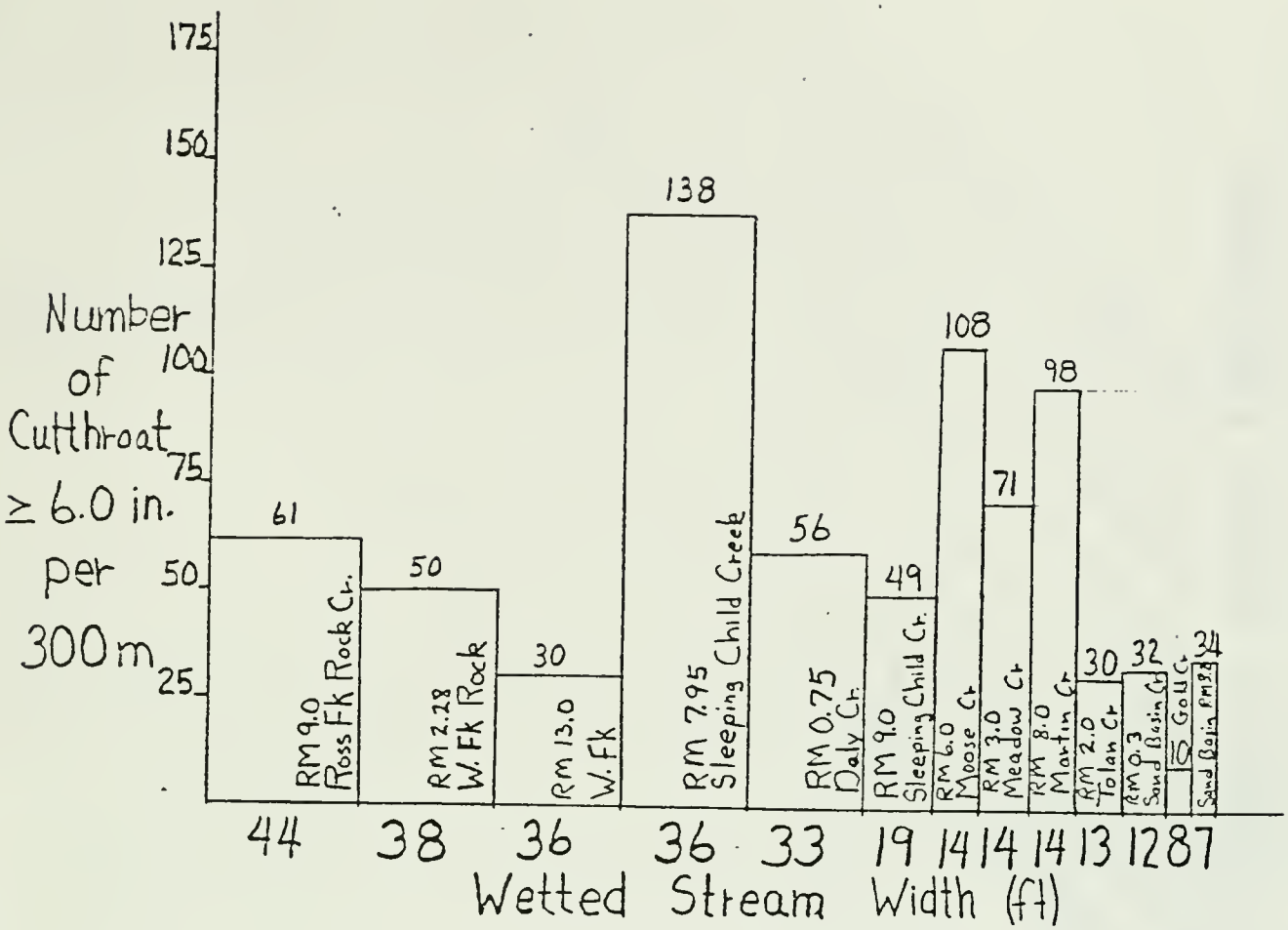

Figure 1. Number of cutthroat trout larger than or equal to 6.0 inches total length per 300 meters of stream length in each of the 13 sections sampled. The width of the bars in the figure are scaled to equal the measured wetted width of each respective stream section.

