To: Chris Hunter

Preliminary Estimates for Trout Densities in the Middle Clark Fork River if Milltown Dam and Reservoir Were Not Present

Prepared for:
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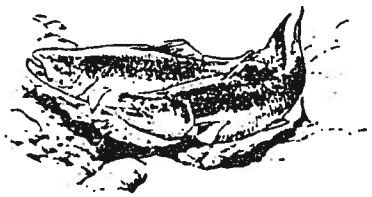


The middle Clark Fork River (CFR) from Milltown Dam to the confluence of the Flathead River, presently supports a relatively sparse trout population. Estimates for trout densities average 378/mile over this 120-mile river reach. Section averages for estimates taken over the last six years are:

DFWP Section	Trout/Mile
Milltown	441
Missoula (below the Bitterroot)	275
Huson	478
Superior	430
St. Regis	274
Quinn (above the Flathead)	238

Rainbow trout make up approximately 90% of the middle CFR trout fishery. Brown trout are the second-most common species, followed by lesser numbers of westslope cutthroat and bull trout (Appendix A). Trout population averages for the CFR are far below the values for other large Montana rivers; i.e. the Madison (4466/mi); Missouri at Craig (3590/mi); Yellowstone at Livingston (2307/mi); Missouri at Cascade (1581/mi); and the Yellowstone at Corwin Springs (1109/mi). Even the CFR's major headwater tributaries, Rock Creek (1518/mi) and the Blackfoot River (1066/mi) contain significantly higher numbers of trout.

The trout fishery in the middle CFR is not impacted by dewatering, elevated summer water temperatures and/or channel or streambank alterations to the extent that occurs on many other Montana trout rivers. The nutrient regime of the middle CFR is

comparable to other similar-sized trout streams, particularly the middle Missouri and Yellowstone rivers (Figure 1). As can also be seen on this graph, nutrient levels in the middle CFR are also equal to, or greater than, levels found in Rock Creek or the Blackfoot River.

The water quality impacts associated with mining wastes in the headwaters dissipate substantially after the confluence of Rock Creek and the Blackfoot River. Figure 2 displays average instream concentrations for total recoverable copper at 19 monitoring stations on the CFR during fiscal years 1988 and 1989. Stations 7 (Warm Springs) through 13 (Turah) are above Milltown Dam. Station 15 (above Missoula) through 25 (above the Flathead) are in the middle CFR.

Figure 3 shows that while the instream criterion for copper was routinely exceeded in the upper river, in the CFR between Milltown and the Bitterroot (Stations 15-18), it was exceeded during less than 10% of the sampling dates. Below the Bitterroot to the confluence of the Flathead this instream criterion, which is based on levels that must not be exceeded if trout and associated aquatic life are to be protected, was never violated from July 1987 to June 1989.

Wastewater treatment efforts at the Missoula WWTP and the Stone Container Corporation have improved significantly over the last decade. In the Missoula area, toxic discharges originating from dry cleaning, petroleum, dental plating and other industrial and agricultural sources have been steadily reduced. Generally

Figure 1. Comparison of nutrient concentrations, as a soluble reactive phosphorus, in the Clark Fork River to other Montana trout streams. Stations 7 through 13 are in the river above Milltown. Stations 15.5 through 25 are in the middle CFR (taken from Knudson, 1992).

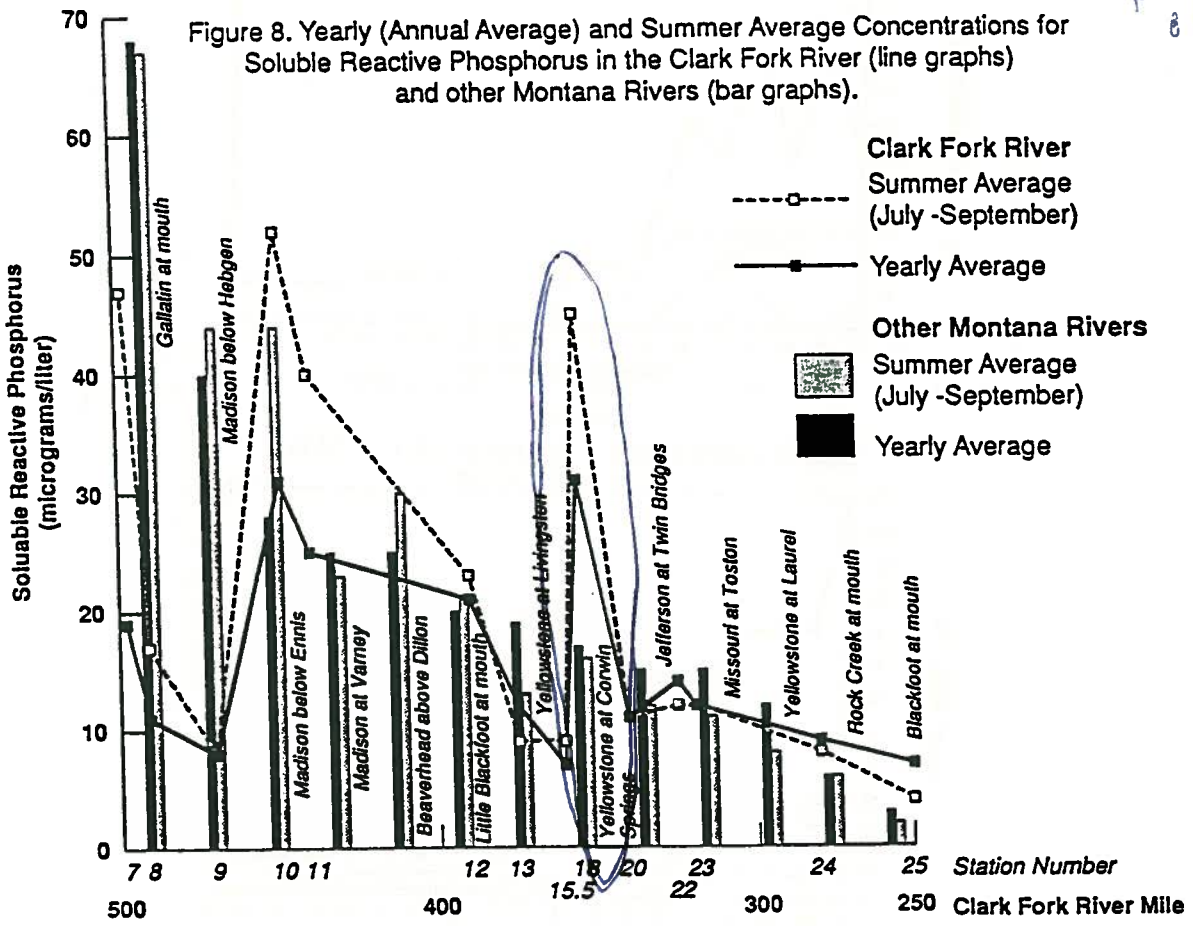


Figure 2. Total recoverable copper concentrations in the Clark Fork River, July 1987 to June 1989. Stations 15-25 are in the middle Clark Fork (taken from Ingman, 1990).

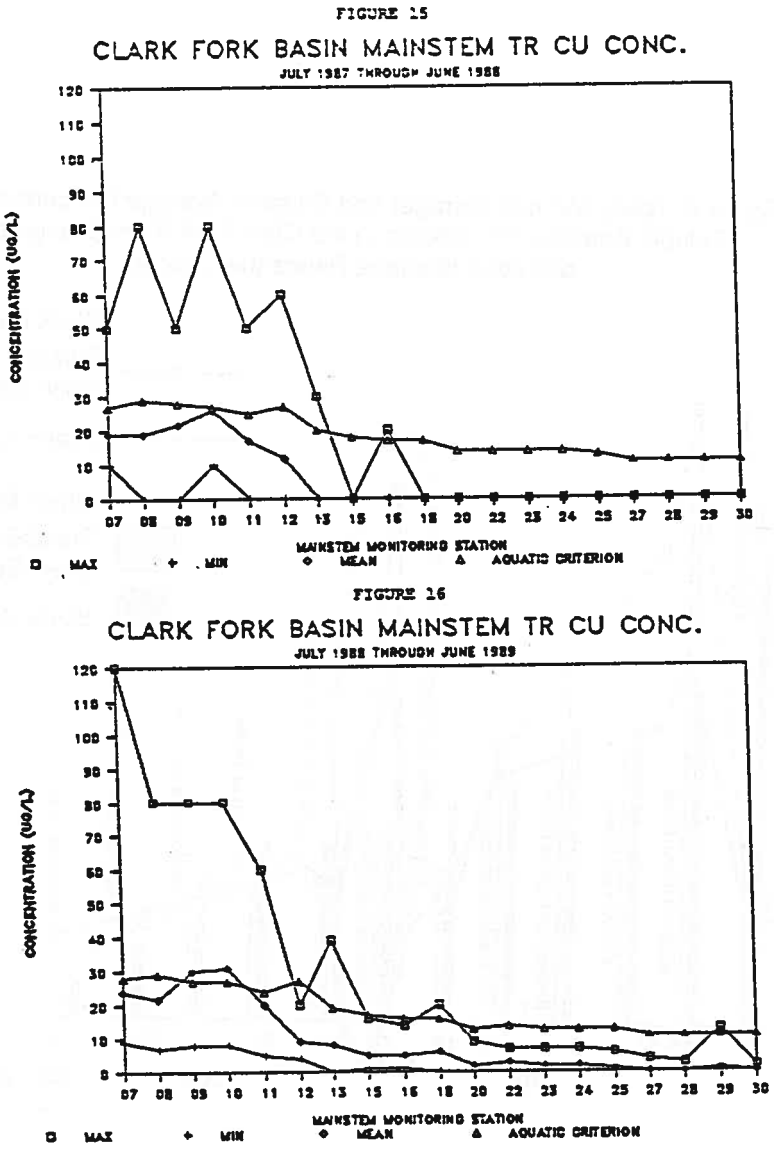


Figure 3. Frequency of exceedence of the instream criterion for copper in the Clark Fork River, July 1987 to June 1989 (taken from Ingman, 1990).