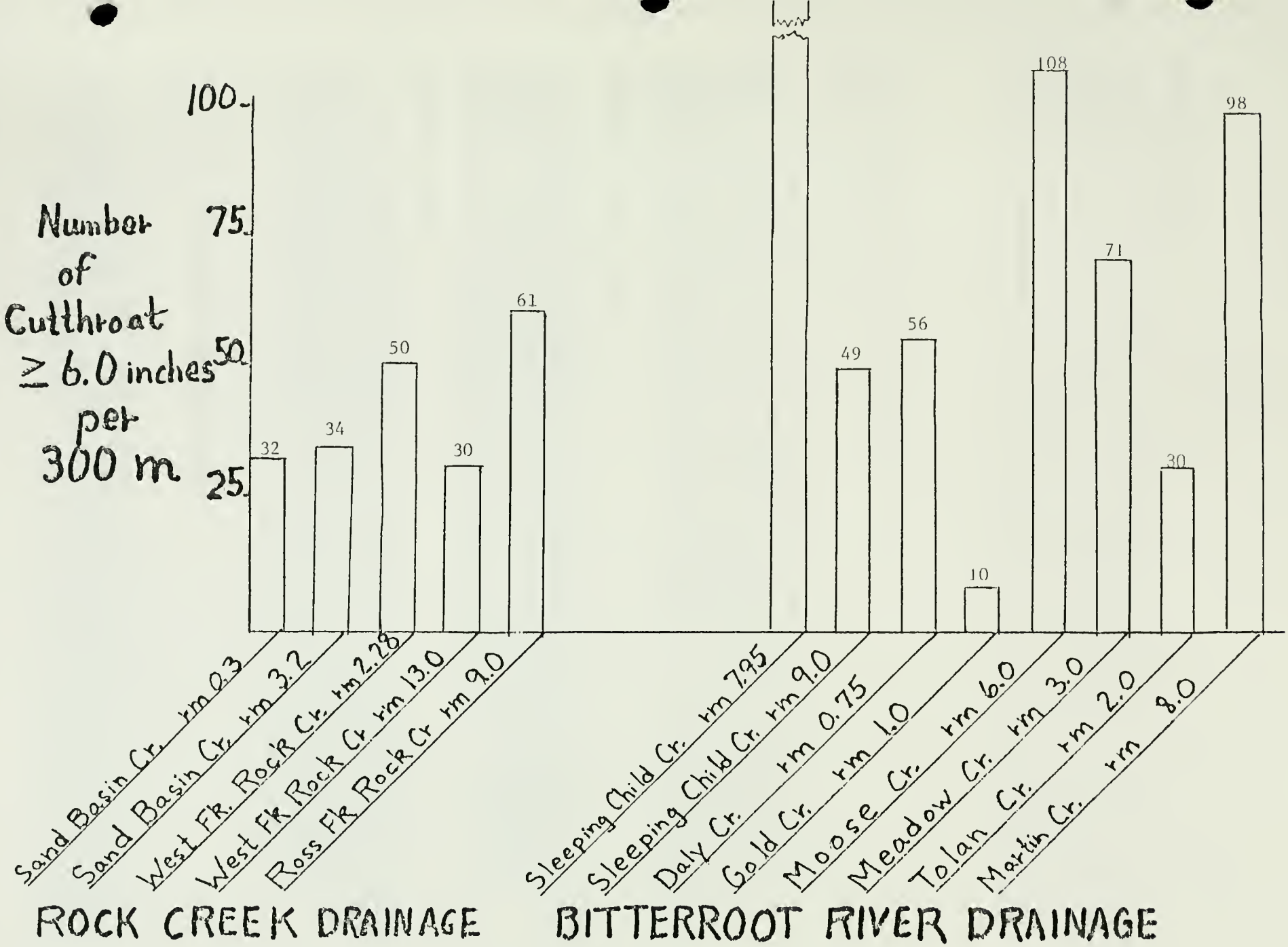

Figure 2. Peterson mark and recapture estimates for cutthroat trout larger than or equal to 6.0 inches total length per 300 meters of stream length sampled in 1985.

Genetic Evaluation

Electrophoretic analysis of samples of Salmo collected in the vicinity of sediment monitoring stations on Gold Creek, Martin Creek, Meadow Creek, Moose Creek, Sleeping Child Creek, and Tolan Creek detected only westslope cutthroat Salmo clarki lewisi genetic material (Appendix A-1). This result indicates we are dealing with pure westslope cutthroat populations in these drainages. Only three other streams with pure populations have been identified in the Clark Fork River basin compared to numerous introgressed populations. The Bitterroot drainage is suspected to harbor a fair number of the pure populations still available in Western Montana.