FIGURE 29

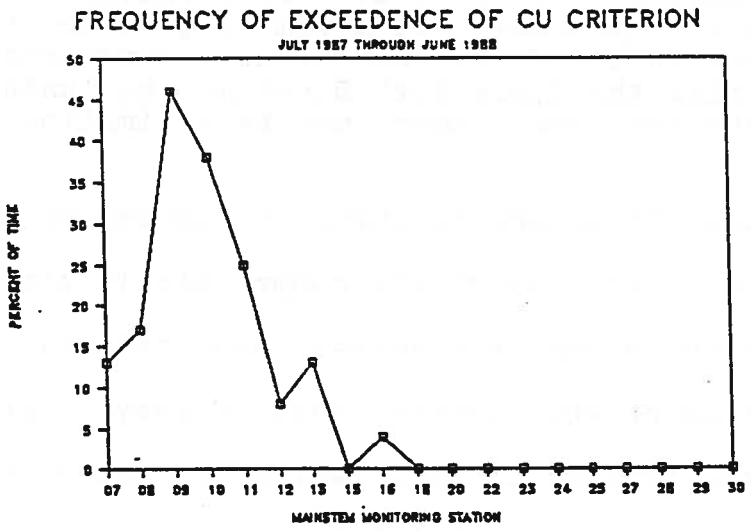
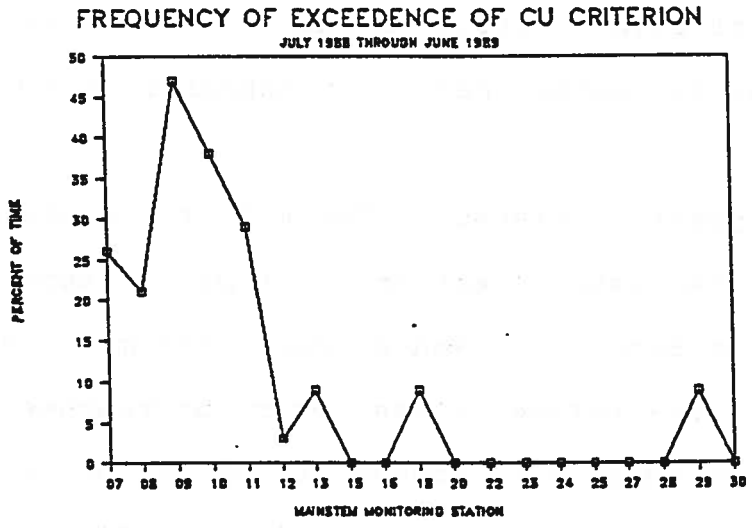


FIGURE 30



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speaking, fish habitat and water quality conditions in the middle Clark Fork appear adequate enough to support more trout than are present. Furthermore, the food base for trout in the middle CFR appears to be more than adequate. Quoting from Berg (1990):

> "Preliminary findings indicate growth rates of trout in the Clark Fork are relatively high when compared to trout streams of similar size. This indicates that food supply is probably not a limiting factor for trout populations in the Clark Fork River. Furthermore, it suggests that the Clark Fork River may be 'under seeded' and that recruitment may be a limiting factor."

The rainbow, brown and cutthroat fisheries of the Missouri and Yellowstone rivers, which are comparable in size to the middle CFR, depend almost exclusively upon tributaries for reproduction (Leathe and Licknes, 1988; Clancy, 1988). In the middle CFR there appears to be a lack of suitable spawning and rearing tributaries for river trout; the length-frequency distribution of rainbow trout in the middle CFR versus the Missouri River at Cascade certainly supports this observation (Table 1).

For the years displayed in Table 1, the average population estimate for the Cascade section (1774/mi) is about 3 times higher than the Superior/Huson average (593/mi). But, a more graphic difference between these two river reaches is found in the smallest measured size groups, trout in the 7- to 9-inch range. The Missouri River's population of 544/mile is over 8 times greater than for the middle CFR (67/mi). The 9- to 11-inch size group in the Missouri population is about 4 times more

Table 1. Length-frequency distribution for rainbow trout in the middle Clark Fork versus the Missouri River.

Length (inches)	Missouri at Cascade; Fall 1990 & 1991 average		Clark Fork at Superior; Fall 1988 & 1989 plus Huson Fall 1988 average	
	Per mile		Per mile	
17+	46	3%	24	4%
15-17	156	9%	87	14%
13-15	174	10%	143	24%
11-13	124	7%	79	13%
9-11	730	41%	193	33%
7-9	554	31%	67	11%
Total	1774/mi		593/mi	

numerous than for the CFR (730 vs. 193.mi). The significantly smaller relative abundance of trout in the smallest size groups on the CFR certainly supports a conclusion that recruitment of young fish is a major factor limiting trout numbers in this river reach.

The only tributaries in the middle CFR basin that presently support significant spawning runs for river rainbow trout are Ninemile, Petty, Fish and Trout creeks. The St. Regis River, which has an extremely high logging road density and has been channelized between a railroad, four-lane interstate highway and various frontage/access roads, does not support a rainbow trout spawning run of any significance.

The watersheds for all of the above streams have been heavily logged and roaded during the past 30 years. Past and active mining operations also degrade these streams, particularly Ninemile and Trout creeks. Cattle grazing has affected riparian areas and streambanks and contributes to erosion problems in these watersheds. These environmental impacts cause, or certainly contribute to resident trout densities being low in these tributaries; e.g. ranging from 100 to 400 trout per mile.

In contrast, Rock Creek and the Blackfoot River, two tributaries that have been severed from the middle CFR since 1907 by Milltown Dam, have less impacted watersheds and more productive trout fisheries. Rock Creek's basin is relatively pristine and undeveloped. All or portions of five designated or proposed wilderness areas are within this watershed. There has

been no significant logging and associated road building in Rock Creek's basin for nearly fifteen years. Recent mining has been limited and carefully monitored.

Excellent water quality, habitat and management have enabled Rock Creek to become western Montana's best trout stream. The Blackfoot River, although impacted by all of the problems found in the middle CFR tributaries, continues to be resilient enough to support a decent trout fishery -- at least in its lower reaches. Growing public and professional concern about the noticeable decline in this river's trout fishery will hopefully lead to actions that will return the Blackfoot to its full trout-producing potential.

Because of Milltown Dam, spawning trout from the middle CFR have been, and continue to be, denied access to the Blackfoot River and Rock Creek. Additionally, most of the juvenile trout from these tributaries that try to emigrate below Milltown are likely eaten by squawfish in Milltown Reservoir or are injured or killed passing through the dam's turbines.

Comparing the length-frequency distribution of rainbow trout in the Milltown section versus the lower Blackfoot River at Johnsrud Park reveals significant differences between the two populations (Table 2). The most noticeable factor regarding the Blackfoot River's population is the high relative abundance of smaller-sized fish. Nearly two-thirds of the population is less

Table 2. Length-frequency distribution for rainbow trout in the Blackfoot River at Johnsrud Park versus the CFR at Milltown.

Length (inches)	Blackfoot; Fall 1989, 1990 & 1991 average: Per mile		Milltown; Fall 1988 and 1991 average: Per mile	
15+	5	1%	9	2%
13-15	35	4%	93	20%
11-13	123	13%	142	30%
9-11	195	20%	80	17%
7-9	316	33%	135	29%
5-7	285	30%	13	3%
Total	960/mi		472/mi	

than 9 inches in length, with nearly one-third being in the 5- to 7-inch range.

The Milltown section, on the other hand, is top-heavy with larger-sized trout; i.e. 52% are larger than 11 inches at Milltown compared to 18% in this size group at Johnsrud Park. As well, rainbow trout in the 5- to 7-inch group at Milltown were conspicuously more scarce than on the lower Blackfoot (13/mile versus 285/mile, roughly a twenty-fold difference). This suggests that small rainbow trout trying to emigrate from the lower Blackfoot River and Rock Creek to the Milltown section likely suffer high mortality rates in the dam/reservoir complex.

not necessarily but it does indicate recruitment is a problem.

If Milltown Dam were not present, reproductive and recruitment opportunities for the trout fishery of the middle CFR would be greatly enhanced. An estimate of the degree of this enhancement can be made by comparing present spawning and rearing opportunities for this river reach to potential opportunities that would be provided by Rock Creek and the Blackfoot River. Three assumptions are made: 1) that the water quality and watershed conditions of Rock Creek and the Blackfoot River are at least as good as those in the tributary basins that presently support the middle CFR trout fishery; 2) that the average annual discharge of streams can be used to compare their relative sizes, and therefore, their potential capacity to support spawning and recruitment for a mainstem trout fishery; and 3) that river trout

only if assumption 1 is correct

would migrate to Rock Creek and the Blackfoot River if these streams were available for spawning.

Evidence to support the latter assumption can be found in tag return studies conducted on the middle CFR. Fish tagged at the Quinn section have been found to travel as far as Ninemile Creek, a distance of over 80 miles, to spawn. Also, trout in the Clark Fork River above Milltown presently utilize Rock Creek for spawning.

The approximate average annual discharges of tributaries presently supporting spawning and recruitment for trout in the middle CFR are:

	Average annual discharge estimated range (cfs)
Ninemile Creek	132 - 132
Petty Creek	55 - 78
Fish Creek	295 - 430
Trout Creek	68 - 110
Total	550 - 750 cfs

The data for Ninemile Creek is based upon USGS gauging records. The range of values for Petty, Fish and Trout creeks are estimates based upon stream discharge measurements taken by the DFWP and DHES from 1986 to 1990; comparisons of relative basin sizes and topography; and correlations with historical USGS records for gauges on the St. Regis River and Ninemile Creek (see Appendix B for raw data).

Based upon USGS gauging records the average annual discharge for potential spawning and recruitment streams are:

	Average annual discharge (cfs)
Rock Creek	464
Blackfoot River	1633
Total	2097 cfs

By comparing the relative sizes of these streams, based upon their average annual streamflows, we can estimate the population density that would be present if Rock Creek and the Blackfoot River were available to provide spawning and recruitment to the mainstem:

Present Situation
Average annual discharge of tributaries = 550 - 750 cfs
Average mainstem trout population = 378/mile

Estimated Population
Average annual discharge of Rock Creek plus the Blackfoot River = 2097 cfs

1. Assuming present tributaries = 750 cfs

$$\frac{378 \text{ per mile}}{750 \text{ cfs}} = \frac{x \text{ per mile}}{(750 + 2097 \text{ cfs})}$$

$$x = 1435 \text{ trout/mile}$$

2. Assuming present tributaries = 550 cfs

$$\frac{378 \text{ per mile}}{550 \text{ cfs}} = \frac{x \text{ per mile}}{(550 + 2097)}$$

$$x = 1819 \text{ trout/mile}$$

Potential trout densities in the middle CFR can also be obtained, although less precisely, by again comparing the length-frequency distribution of trout populations in this reach to those in the lower Blackfoot and middle Missouri rivers. Table 1 shows that, on the Missouri, trout larger than 13 inches make up only 22% of the population, compared to 42% on the CFR. If recruitment of small trout was not a problem in the middle CFR, the size distribution of the trout population at Huson/Superior should be similar to that on the Missouri at Cascade. If we assume that the number of trout greater than 13 inches at Huson/Superior (which total 254/mile; see Table 1) accounted for only 22% instead of 42% of the population, an estimated population density for this reach would be:

$$254 \text{ mi} = 22\% \times$$
$$x = 1154/\text{mi}$$

Using similar length-frequency comparisons for the CFR at Milltown and the lower Blackfoot River (Table 2) yields a projected estimate for the Milltown section:

% of trout greater than 11 inches
Milltown = 52%
Blackfoot = 18%

Number of trout greater than 11 inches presently at Milltown = 244/mi

$$244/\text{mi} = 18\% \times$$
$$x = 1356/\text{mi}$$

More refined quantification of the increase in spawning and recruitment provided by Rock Creek and the Blackfoot River and the resulting population increases in the CFR could be obtained by calculating the actual miles and/or surface area of streambottom suitable for spawning and rearing on all present versus potential tributaries. This information could be computed from existing information, utilizing large scale topographic maps and DFWP and USFS data on existing or potential spawning streams or stream reaches. Where hard data does not exist, the best judgement of fisheries biologists most familiar with the Rock Creek, Blackfoot River and middle CFR watersheds would be extremely helpful.

It is clear however that

Angler use, or fishing pressure, on streams is influenced by aesthetics, ease of access, proximity to population centers and, of course, the likelihood of being able to catch a fish. Table 3 displays the population density (trout per mile), angler use days (fishing pressure) and total length of the middle CFR compared to other Montana river reaches. The "angler pressure per mile" column is derived by dividing the total fishing pressure values by the length of the reach. Fishing pressure values are from a state-wide angler survey conducted by DFWP in 1985 and reported in Duffield (1987).

Not surprisingly, higher trout population densities tend to support higher angler use. The Madison receives the highest

Table 3. Trout population densities and angler use for select reaches of Montana trout streams.

Stream Reach	Trout per Mile	Fishing Pressure (days)	Reach Length (miles)	Angler Pressure (per mi)
Middle Clark Fork	378	30,414	120	253
Upper Yellowstone				
Corwin Spring	1109			
Livingston	2307			
Average	1708	52,016	85	612
Middle Missouri				
Craig	3590			
Cascade	1581			
Average	2580	72,788	55	1323
Madison	4466	108,712	105	1035

fishing pressure of any river in Montana, while the middle Missouri receives the highest angler use per mile of any river reach in the state. The upper Yellowstone supports a trout population density close to the projected range of values estimated for the middle CFR if Milltown Dam were not present; i.e., Yellowstone = 1708/mi, middle CFR = 1154-1819/mi. By assuming that increased numbers of trout would lead to increased angler use, we can estimate a range of projected fishing pressure values for the middle CFR:

	Trout Density		Angler Pressure
CFR low estimate Yellowstone	$\frac{1154/mi}{1708/mi}$	=	$\frac{x/mi}{612/mi}$

$x = 413/mi$

$\underline{(x\ 120\ mi)}$

49,560 angler days

CFR high estimate Yellowstone	$\frac{1819/mi}{1708/mi}$	=	$\frac{x/mi}{612/mi}$

$x = 652/mi$

$\underline{(x\ 120\ mi)}$

78,240 angler days

The estimated range of values as pressure per mile, for the middle CFR (413-652/mi) brackets the value for the upper Yellowstone. At the same time the CFR values are considerably less than the pressure per mile values for the Madison and middle Missouri (1035-1323/mi), streams that support substantially more trout per mile.

The above estimated angler use figures for the middle CFR were obtained using stream reaches that are similar in size and accessibility to the middle CFR. Refinement of these figures might be possible by more thoroughly evaluating all stream reaches in Montana that have current trout population density and fishing pressure estimates. Care would have to be taken, however, when comparing density and pressure values for small versus large streams. As well, given the close proximity of Missoula, a major population center, to the middle CFR, these estimates are probably conservative.

As a final point, it should be noted that any estimates for trout population densities and resulting angler use on the middle CFR should consider the lingering impacts of heavy metal toxicity to the river's aquatic life. As displayed earlier in Figures 2 and 3, it appears that instream concentrations of heavy metals definitely impact the trout fishery of the upper river, but this impact lessens below the confluence of Rock Creek, the Blackfoot River and finally the Bitterroot River. This is to be expected, since each of these tributaries, in turn, roughly double the discharge or dilution capacity of the mainstem. Nonetheless, there still are instances when instream concentrations in the CFR exceed criteria recommended for the protection of trout, particularly in the reach from Rock Creek to Milltown.

Since 1984, the MDHES, Water Quality Bureau, has been collecting surface water samples for heavy metal analyses from

stations listed in Figures 2 and 3 at a frequency of 12 to 15 times per year. Using this data base, the average frequency of criteria exceedence for heavy metals and estimates of the duration of these water quality problems can be made for the Rock Creek to Milltown, Milltown to Bitterroot and Bitterroot to Flathead reaches of the middle CFR. This information, combined with the periodicity and duration of expected juvenile trout emigrations from Rock Creek and the Blackfoot River, will help determine the degree of impact that heavy metals may have upon potential recruits from these tributaries.

Preliminary estimates, based upon a cursory review of the Water Quality Bureau's data, suggest that heavy metal toxicity may lower the potential contribution of recruits from Rock Creek to the middle CFR by at most 25%. Potential recruitment of young trout from the Blackfoot River might be lowered by 10-15%. Below the confluence of the Bitterroot, young trout would rarely be subjected to toxic concentrations of heavy metals. However, as stated earlier, a more complete analysis of the WQB's data base should be made to better quantify these preliminary impact estimates.

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Appendix A. Relative abundance of trout species in the middle Clark Fork River

MILLTOWN SECTION CATCHABLE TROUT POPULATION DENSITY

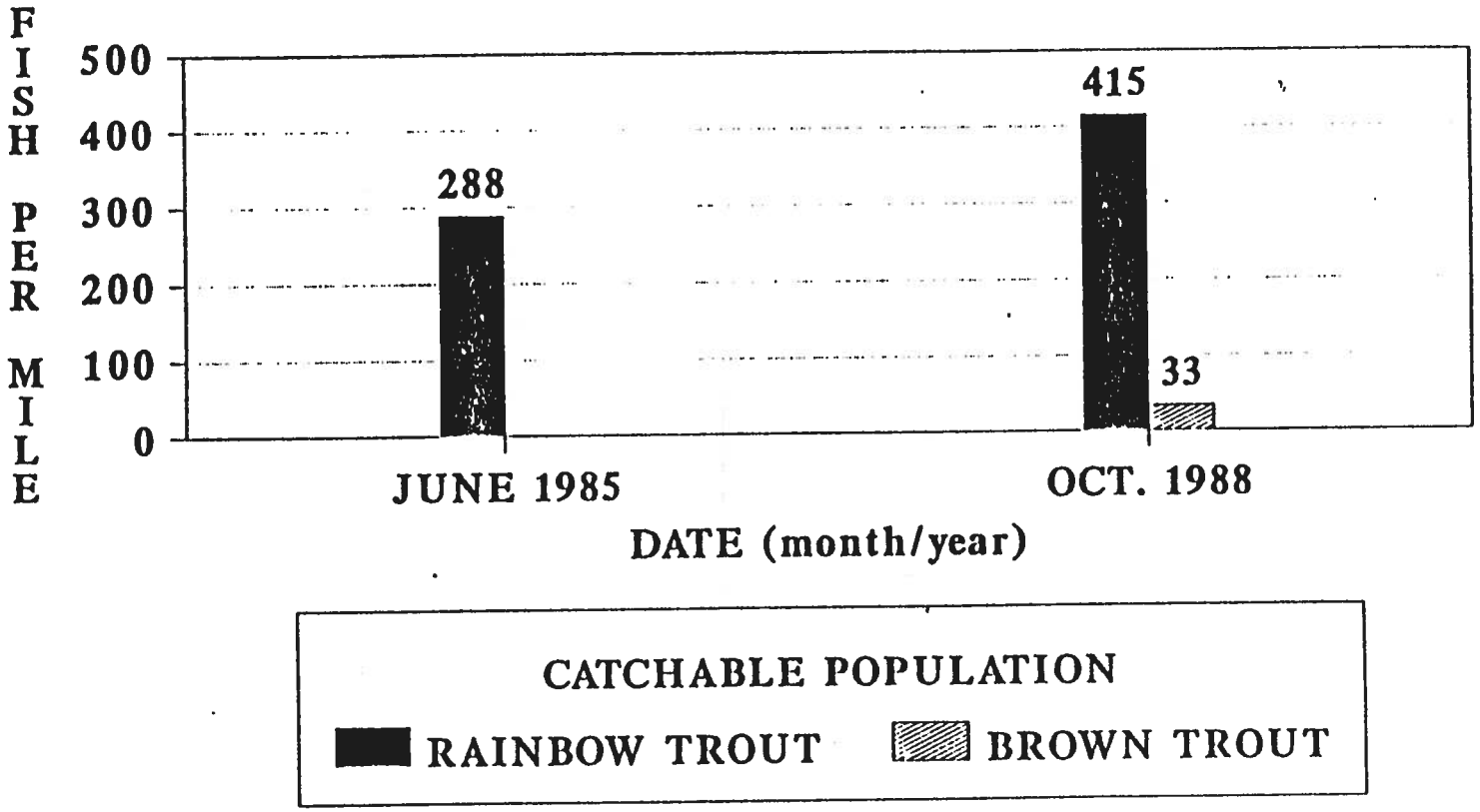

Figure 2. Catchable trout population density trends in the Milltown study section.