Fish Populations Rock Creek Drainage

West Fork of Rock Creek

The West Fork of Rock Creek was sampled at two locations; one 2.28 miles from the mouth, the other 13 miles upstream from the mouth below Sand Basin Creek. The species of fish found included cutthroat trout (suspected pure because near absences of rainbow trout), rainbow, bull trout (suspected pure since no brook trout found in all West Fork drainage stream), mountain whitefish, longnose sucker, longnose dace, and sculpins (Table 1). Cutthroat dominated the catch with mountain whitefish and bull trout sharing the second most abundance.

Ross Fork of Rock Creek

The Ross Fork of Rock Creek was sampled upstream from the sediment monitoring station because of the interference with a headgate structure, bottom disturbance and potential flow problems from the diversion. The species of fish found included: cutthroat, brook, and bull trout, mountain whitefish, and sculpins (Table 2). Cutthroat were dominate in terms of number of individuals found and are suspected to be pure since no rainbows were collected.

Sand Basin Creek

Sand Basin Creek was sampled at two locations; one approximately 0.3 miles from the mouth, the other 3.2 miles from the mouth. The species of fish found differed between the two sections. The upper section had only cutthroat trout and sculpins whereas the lower section was cutthroat, bull trout, mountain whitefish, and sculpin (Table 3). The upper section of Sand Basin Creek had 100% sand substrate, the worst sediment situation of all sections sampled.

Fish Populations in Bitterroot Drainage

Daly Creek

We sampled Daly Creek approximately 0.65 miles upstream from the confluence with Skalkaho Creek. We now have two estimates on this section since estimates were completed in 1984 as well as in 1985 (Table 4 and 5). The Daly Creek section was lengthened by 150 feet which improved the estimates considerably. Confidence

Table 1. Trout population estimates for the West Fork of Rock Creek, August, 1985.

Section Location	Section length (ft)	Species	Size class (in)	Marked (M)	Captured (C)	Recaptured (R)	Number estimate (N)	80% confidence interval	Number per mile
Approx. 2.28 mi. upstream from confluence with Mid. Fk. Rock Creek *	1,770	WsCt	2.0-2.9	0	2	0			
			3.0-4.9	24	36	7	115 ±	43	343
			5.0-6.4	21	16	6	52 ±	18	155
			6.5-7.9	22	20	9	47 ±	14	140
			8.0-11.4	12	20	9	26 ±	8	78
		Rb	6.0-6.4	0	1	0			
		DV	3.5-5.4	9	5	1	29* ±	18	86
			5.5-7.4	9	14	6	20 ±	7	60
			7.5-10.9	8	4	3	10* ±	3	30
		Mwf	5.5-9.4	4	2	0			-
			9.5-15.3	16	14	3	63* ±	31	188
		LnSu	3.5-5.9	15	23	0	-	-	-
			6.0-9.4	5	10	3	16* ±	8	48
		Longnose dace common, sculpins abundant							
Approx. 13.0 mi. upstream from confluence with Mid. Fk.	1,250	WsCt	2.5-3.9	18	16	2	107* ±	62	452
			4.0-5.9	17	17	7	40 ±	14	169
			6.0-10.9	12	14	4	38 ±	16	160
		DV	4.5-5.9	5	5	2	11* ±	5	46
			6.0-8.9	5	1	0	-	-	-
		Mwf	2.0-3.4	2	3	0	-	-	-
			3.5-5.9	11	6	2	27* ±	13	114
			6.0-8.4	8	9	1	44* ±	29	186
			8.5-13.4	19	18	10	34 ±	16	144
		LnSu	8.0-8.4	1	0	0	-	-	-

* This estimate did not meet minimum standards for an unbiased estimate and should be used with caution (Ricker, 1975 pp. 79).

Table 2. Trout population estimates for Ross Fork of Rock Creek, August, 1985.

Section Location	Section length (ft)	Species	Size class (in)	Marked (M)	Captured (C)	Recaptured (R)	Number estimate (N)		80% confidence interval	Number per mile
Upper end of section is the first bridge crossing on the Ross Fk. river mile 9.0	830	WsCt	3.0-4.9	23	25	4	124	±	58	789
			5.0-5.9	13	14	5	34	±	13	216
			6.0-6.9	8	12	8	12	±	3	76
			7.0-8.4	15	11	4	37	±	15	235
			8.5-10.9	6	5	2	13*	±	6	83
		Mwf	2.5-2.9	0	1	0	-		-	-
			4.0-6.9	4	0	0	-		-	-
			8.5-11.9	25	13	7	45	±	13	286
		Eb	2.5-2.9	0	1	0	-		-	-
			4.5-7.4	2	1	0	-		-	-
			8.0-9.9	1	2	1	3*	±	1	19
		DV	5.0-7.9	1	2	0	-		-	-
			10.0-11.4	0	2	0	-		-	-

* This estimate didnot meet minimum standards for an unbiased estimate and should be used with caution (Ricker, 1975, pp. 79).

Table 3 . Trout population estimates for Sand Basin Creek, August 1985.

Section location	Section length (ft)	Species	Size class (in)	Marked (M)	Captured (C)	Recaptured (R)	Number estimate (N)		80% confidence interval	Number per mile
Approx. 0.3 mi. upstream from mouth	760	WsCt	2.0-3.4	11	14	1*	89	±	61	618
			3.5-4.9	10	19	7	26	±	8	180
			5.0-6.4	9	14	5	25	±	9	174
			6.5-8.4	13	11	8	18	±	4	125
		DV	4.5-6.4	3	4	2*	6	±	2	42
			6.5-8.9	3	0	0	-		-	-
		Mwf	4.0-7.9	5	3	1*	11	±	6	76
			8.0-10.9	4	2	1*	6	±	3	42
		Sculpin plentiful in section no estimate attempted.								
Approx. 3.2 mi. upstream from mouth	620	WsCt	2.0-3.4	12	9	2*	42	±	22	358
			3.5-4.9	11	15	6	26	±	9	221
			5.0-6.4	15	14	11	19	±	3	162
			6.5-8.9	10	7	6	12	±	2	102
		Sculpin plentiful in section no estimate attempted.								

* This estimate did not meet minimum standards for an unbiased estimate and should be used with caution (Ricker, 1975 pp. 79).

Table 4. Comparison of mark and recapture trout population estimates in Daly Creek, between 1984 and 1985 in the section 0.65 miles upstream from Skalkaho-Rye Creek Road turn-off.

Sampling date	Section length (ft.)	Species	Marked (M)	Captured (C)	Recaptured (R)	Size class (in.)	Number estimate ($\hat{N}$)	80% Confidence interval	Number per mile
9-19-85	700	Wsct	10	19	6	4.0-5.9	30	± 11	226
9-5-84	550	Wsct	8	13	3	4.0-5.9	31[1]	± 15	298
9-19-85	700	Wsct	12	13	5	6.0-7.9	29	± 11	219
9-5-84	550	Wsct	11	4	3	6.0-7.9	14[1]	± 4	134
9-19-85	700	Wsct	11	3	3	8.0-10.9	11[1]	± 4	83
9-5-84	550	Wsct	11	5	3	8.0-10.9	17[1]	± 6	163
9-19-85	700	DV	18	19	8	4.0-5.9	41	± 13	309
9-5-84	550	DV	22	11	6	4.0-5.9	38	± 11	365
9-19-85	700	DV	16	9	3	6.0-7.9	42[1]	± 19	317
9-5-84	550	DV	8	7	2	6.0-7.9	23[1]	± 12	221
9-19-85	700	DV	8	11	2	8.0-12.9	35[1]	± 19	264
9-5-84	550	DV	4	3	0	8.0-12.9	-		-

[1] This estimate did not meet minimum standards for an unbiased estimate and should be used with caution (Ricker, 1975 pp. 79).

Table 5. Trout population estimates for Daly Creek, August, 1985.

Section location	Section length (ft.)	Species	Size class (in.)	Marked (M)	Cap-tured (C)	Re-cap-tured (R)	Number estimate (N)	80% Confi-dence interval	Number per mile
0.65 mi. upstream from Skalkaho-Rye Creek Rd. turnoff on Skalkaho Rd.	700	Wsct	2.5-4.4	12	16	4	44	±19	332
			4.5-6.4	8	16	4	30	±13	226
			6.5-10.9	19	13	4	56	±12	422
		DV	2.0-2.9	1	2	0	-	-	-
			3.0-4.4	18	17	2	113	±66*	852
			4.5-5.9	17	18	8	37	±11	279
			6.0-8.4	17	11	4	42	±17	317
			8.5-12.9	7	9	1	39	±26*	294
		Sculpin Abundant							

* This estimate did not meet minimum standards for an unbiased estimate and should be used with caution (Ricker, 1975 pp. 79).

Table 6. Trout population estimates for Martin Creek, September, 1985.