MISSOULA SECTION CATCHABLE TROUT POPULATION DENSITY

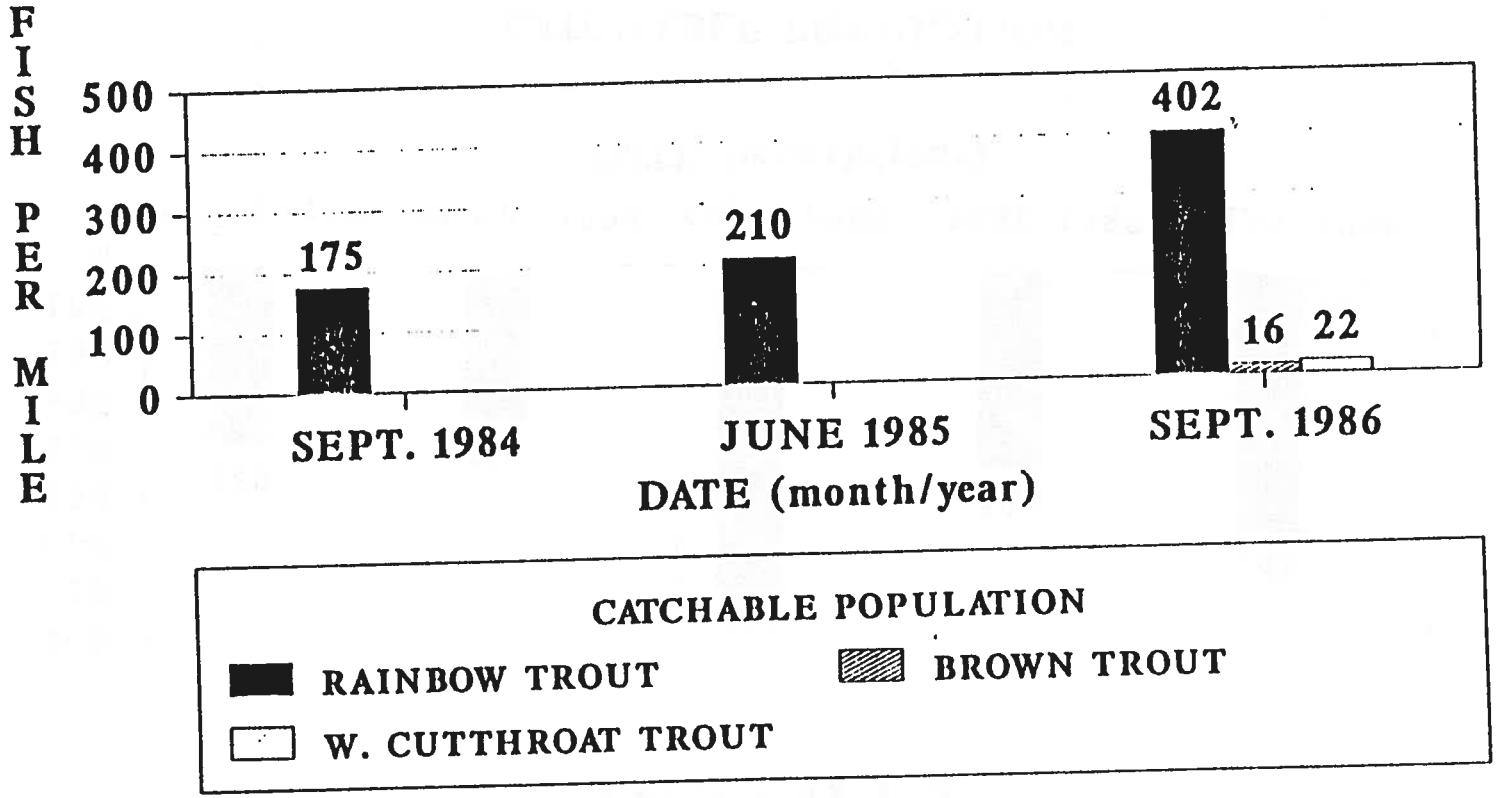

Figure 3. Catchable trout population density trends in the Missoula study section.

HUSON SECTION
CATCHABLE TROUT POPULATION DENSITY

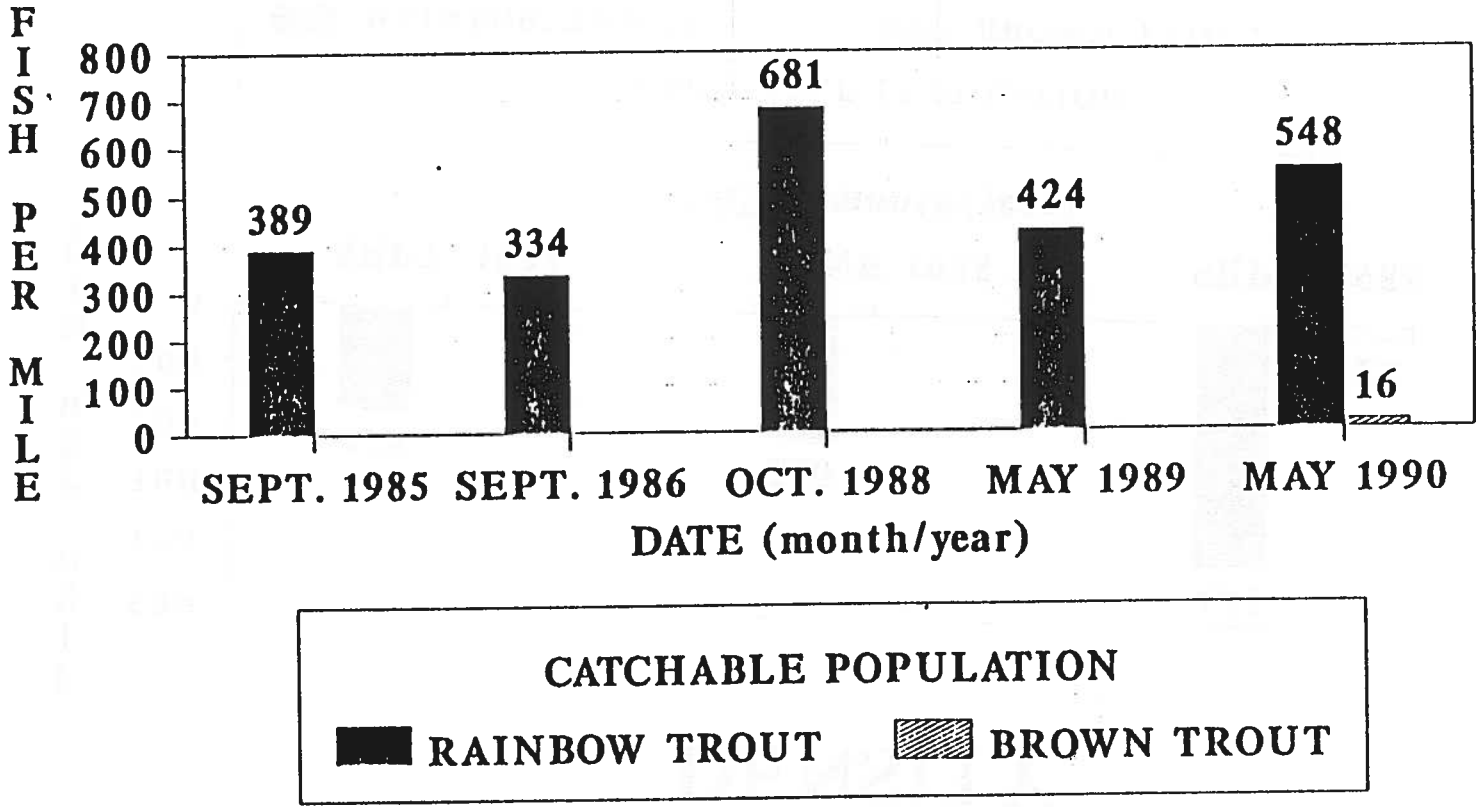

Figure 4. Catchable trout population density trends in the Huson study section.

SUPERIOR SECTION
CATCHABLE TROUT POPULATION DENSITY

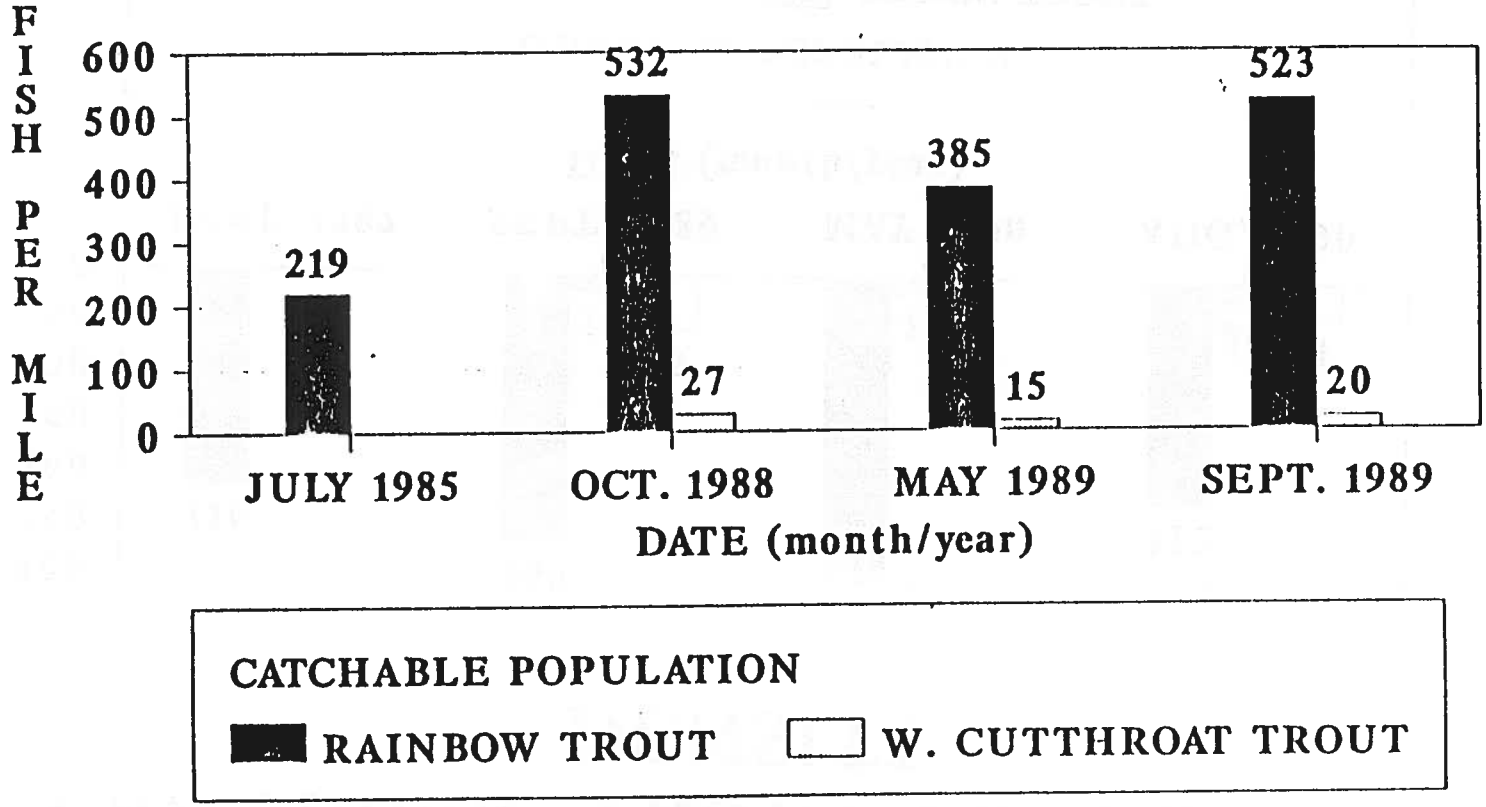

Figure 5. Catchable trout population density trends in the Superior study section.