Section location	Section length (ft.)	Species	Size class (in.)	Marked (M)	Cap-tured (C)	Re-cap-tured (R)	Number estimate (N)	80% confi-dence interval	Number per mile
Sec. 22cc; approx.8 mi. upstream from confluence w/ Moose Cr.	572	Wsct	2.0-3.4	8	2	0	-	-	-
			3.5-5.4	13	9	0	-	-	-
			5.5-7.4	20	17	8	41	±12	378
			7.5-8.9	5	3	0	-	-	-
		DV	2.5-3.9	4	0	0	-	-	-
			4.0-4.9	12	0	0	-	-	-

intervals of estimates on all size classes and species overlapped indicating no significant changes in the section between 1984 and 1985. The fish species found included cutthroat trout (suspected pure population), bull trout, and sculpin.

Martin Creek

Martin Creek was sampled in September of 1985; the section was located approximately 8.0 miles upstream from the confluence with Moose Creek. We found westslope cutthroat trout (tested pure, Appendix A-1), and bull trout in this section (Table 6). We appear to be dealing with a fairly mobile fish population with both species exhibiting some apparent movement from our section between the marking and recapture runs.

Meadow Creek

Meadow Creek was sampled in August of 1985, the study section has a fair amount of beaver activity in the area. The section is located approximately 3 miles upstream from the confluence with the East Fork of the Bitterroot River. We found westslope cutthroat trout (tested pure, Appendix A-1) and bull trout in the section (Table 7).

Tolan Creek

Tolan Creek was sampled in August of 1985, approximately 2 miles upstream from the confluence with the East Fork of the Bitterroot River. We found westslope cutthroat (tested pure, Appendix A-1), bull trout and brook trout (Table 8).

Sleeping Child Creek

We sampled Sleeping Child Creek in two locations; one above the hot springs inlet and the other below the hot springs in September and August, respectively. The upper section is located approximately 9.0 river miles and the lower section 7.95 river miles from the confluence with the Bitterroot River. We found westslope cutthroat (tested pure, Appendix A-1), bull trout, and the slimy sculpin above the hot springs and added brook trout to the list below the hot springs. There was a large difference in standing crop between the two sections; the section below the hot springs contained considerably more individuals of each species and larger fish (Table 9).

Gold Creek

We sampled Gold Creek in August of 1985 in a location approximately 0.1 miles from the confluence with the Burnt Fork. The section contained westslope cutthroat (tested pure, Appendix A-1), and bull trout (Table 10).

Moose Creek

Moose Creek was sampled in August of 1985, approximately 6.0 miles upstream from the confluence with the East Fork of the Bitterroot River. We found westslope cutthroat trout (tested pure, Appendix A-1), and bull trout (Table 11).

Table 7. Trout population estimates for Meadow Creek (tributary to E. Fk. of Bitterroot River) August, 1985.

Section Location	Section length (ft)	Species	Size class (in)	Marked (M)	Captured (C)	Recaptured (R)	Number estimate (N)		80% confidence interval	Number per mile
Approx. 3 mi. upstream from the mouth	400	WsCt	2.0-2.9	4	2	0	-		-	-
			3.0-4.4	16	17	7	37	±	12	488
			4.5-5.9	16	11	8	22	±	4	290
			6.0-6.9	9	5	4	11	±	3	145
			7.0-9.4	13	6	4	19	±	5	251
		DV	2.0-2.9	0	6	0	-		-	-
			3.5-4.9	7	3	1	15*			198
			5.0-6.4	10	13	4	30	±	12	396
			6.5-7.9	6	7	3	13*	±		172

* This estimate did not meet minimum standards for an unbiased estimate and should be used with caution (Ricker, 1975 pp. 79).

Table 8. Trout population estimates for Tolan Creek (tributary to E. Fk. of Bitterroot River) August, 1985.

Section Location	Section length (ft)	Species	Size class (in)	Marked (M)	Captured (C)	Recaptured (R)	Number estimate (N)		80% confidence interval	Number per mile
Approx. 2 mi. upstream from mouth	400	WsCt	2.0-3.9	17	18	5	56	±	22	739
			4.0-5.4	21	12	8	31	±	7	409
			5.5-6.9	11	4	4	11	±	5	145
			7.5-9.4	6	0	0	-		-	-
		DV	2.0-2.4	1	0	0	-		-	-
			4.0-5.9	2	3	0	-		-	-
			7.5-7.9	0	1	0	-		-	-
		Eb	1.5-2.9	9	14	1	74*	±	51	977
			3.5-4.9	5	4	2	9*	±	4	119
			5.0-7.9	6	5	3	10*	±	5	132

* This estimate did not meet minimum standards for an unbiased estimate and should be used with caution (Ricker, 1975, pp. 79).