ST. REGIS SECTION CATCHABLE TROUT POPULATION DENSITY

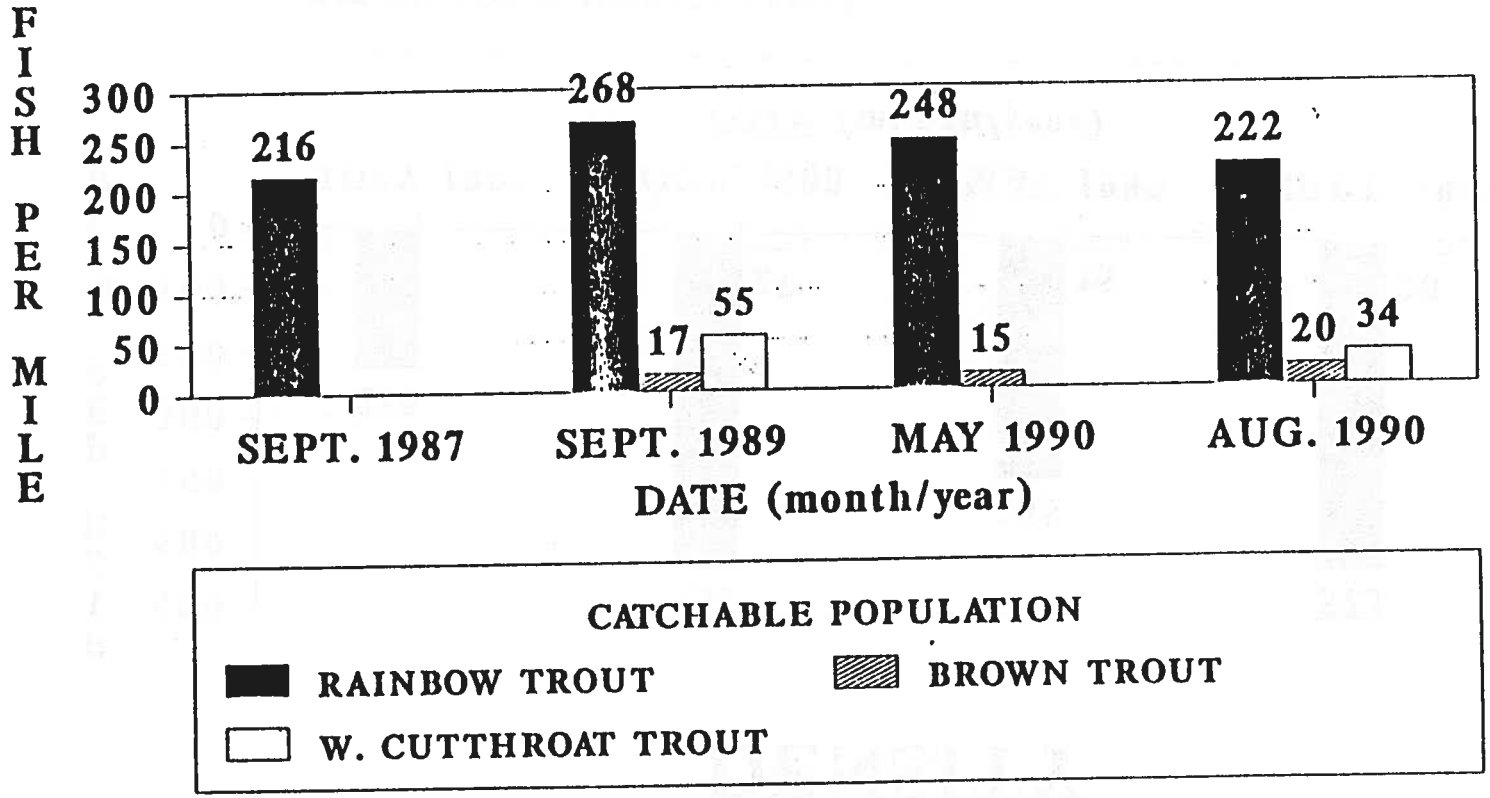

Figure 6. Catchable trout population density trends in the St. Regis study section.

QUINN SECTION
CATCHABLE TROUT POPULATION DENSITY

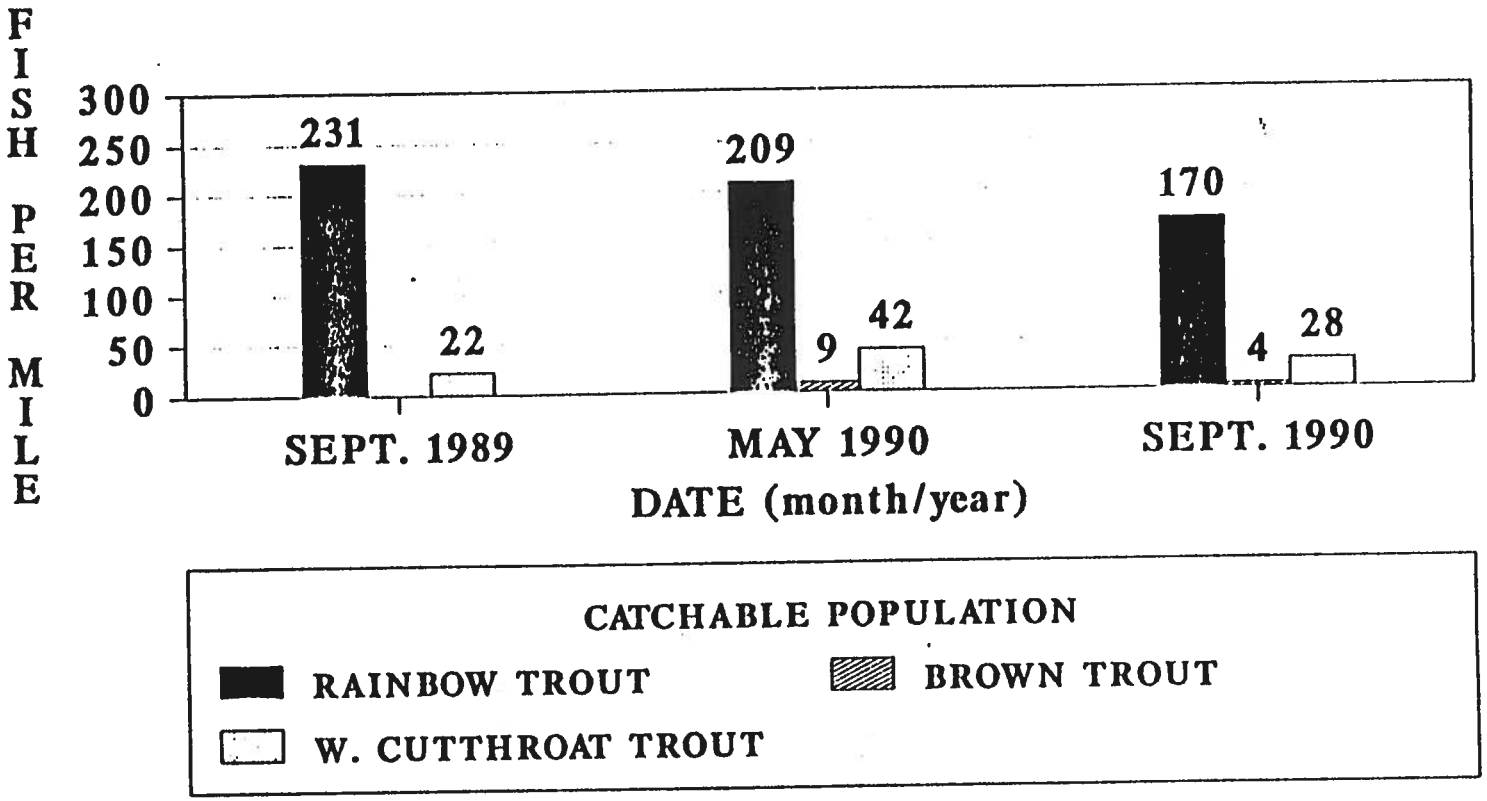

Figure 7. Catchable trout population density trends in the Quinn study section.

Appendix B. Stream discharge data

CLARK FORK BASIN MONITORING - FY 1990 MONTANA WATER QUALITY BUREAU GARY INGMAN

Station: 22.5 Ninemile Creek near mouth

Monthly Average Values

Month	N=	Stream-flow (cfs)	Water Temp. (deg.C)	pH	Diss.Ortho P (SRP) Conc. (ug/l as P)	Total P Conc. (ug/l as P)	Diss.NO3+NO2 Conc. (ug/l as N)	Diss.NH3+NH4 Conc. (ug/l as N)	Total KJL-N Conc. (ug/l as N)	TSIN Conc. (ug/l as N)
JUL	1	32.2			2	20	20	10 <	100 <	20
AUG	1	26.8			5	14	10 <	10 <	100 <	10 <
SEP	1	27.3			4	9	10 <	10 <	100 <	10 <
OCT	1	25.2			2	10	10 <	10 <	100 <	10 <
NOV	1	44.5			5	11	10 <	10 <	100 <	10 <
DEC	1	49.9			4	4	30	10 <	100 <	30
JAN	1	54.2			4	12	60	10 <	100 <	60
FEB	1	24.1			2	8	10 <	10 <	100 <	10 <
MAR	1	49.9			3	13	20	10 <	200	20
APR	2	292.0			4	24	10 <	10	400	10
MAY	2	212.0			4	14	10	10 <	100	10
JUN	2	384.0			6	18	10 <	10 <	200	10 <
N=	15	12	0	0	12	12	12	12	12	12
Max		384.0			6	24	60	10	400	60
Min		24.1			2	4	10 <	10 <	100 <	10 <
Mean		101.8			4	13	12	10 <	100 <	13
Annual Nutrient Load (tons/year)					0.43	1.67	0.71	0.24	18.26	0.95

Frequency of Exceedence	
Phosphorus Criterion	0%
Nitrogen Criterion	0%
Magnitude of Exceedence	
Phosphorus Criterion	0.3 X
Nitrogen Criterion	0.0 X
NUTRIENT ENRICHMENT SEVERITY SCORE	
PHOSPHORUS	0.00
NITROGEN	0.00
CUMULATIVE SCORE	0.00

Frequency of Exceedence	
Chronic Ammonia Criterion	ERR
Acute Ammonia Criterion	ERR
Magnitude of Exceedence	
Chronic Ammonia Criterion	ERR X
Acute Ammonia Criterion	ERR X
AMMONIA TOXICITY SEVERITY SCORE	
CHRONIC	ERR
ACUTE	ERR

NOTE:Monthly average streamflows are USGS monthly means where available.