Table 9. Trout population estimates for Sleeping Child Creek August and September, 1985.

Section location	Section length (ft.)	Species	Size class (in.)	Marked (M)	Captured (C)	Recaptured (R)	Number estimate (N)	80% Confidence interval	Number per mile
300 ft. above hot springs inlet; 0.1 mi. upstream from bridge	400	Wsct	1.5-2.9	0	3	0	-	-	-
			3.0-4.4	15	36	7	73	±27	964
			4.5-5.4	7	7	4	12	± 4	158
			5.5-7.9	6	13	4	19	± 8	250
		DV	6.0-9.9	3	2	0	-	-	-
(River Mile 9.0)		Slimy sculpin	Abundant						
2.95 mi. downstream from hot springs inlet	400	Wsct	1.5-2.9	3	2	0	-	-	-
			3.0-4.4	63	62	31	125	±19	1,650
			4.5-5.4	23	16	8	44	±12	581
			5.5-6.9	14	13	8	22	± 5	290
(River mile 7.95)			7.0-8.9	13	11	7	20	± 5	264
			9.0-11.9	14	9	5	24	± 7	317
		DV	2.5-3.0	0	1	0	-	-	-
			5.0-7.4	1	2	0	-	-	-
		Eb	2.0-3.9	6	6	0	-	-	-
			5.0-7.4	2	1	0	-	-	-
		Slimy sculpin	Abundant						

Table 10. Trout population estimates for Gold Creek (Tributary to Burnt Fork), August, 1985

Section Location	Section length (ft)	Species	Size class (in)	Marked (M)	Captured (C)	Recaptured (R)	Number estimate (N)		80% confidence interval	Number per mile
Approx. 0.1 mi. upstream from mouth	600	WsCt	2.0-3.9	11	3	1	23*	±	12	202
			4.0-5.9	19	7	4	31	±	10	273
			6.0-7.9	4	3	2	6*	±	2	53
		DV	2.0-2.9	4	1	0	-		-	-
			3.0-3.9	8	3	1	17*	±	9	150
			4.0-5.4	19	5	3	29*	±	10	255
			5.5-6.4	0	1	0	-		-	-
			8.0-10.4	1	2	0	-		-	-

* This estimate did not meet minimum standards for an unbiased estimate and should be used with caution (Ricker, 1975 pp. 79).

Table 11 Trout population estimates for Moose Creek (tributary to the E. Fk. of Bitterroot River), August, 1985.

Section Location	Section length (ft)	Species	Size class (in)	Marked (M)	Captured (C)	Recaptured (R)	Number estimate (N)		80% confidence interval	Number per mile
Approx. 6 mi. upstream from confluence with E. Fk. of Bitterroot R.	686	WsCt	2.5-4.4	7	6	0	-		-	-
			4.5-6.4	7	7	4	12	±	4	92
			6.5-8.9	15	10	4	34	±	14	262
			9.0-11.9	10	8	2	32*	±	17	246
		DV	3.5-3.9	3	3	0	-		-	-
			6.0-7.9	1	1	0	-		-	-

* This estimate did not meet minimum standards for an unbiased estimate and should be used with caution (Ricker, 1975 pp. 79).

DISCUSSION

The sampling of fish populations in this study has raised more questions than the effort has answered so far. Recent literature searches and on-going fisheries work further clouded our results with uncertainty as to what exactly we are measuring in the limited fish population sections. Are we measuring the carrying capacity of that section or the result of some limiting factor either spatially or temporally removed from that site? The ramifications of this difficulty is that our sampling design may only show impacts if the summer habitat contains the limiting factor(s) on the particular population. Studies of cutthroat trout in the Flathead River system indicate that some fish enter the interstitial areas in the substrate while some adult fish move to pools in the larger river system (personal communication with Pat Graham).

Campbell and Neuner, 1985, reported that rainbow trout in the Cascade mountain streams have seasonal behavior changes which follow water temperature. A hiding response begins at 8C and few trout can be found in the water column below 3C. The seasonal change creates an alternative emphasis on food in summer and cover in winter. Konopacky in 1985 reported that in test streams cold water temperatures, a lack of suitable substrate cover, and possibly food size rather than food item density, caused underyearling salmon to migrate downstream early in the fall.

Evidence from several authors suggests that interstital spaces within stream substrates may be a universal behavioral characteristic of salmonid fishes in cold streams when overhead cover is lacking. Winter cover may be a primary influence on the carrying capacity of trout in streams.

In our study sections seasonal movements appear to be taking place. In Martin Creek bull and westslope cutthroat trout seemed to move out of the section between our marking run on September 11 and the recapture run on September 23, 1985. I also failed to observe any cutthroat in the upper section of Sand Basin Creek by walking the banks on October 16, 1985, in contrast to many visual sitings in August. A Forest Service field technician also reported observing a tagged fish in the West Fork near the Sand Basin Creek road bridge; a section that we did not tag fish in. This fish could have moved either upstream or downstream from other sampling sections. Snorkel and mask work in the Bitterroot drainage on 28 streams by O'Dell in 1984 and work by Wilson and Blount in Rattlesnake Creek in 1985 have given the best local quantitative data on the large seasonal changes in population density of cutthroat and bull trout in specific stream sections. Both studies have shown large decreases in trout populations during the fall, winter, and spring months compared with summer abundance. The changes in trout population in these streams could be attributed to movement out of the section, mortality, movement into the substrate, or combinations of all the above.

Our fishery study design appears to need a significant restructuring to understand the dynamics of the fish populations we are trying to protect. Money and man-power will probably be the most pressing need of a new study design. Under current Department as well as U.S. Forest Service funding, not much more than the existing effort is possible.

LITERATURE CITED

Campbell, R. F. and J. H. Neuner, 1985. Seasonal and Diurnal Shifts in Habitat Utilized by Resident Rainbow Trout in Western Washington Cascade Mountain Streams. In Symposium on Small Hydropower and Fisheries. AFS Western Division, Bio-engineering Section.

Konopacky, R. C. Sedimentation and Productivity in Salmonid Streams. PhD Dissertation, University of Idaho. 214 pp.

O'Dell, Dave. 1985. A Fishery Study of Potential Hydropower Sites on Bitterroot River Tributary Streams. Multilith. 60 pp.

Ricker, W. F. 1975. Handbook of Computations for Biological Statistics of Fish Populations. Fisheries Research Board of Canada, Bulletin 119. 300 pp.

Wilson, D. and G. Blount. 1985. Unpublished report on Investigations of Trout Population in Rattlesnake Creek. Report in progress. January, 1985.

APPENDIX

University of Montana

Department of Zoology • Missoula, Montana 59812 • (406) 243-5122

January 9, 1986

Don Peters
Montana Department of Fish, Wildlife and Parks
3201 Spurgin Road
Missoula, Montana 59801

Don,

We have completed the electrophoretic analysis of the samples of Salmo you collected from the following locations: Gold Creek (col 8/29/85; N=26), Martin Creek (9/23/85;25), Meadow Creek (8/22/85; 25), Moose Creek (9/4/85;25), Sleeping Child Creek (9/5/85;25), and Tolan Creek (8/28/85;26)in the Bitterroot River drainage and Rattlesnake Creek (10/4/85;32) in the Clark Fork River drainage. We detected only westslope cutthroat trout, S. clarki lewisi, genetic material at those loci that can be used to distinguish the rainbow, S. gairdneri, Yellowstone cutthroat, S.c. bouvieri, and westslope cutthroat trout (Table 1) in all the samples from the Bitterroot drainage. With the sample sizes from these creeks, we are capable of detecting as little as one percent rainbow trout genetic material in a population 95 percent of the time and as little as one percent Yellowstone cutthroat trout genetic material greater than 99 percent of the time. Thus, the samples from these creeks almost certainly came from 'genetically pure' populations of westslope cutthroat trout.

The protein products of 45 loci were analyzed in all the fish (Table 2). The allele frequencies at those loci at which we detected evidence of genetic variation in the samples of westslope cutthroat trout are given in Table 3. Although the Ck2(100) allele is characteristic of rainbow trout, we feel that its presence in the Martin and and Moose Creek samples is more likely indicative of westslope cutthroat trout intraspecific genetic variation than of introgression with rainbow trout. For example, if there actually is 4 percent rainbow trout genetic material in the Martin Creek population (the frequency of the Ck2(100)allele), then we expect not to detect alleles characteristic of rainbow trout at the other 5 loci that distinguish the rainbow and westslope cutthroat trout only one out of 25,000 times. The same argument pertains to the presence of the Idh1(-75) allele in the Sleeping Child Creek sample.