Nutrient values less than the analytical detection limit are denoted with a less than sign (<) following the result and are considered to be zero in the data computations.

Ammonia toxicity evaluations valid for temperatures between -1 and 30 degrees Centigrade and pH's between 6.5 and 9.0 only. Values outside of these ranges will result in errors.

CLARK FORK BASIN MONITORING - FY 1990 MONTANA WATER QUALITY BUREAU GARY INGMAN

Monitoring Station:22.5 Ninemile Creek near mouth

Instantaneous Values

Date	Stream-flow (cfs)		Water Temp. (deg.C)	pH	Diss.Ortho P (SRP) Conc. (ug/l as P)	Total P Conc. (ug/l as P)	Diss.NO3+NO2 Conc. (ug/l as N)		Diss.NH3+NH4 Conc. (ug/l as N)		Total KJL-N Conc. (ug/l as N)		TSIN Conc. (ug/l as N)	
Jul 19	32.2	(I)			2	20	20		10	<	100	<	20	
Aug 16	23.1	(I)			5	14	10	<	10	<	100	<	10	<
Sep 20	27.3	(I)			4	9	10	<	10	<	100	<	10	<
Oct 18	24.1	(I)			2	10	10	<	10	<	100	<	10	<
Nov 15	47.2	(I)			5	11	10	<	10	<	100	<	10	<
Dec 12	49.9	(I)			4	4	30		10	<	100	<	30	
Jan 16	54.2	(I)			4	12	60		10	<	100	<	60	
Feb 05	24.1	(I)			2	8	10	<	10	<	100	<	10	<
Mar 13	49.9	(I)			3	13	20		10	<	200		20	
Apr 10	221.0	(I)			3	18	10	<	20		400		20	
Apr 23	421.0	(I)			5	29	10	<	10	<	400		10	<
May 08	260.0	(I)			5	15	20		10	<	100	<	20	
May 22	164.0	(I)			3	13	10	<	10	<	200		10	<
Jun 06	396.0	(I)			5	21	10	<	10	<	200		10	<
Jun 18	252.0	(I)			6	15	10	<	10	<	200		10	<
N=	15		0	0	15	15	15		15		15		15	
Max	421.0				6	29	60		20		400		60	
Min	23.1				2	4	10	<	10	<	100	<	10	<
Mean	136.4				4	14	10		10	<	107		11	

NOTE:Estimated streamflows are denoted with an (E) following the value.
Instantaneous streamflows (gaged) are denoted with an (I) following the value.
Mean daily streamflows (USGS) are denoted with an (M) following the value.

Nutrient values less than the analytical detection limit are denoted with a less than sign (<) following the result and are considered to be zero in the data computations.

CLARK FORK BASIN MONITORING - FY 1990 | MONTANA WATER QUALITY BUREAU | GARY INGMAN

Station: 23.7 Fish Creek near mouth

Monthly Average Values

Month	N=	Stream-flow (cfs)	Water Temp. (deg.C)	pH	Diss.Ortho P (SRP) Conc. (ug/l as P)	Total P Conc. (ug/l as P)	Diss.NO3+NO2 Conc. (ug/l as N)	Diss.NH3+NH4 Conc. (ug/l as N)	Total KJL-N Conc. (ug/l as N)	TSIN Conc. (ug/l as N)
JUL	1	184.0			1 <	7	30	10 <	100 <	30
AUG	1	112.0			2	3	10 <	10 <	100 <	10 <
SEP	1	94.0			2	4	10 <	10 <	100 <	10 <
OCT	1	83.2			1 <	3	40	10 <	100 <	40
NOV	1	232.0			2	4	50	10 <	100	50
DEC	1	265.0			1	1	70	10 <	100 <	70
JAN	1	199.0			1	3	50	10 <	100 <	50
FEB	1	133.0			2	4	60	10 <	200	60
MAR	1	158.0			2	7	40	10 <	100	40
APR	2	898.0			2	15	90	10	250	100
MAY	2				2	3	80	10 <	100 <	80
JUN	2	986.0			2	6	50	10 <	100	50
N=	15	12	0	0	12	12	12	12	12	12
Max		986.0			2	15	90	10	250	100
Min		0.0			1 <	1	10 <	10 <	100 <	10 <
Mean		278.7			1	5	47	10 <	100 <	48
Annual Nutrient Load (tons/year)					0.42	2.00	15.71	0.73	31.33	16.43

Frequency of Exceedence	
Phosphorus Criterion	0%
Nitrogen Criterion	0%
Magnitude of Exceedence	
Phosphorus Criterion	0.1 X
Nitrogen Criterion	0.0 X
NUTRIENT ENRICHMENT SEVERITY SCORE	
PHOSPHORUS	0.00
NITROGEN	0.00
CUMULATIVE SCORE	0.00

Frequency of Exceedence	
Chronic Ammonia Criterion	ERR
Acute Ammonia Criterion	ERR
Magnitude of Exceedence	
Chronic Ammonia Criterion	ERR X
Acute Ammonia Criterion	ERR X
AMMONIA TOXICITY SEVERITY SCORE	
CHRONIC	ERR
ACUTE	ERR

NOTE:Monthly average streamflows are USGS monthly means where available.

Nutrient values less than the analytical detection limit are denoted with a less than sign (<) following the result and are considered to be zero in the data computations.

Ammonia toxicity evaluations valid for temperatures between -1 and 30 degrees Centigrade and pH's between 6.5 and 9.0 only. Values outside of these ranges will result in errors.

CLARK FORK BASIN MONITORING - FY 1990 MONTANA WATER QUALITY BUREAU GARY INGMAN

Monitoring Station:23.7 Fish Creek near mouth

Instantaneous Values

Date	Stream-flow (cfs)		Water Temp. (deg.C)	pH	Diss.Ortho P (SRP) Conc. (ug/l as P)		Total P Conc. (ug/l as P)	Diss.NO3+NO2 Conc. (ug/l as N)		Diss.NH3+NH4 Conc. (ug/l as N)		Total KJL-N Conc. (ug/l as N)		TSIN Conc. (ug/l as N)	
Jul 19	184.0	(I)			1	<	7	30		10	<	100	<	30	
Aug 16	112.0	(I)			2		3	10	<	10	<	100	<	10	<
Sep 20	94.0	(I)			2		4	10	<	10	<	100	<	10	<
Oct 18	73.7	(I)			1	<	3	40		10	<	100	<	40	
Nov 15	242.0	(I)			2		4	50		10	<	100		50	
Dec 12	265.0	(I)			1		1	70		10	<	100	<	70	
Jan 16	199.0	(I)			1		3	50		10	<	100	<	50	
Feb 06	133.0	(I)			2		4	60		10	<	200		60	
Mar 14	158.0	(I)			2		7	40		10	<	100		40	
Apr 10	634.0	(I)			2		8	70		20		300		90	
Apr 23	1530.0	(I)			2		21	110		10	<	200		110	
May 08	883.0	(I)			3		2	100		10	<	100	<	100	
May 22	668.0	(I)			1		4	60		10	<	100	<	60	
Jun 06	1040.0	(I)			2		7	60		10	<	100		60	
Jun 18	932.0	(I)			1		5	40		10	<	100		40	
N=	15		0	0	15		15	15		15		15		15	
Max	1530.0				3		21	110		20		300		110	
Min	73.7				1	<	1	10	<	10	<	100	<	10	<
Mean	476.5				2		6	52		10	<	100	<	53	

NOTE:Estimated streamflows are denoted with an (E) following the value.
Instantaneous streamflows (gaged) are denoted with an (I) following the value.
Mean daily streamflows (USGS) are denoted with an (M) following the value.

Nutrient values less than the analytical detection limit are denoted with a less than sign (<) following the result and are considered to be zero in the data computations.

CLARK FORK BASIN MONITORING - FY 1990 MONTANA WATER QUALITY BUREAU GARY INGMAN

Station: 24.7 St. Regis River near mouth

Monthly Average Values

Month	N=	Stream-flow (cfs)	Water Temp. (deg.C)	pH	Diss.Ortho P (SRP) Conc. (ug/l as P)	Total P Conc. (ug/l as P)	Diss.NO3+NO2 Conc. (ug/l as N)	Diss.NH3+NH4 Conc. (ug/l as N)	Total KJL-N Conc. (ug/l as N)	TSIN Conc. (ug/l as N)
JUL	1	202.0			1	6	10	10 <	100 <	10
AUG	1	131.0			2	5	10 <	10 <	100 <	10 <
SEP	1	111.0			2	4	10 <	10 <	100 <	10 <
OCT	1	93.4			1	4	10 <	10 <	100 <	10 <
NOV	1	459.0			3	7	20	10 <	100	20
DEC	1	580.0			3	1	10	10 <	100	10
JAN	1	587.0			1 <	4	30	10 <	100	30
FEB	1	294.0			2	5	20	10 <	200	20
MAR	1	384.0			2	2	10	10 <	300	10
APR	2	2063.0			4	14	30	10	300	40
MAY	2	1370.0			3	6	10	10 <	150	10
JUN	2	1340.0			3	6	15	10 <	100	15
N=	15	12	0	0	12	12	12	12	12	12
Max		2063.0			4	14	30	10	300	40
Min		93.4			1 <	1	10 <	10 <	100 <	10 <
Mean		634.5			2	5	13	10 <	113	14
Annual Nutrient Load (tons/year)					1.57	4.43	11.40	1.67	105.56	13.07

Frequency of Exceedence
- Phosphorus Criterion 0%
- Nitrogen Criterion 0%

Magnitude of Exceedence
- Phosphorus Criterion 0.1 X
- Nitrogen Criterion 0.0 X

NUTRIENT ENRICHMENT SEVERITY SCORE
- PHOSPHORUS 0.00
- NITROGEN 0.00

CUMULATIVE SCORE 0.00

Frequency of Exceedence
- Chronic Ammonia Criterion ERR
- Acute Ammonia Criterion ERR

Magnitude of Exceedence
- Chronic Ammonia Criterion ERR X
- Acute Ammonia Criterion ERR X

AMMONIA TOXICITY SEVERITY SCORE
- CHRONIC ERR
- ACUTE ERR

NOTE:Monthly average streamflows are USGS monthly means where available.