The average percentage of heterozygous loci per individual and the proportion of polymorphic loci in the samples from the Bitterroot drainage (Table 3) cluster into the upper end of the distribution of these parameters among 45 other populations of

westslope cutthroat trout from which we have comparable data (Fig.1). Thus, it appears that on the average the Bitterroot drainage populations appear to be genetically more variable than populations of westslope cutthroat from other areas of Montana; e.g. Lower Clark Fork around Noxon Reservoir, Hungry Horse region of the South Fork Flathead, North Fork Flathead, and Upper Missouri.

We detected evidence of rainbow, westslope cutthroat, and Yellowstone cutthroat trout genetic material at those loci that differentiate these fishes in the Rattlesnake Creek sample (Table 4). This sample, therefore, came from an introgressed population of westslope cutthroat, Yellowstone cutthroat, and rainbow trout. When genetic material from all of these fishes is present in one population, we can only obtain 'ballpark' estimates of the proportional contribution of each taxa to the population because many alleles at the diagnostic loci cannot unambiguously be assigned to a particular taxon. For example, the Gpi3(100) allele is characteristic of both rainbow and Yellowstone cutthroat trout. We can state, however, that the vast majority of the genetic material in this population is of westslope cutthroat trout origin as the average frequency of the five alleles that we can assign to this fish (Aat1(200), Gpi3(92), Idh3(86), Me1(88), and Sdh(40)) in the sample is 0.941.

Sincerely,

Robb Leary

Robb Leary

RL/pkf
Enclosures

Description of study sites

USFS-FWP Sediment fishery study on Rock Creek and Bitterroot River tributaries. All study sections are marked with a steel fence post at the lower boundary of the section.

Rock Creek Drainage

Ross Fork of Rock Creek (830 feet long)

Upper boundary is first bridge crossing of Ross Fork. Lower boundary is adjacent to small pull out; 4.75 miles fromt he turn-off on to the Ross Fork Road.

West Fork of Rock Creek - lower (1,770 feet long)

Lower boundary is 2.28 miles from junction of West Fork Road and main Rock Creek roads; lower boundary 20 feet below culvert and 0.14 miles below the bridge crossing on the West Fork. Upper boundary is the old bridge abutments approximately 800 feet above West Fork bridge.

West Fork of Rock Creek - upper (1,250 feet long)

Upper boundary begins at small undeveloped campground 0.4 miles from Skalkaho Pass on the Sand Basin Road; about 0.1 miles above cattleguard.

Sand Basin Creek - lower (760 feet long)

Upper boundary is at red "X" on boulder. Lower boundary is adjacent to road location 0.3 miles upstream on Sand Basin Creek Road from Sand Basin road; a small meadow opens up just above the lower boundary; lower boundary begins downstream from meadow about 200 feet in the trees.

Sand Basin Creek - upper (620 feet long)

Lower boundary begins adjacent to small undeveloped camping site on edge of large meadow; 3.2 miles up Sand Basin Creek road.

Bitterroot River Drainage

Daly Creek (750 feet long)

0.65 miles upstream along Skalkaho Road from the Skalkaho-Rye road turn-off; wide pull out at upper end of section; section extends 200 feet above wide turn out area as creek turns back toward road to 550 feet below the wide turn-out area.

Sleeping Child Creek - lower (400 feet long)

2.85 miles downstream from bridge below mouth of hot springs. Lower boundary is approximately 150 feet above a concrete monolith in camping pull out.

Sleeping Child Creek - upper (400 feet long)

Stop at turn-out located at bottom of steeper grade heading up to the hot springs resort area; about 0.1 mile above bridge. Walk over hot springs mouth, upstream approximately 300 feet. Lower boundary is the USFS stream flow gage.

APPENDIX A3

Stream Sediment/Fisheries Study USFS/MTDFW&P
Project Costs Through the Month of September, 1985.

Period	Employee	Per Diem	Wages/Benefits	Other Expenses
July	Don	$ 23.00	$ 220.03	
August	Gary	195.50	1,414.42	$ 1.20 Ice (Electrophoresis)
	Ed	202.50	1,010.38	2.20 Generator fuel
	Don	151.52	2,203.27	1.04 Generator oil
		549.52	4,628.07	4.44
			+ 549.52	
			+ 4.44	
			$5,182.03 August Total	
September	Gary	41.50	1,069.61	29.85 Felt soles
	Ed	41.50	788.10	1.20 Ice (Electrophoresis)
	Don	26.50	1,177.89	104.00 Repair raft
		109.50	3,035.60	125.00 Raft frame
			+ 109.50	260.05
			+ 260.05	
			$3,405.15 September Total	