Nutrient values less than the analytical detection limit are denoted with a less than sign (<) following the result and are considered to be zero in the data computations.

Ammonia toxicity evaluations valid for temperatures between -1 and 30 degrees Centigrade and pH's between 6.5 and 9.0 only. Values outside of these ranges will result in errors.

CLARK FORK BASIN MONITORING - FY 1990 MONTANA WATER QUALITY BUREAU GARY INGMAN

Monitoring Station:24.7 St. Regis River near mouth

Instantaneous Values

Date	Stream-flow (cfs)		Water Temp. (deg.C)	pH	Diss.Ortho P (SRP) Conc. (ug/l as P)		Total P Conc. (ug/l as P)		Diss.NO3+NO2 Conc. (ug/l as N)		Diss.NH3+NH4 Conc. (ug/l as N)		Total KJL-N Conc. (ug/l as N)		TSIN Conc. (ug/l as N)	
Jul 19	202.0	(I)			1		6		10		10	<	100	<	10	
Aug 16	117.0	(I)			2		5		10	<	10	<	100	<	10	<
Sep 20	111.0	(I)			2		4		10	<	10	<	100	<	10	<
Oct 18	92.1	(I)			1		4		10	<	10	<	100	<	10	<
Nov 15	459.0	(I)			3		7		20		10	<	100		20	
Dec 12	580.0	(I)			3		1		10		10	<	100		10	
Jan 16	587.0	(I)			1	<	4		30		10	<	100		30	
Feb 06	270.0	(I)			2		5		20		10	<	200		20	
Mar 14	384.0	(I)			2		2		10		10	<	300		10	
Apr 11	1890.0	(I)			3		8		30		20		400		50	
Apr 24	2610.0	(I)			4		19		30		10	<	200		30	
May 08	1630.0	(I)			3		6		20		10	<	100	<	20	
May 22	1110.0	(I)			2		5		10	<	10	<	300		10	<
Jun 07	1490.0	(I)			2		6		10		10	<	200		10	
Jun 19	1190.0	(I)			3		6		20		10	<	100	<	20	
N=	15		0	0	15		15		15		15		15		15	
Max	2610.0				4		19		30		20		400		50	
Min	92.1				1	<	1		10	<	10	<	100	<	10	<
Mean	848.1				2		6		14		10	<	127		15	

NOTE:Estimated streamflows are denoted with an (E) following the value.
Instantaneous streamflows (gaged) are denoted with an (I) following the value.
Mean daily streamflows (USGS) are denoted with an (M) following the value.

Nutrient values less than the analytical detection limit are denoted with a less than sign (<) following the result and are considered to be zero in the data computations.

DFWP Streamflow Data
(from Rod Berg)

Stage Discharge Relationships

	Gage	Calc. Flow	
Tamarack	3/6/89 5.28	8.17	← not accurate - Diff locations
	11/4/88 5.30	7.85	
	~~6/24/89~~ 7/12/88 5.34	10.94	
	4/24/89 5.64	18.87	
	5/2/89 5.93	29.78	
	5/8/89 6.34	48.70	
Cedar	4.34	0:00	To River
	6/24/89 4.62	3.22	Not Running To River
	8/20/87 4.83	10.16	
	8/11/89 4.90	15.33	
	7/17/89 5.15	41.39	
	6/7/87 5.40	55.60	
	4/11/89 5.66	68.11	
	5/19/87 5.94	120.14	Observed at 6.22 Too high
Fish	9/29/88 1.32	83.62	
	8/4/86 1.52	162.57	
	7/7/86 1.82	303.87	
	6/15/87 1.90	348.05	
	6/24/86 2.06	424.65	
Trout	~~9/29/87~~ 0.06	21.05	
	0.40	27.81 - '89	
	~~0.50~~	~~97.58~~) → ?	Throw out - erroneous gage height
	3/15/89 0.69	41.75 - '89	
	~~0.98~~	~~291.10~~ ? ?	Throw Out - erroneous gage height
	4/10/89 1.08	122.07 - '89	
	4/17/89 1.44	217.89 - '89	517/90 ¥11.6 - 743.91

	Gage	Calc Flow	
St. Regis	6/28/07 0.42	113.6	
	10/24/07 0.56	164.17	
	7/21/07 0.60	171.51	
	6/23/08 1.08	384.38	
	4/7/08 1.63	746.80	observed at 3.50 Too high
12 mile	-0.05	7.16	
	0.08	10.82	
	0.46	25.99	
	0.93	56.81	
	1.28	115.47	observed at 1.96 Too high
Little Joe	0.88	4.53	
	1.01	7.10	
	1.18	22.44	
increase to St. Regis Rd	1.84	66.41	have side channel reading
	2.07	157.44	1.74 - Flow @ 2.45
	2.28	164.46	
	2.46	209.20	
Ward	4.37	9.88	
	4.48	13.70	
	4.54	17.44	observed at 5.38 Too high
	5.10	74.08	

Station 12354000 ST. REGIS RIVER NEAR ST. REGIS, MT.

MEAN DISCHARGE
Normal monthly means (All days)

Year	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept
1910	*	*	*	*	*	*	*	*	*	*	*	126.6
1911	210.3	443.3	120.0	*	*	686.5	1672	1906	1323	374.9	184.1	144.8
1912	124.1	*	*	*	165.0	200.4	1395	2065	1073	265.9	122.9	132.1
1913	130.8	*	*	*	*	290.0	1742	3272	1763	401.2	174.5	107.8
1914	123.2	161.9	*	*	*	542.1	1751	1896	617.0	228.7	145.4	204.0
1915	174.9	590.3	*	*	*	*	1126	671.2	387.9	190.4	110.1	*
1916	91.0	*	*	*	*	*	2057	2846	3060	1150	312.6	192.3
1917	*	*	*	*	*	*	1600	4700	2554	667.6	210.0	145.0
1958	*	*	*	*	*	*	*	*	*	*	*	103.8
1959	129.4	462.8	555.4	509.5	340.5	334.5	1601	2270	1792	422.1	168.9	181.5
1960	349.5	447.7	343.0	178.0	183.3	408.6	1458	1620	1205	300.5	173.6	113.8
1961	114.2	149.5	97.9	118.2	567.8	531.8	1204	2549	1549	262.2	134.2	118.0
1962	124.7	100.6	105.9	124.1	184.5	188.0	1670	2121	1162	309.2	146.2	117.7
1963	189.7	334.1	417.7	249.2	545.7	500.0	863.6	1339	673.9	216.2	112.5	103.0
1964	90.9	112.1	92.4	89.3	86.6	94.2	528.2	1740	2099	425.6	187.5	156.2
1965	161.8	178.4	514.0	348.8	370.4	443.4	1752	2071	1349	379.0	188.2	166.4
1966	117.5	157.0	137.7	144.6	119.9	265.5	1203	1678	791.2	245.5	130.7	98.7
1967	95.7	122.3	159.8	180.8	278.0	274.9	584.5	2334	2067	418.3	145.1	100.8
1968	153.7	230.2	165.7	167.3	494.2	799.9	685.7	1459	977.7	267.5	141.9	171.9
1969	233.9	322.2	231.8	367.2	263.7	301.1	1752	2370	905.6	250.1	119.4	98.3
1970	114.7	100.8	99.6	131.7	159.2	249.5	532.6	2404	1664	329.2	147.3	117.3
1971	112.6	156.1	161.9	300.5	759.5	382.8	1099	3398	1766	584.4	194.4	143.3
1972	126.5	120.5	94.5	159.1	301.0	1366	1162	3220	2384	538.6	196.2	128.9
1973	123.3	116.6	161.8	236.8	159.0	200.4	450.1	885.6	419.9	155.0	83.1	77.3
1974	85.5	277.2	307.9	1363	404.4	443.8	1568	2410	3367	685.2	214.5	129.9
1975	102.4	114.4	93.8	121.2	111.4	152.7	348.7	1859	2070	538.1	205.0	131.7
1976	*	*	*	*	*	*	*	*	*	*	*	*

* Indicates a no-value month

Station 12354000 ST. REGIS RIVER NEAR ST. REGIS, MT.

MEAN DISCHARGE
Normal annual means (All days)

Year	
1910	*
1911	*
1912	*
1913	*
1914	*
1915	*
1916	*
1917	*
1958	*
1959	730.8
1960	564.5
1961	615.1
1962	529.7
1963	461.0
1964	474.5
1965	660.4
1966	425.1
1967	564.0
1968	475.7
1969	602.2
1970	505.9
1971	754.4
1972	817.9
1973	256.4
1974	938.0
1975	488.5
1976	*

* Indicates a no-value year

Station 12354000 ST. REGIS RIVER NEAR ST. REGIS, MT.

MEAN DISCHARGE
Statistics on Normal monthly means (All days)

	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept
By rows (Number, Mean, Variance, Standard Deviation, Skewness, Coefficient of Variation, Percentage of Average Value)												
Number	23.00	20.00	18.00	17.00	18.00	21.00	24.00	24.00	24.00	24.00	24.00	25.00
Mean	142.62	234.90	214.49	281.72	305.23	412.19	1241.89	2211.82	1542.51	400.22	164.51	132.44
Var	3499.60	22089.95	22408.98	90064.91	35187.16	79281.50	254828.16	741738.38	628683.38	47017.09	2248.58	1021.27
Std	59.16	148.63	149.70	300.11	187.58	281.57	504.81	861.24	792.90	216.83	47.42	31.96
Skew	2.24	1.10	1.31	3.26	0.97	2.12	-0.40	0.89	0.59	1.97	1.12	0.64
Cvar	0.41	0.63	0.70	1.07	0.61	0.68	0.41	0.39	0.51	0.54	0.29	0.24
Pavg	1.96	3.22	2.94	3.87	4.19	5.66	17.05	30.36	21.18	5.49	2.26	1.82

Station 12354000 ST. REGIS RIVER NEAR ST. REGIS, MT.

MEAN DISCHARGE
Statistics on normal annual means (All days)

Number	Mean	Variance	Standard Deviation	Skewness	Coeff. of Variation
17	580.24	26742.44	163.53	0.41	0.28

Serial Autocorrelation for Normal annual means (All days)

Lag	Serial Correlation
1	-0.494
2	0.231
3	0.177
4	-0.258
5	0.000
6	-0.165
7	0.206

(NOTE--Read the table vertically; Lag is in years.

Station 12353280 NINEMILE CREEK NEAR HUSON, MT.

MEAN DISCHARGE
Normal monthly means (All days)

Year	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept
1973	*	*	*	*	*	*	*	*	*	*	*	19.5
1974	21.6	35.5	39.5	234.0	80.4	138.9	487.1	461.7	599.5	107.9	48.0	35.0
1975	30.7	32.1	22.2	24.5	27.3	40.3	112.2	444.3	543.2	128.7	49.9	39.7
1976	41.3	49.0	100.7	58.6	50.2	83.5	418.2	634.8	234.6	93.1	54.3	36.1
1977	31.8	31.0	26.7	20.5	25.0	26.7	71.3	106.7	59.5	27.4	15.3	23.2
1978	25.5	27.6	75.3	42.3	42.1	258.5	382.0	424.5	322.5	152.5	55.4	44.6
1979	31.3	31.0	28.0	20.4	31.9	99.1	253.9	662.0	222.9	63.4	28.7	26.6
1980	26.2	21.1	25.5	24.8	29.4	45.6	283.9	591.3	427.7	102.4	39.2	38.9
1981	31.0	32.6	45.3	54.1	66.7	92.9	231.5	511.6	302.0	100.3	33.8	31.7
1982	31.8	30.7	33.9	25.2	87.1	154.3	299.0	607.2	480.4	158.5	48.1	37.6
1983	37.7	31.7	30.3	32.9	35.5	147.5	172.6	341.2	201.0	105.5	42.6	34.3
1984	*	*	*	*	*	*	*	*	*	*	*	*

* Indicates a no-value month

Station 12353280 NINEMILE CREEK NEAR HUSON, MT.

MEAN DISCHARGE
Statistics on Normal monthly means (All days)

	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept
By rows (Number, Mean, Variance, Standard Deviation, Skewness, Coefficient of Variation, Percentage of Average Value)												
Number	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	11.00
Mean	30.89	32.23	42.74	53.73	47.56	108.73	271.17	478.53	339.33	103.97	41.53	33.38
Var	32.66	49.23	651.46	4200.67	520.54	4810.88	17585.68	27771.16	28955.83	1511.23	158.83	57.01
Std	5.72	7.02	25.52	64.81	22.82	69.36	132.61	166.65	170.16	38.87	12.60	7.55
Skew	0.29	1.31	1.72	2.91	0.85	1.00	0.10	-1.22	0.06	-0.53	-1.02	-0.60
Cvar	0.19	0.22	0.60	1.21	0.48	0.64	0.49	0.35	0.50	0.37	0.30	0.23
Pavg	1.95	2.03	2.70	3.39	3.00	6.87	17.12	30.21	21.43	6.56	2.62	2.11

Station 12353280 NINEMILE CREEK NEAR HUSON, MT.

MEAN DISCHARGE
Normal annual means (All days)

Year	
1973	*
1974	190.6
1975	124.8
1976	154.8
1977	38.8
1978	154.9
1979	125.6
1980	138.0
1981	128.1
1982	166.3
1983	101.5
1984	*

* Indicates a no-value year

Station 12353280 NINEMILE CREEK NEAR HUSON, MT.

MEAN DISCHARGE
Statistics on normal annual means (All days)

Number	Mean	Variance	Standard Deviation	Skewness	Coeff. of Variation
10	132.34	1712.67	41.38	-1.15	0.31

Serial Autocorrelation for Normal annual means (All days)

Lag	Serial Correlation
1	-0.466
2	0.290
3	-0.569

(NOTE--Read the table vertically; Lag is in years.

Appendix C. Trout Length-Frequency Distribution

HUSON FALL '88

Montana Department of Fish, Wildlife & Parks
CONDITION FACTOR REPORT
9:47:16 5/17/1988

4.5 mi

CLARK FORK RIVER HUSON
Collection Code: 2U8202 001W

Marked 10/19/87

Size Class Interval	Estimated Number	Estimated Weight	Condition Factor
7.00 - 7.49	4 Tot PER mi	1	34.24
7.50 - 7.99	41	8	40.25
8.00 - 8.49	74 267 59 (9%)	15	37.11
8.50 - 8.99	148	32	32.14
9.00 - 9.49	218	70	39.65
9.50 - 9.99	280 910 202 (29%)	97	36.68
10.00 - 10.49	243	99	37.87
10.50 - 10.99	169	77	37.54
11.00 - 11.49	123	55	37.13
11.50 - 11.99	45 472 105 (15%)	26	36.10
12.00 - 12.49	104	69	35.58
12.50 - 12.99	200	145	34.64
13.00 - 13.49	229	185	34.92
13.50 - 13.99	282 861 191 (28%)	252	34.52
14.00 - 14.49	209	210	34.93
14.50 - 14.99	141	155	34.21
15.00 - 15.49	127	154	34.34
15.50 - 15.99	144 492 109 (16%)	189	33.64
16.00 - 16.49	114	160	32.77
16.50 - 16.99	107	165	32.76
17.00 - 17.49	77	130	32.98
17.50 - 17.99	20	36	31.65
18.00 - 18.49	17 124 28 (4%)	33	32.40
18.50 - 18.99	7	15	34.36
19.00 - 19.49	0 124/mi	0	0.00
19.50 - 19.99	3	9	34.65
TOTAL	3064	2403	35.53

Superior Fall '88

Montana Department of Fish, Wildlife & Parks
CONDITION FACTOR REPORT
10:53:0 5/1/1992

Page: 1

6.3 mi
10.1 KM
Marked 10/13/88

CLARK FORK RIVER SUPERIOR
Collection Code: 288203 0014

Size Class Interval	Estimated Number		Estimated Weight		Condition Factor
6.00 - 6.49	0		0		40.96
6.50 - 6.99	0	TOT	0	PER MI	37.95
7.00 - 7.49	10		2		44.16
7.50 - 7.99	35		6		39.61
8.00 - 8.49	68	246	15	39 (7%)	39.10
8.50 - 8.99	133		35		38.74
9.00 - 9.49	333		105		39.52
9.50 - 9.99	479		147		38.13
10.00 - 10.49	393	1531	157	243 (47%)	36.82
10.50 - 10.99	326		148		36.91
11.00 - 11.49	181		93		38.03
11.50 - 11.99	74		44		37.10
12.00 - 12.49	89	446	61	71 (13%)	37.14
12.50 - 12.99	102		77		36.17
13.00 - 13.49	191		144		36.84
13.50 - 13.99	223		179		36.19
14.00 - 14.49	242	818	253	130 (24%)	36.25
14.50 - 14.99	162		182		35.02
15.00 - 15.49	100		126		35.70
15.50 - 15.99	81		115		36.19
16.00 - 16.49	51	291	77	46 (8%)	35.23
16.50 - 16.99	59		96		34.82
17.00 - 17.49	47		88		36.53
17.50 - 17.99	37		71		33.96
18.00 - 18.49	23	132	47	21 (4%)	33.67
18.50 - 18.99	10		23		36.18
19.00 - 19.49	2		4		36.33
19.50 - 19.99	8	550/mi	22		35.40
20.00 - 20.49	3		10		35.81
20.50 - 20.99	2		5		31.16
TOTAL	3354		2410		37.00

Superior Fall '89

Montana Department of Fish, Wildlife & Parks
CONDITION FACTOR REPORT
16:22:8 9/26/1989

Page: 50

6.3 mi
10.1 KM

[illegible] SUPERIOR
Collection Code: [illegible] RAINBOW TROUT
Marked 09/25/89

Size Class Interval	Estimated Number	Estimated Weight	Condition Factor
4.50 - 4.99	0	0	52.70
5.00 - 5.49	0	0	41.25
5.50 - 5.99	0	0	51.56
6.00 - 6.49	0	0	46.87
6.50 - 6.99	47 Tot. Per mi	8	54.00
7.00 - 7.49	53	9	42.69
7.50 - 7.99	137 645 102 (19%)	39	43.78
8.00 - 8.49	180	44	43.89
8.50 - 8.99	275	80	42.97
9.00 - 9.49	322	104	40.94
9.50 - 9.99	254 846 134 (25%)	73	39.43
10.00 - 10.49	186	78	39.01
10.50 - 10.99	85	41	39.11
11.00 - 11.49	56	30	37.86
11.50 - 11.99	63	39	38.44
12.00 - 12.49	115 382 61 (11%)	80	37.69
12.50 - 12.99	148	116	37.66
13.00 - 13.49	179	157	37.74
13.50 - 13.99	172	136	37.12
14.00 - 14.49	156 671 107 (20%)	167	36.54
14.50 - 14.99	158	188	36.98
15.00 - 15.49	217	279	36.30
15.50 - 15.99	219 665 106 (20%)	310	36.40
16.00 - 16.49	141	211	35.04
16.50 - 16.99	88	144	34.99
17.00 - 17.49	71	121	33.33
17.50 - 17.99	39 148 23 (4%)	70	32.05
18.00 - 18.49	28	53	31.40
18.50 - 18.99	9	19	31.60
19.00 - 19.49	2 533/mi	6	33.37
19.50 - 19.99	0	0	0.00
20.00 - 20.49	0	0	0.00
20.50 - 20.99	0	0	0.00
21.00 - 21.49	2	8	37.54
TOTAL	3345	2649	38.92

3345 - 47 = 3298 Rb 7" ÷ 6.3 mi = 523/mi

03-Jan-91

Mo. Riv @ Cascade
Fall '90

Brown Trout | Rainbow Trout

MISSOURI RIVER - CASCADE SECTION - FALL 1990

CC#490014CC#490014CC#490014CC#490014CC#490014CC#490014CC#490014CC#490014CC#490014CC#490014CC#490014

LL CASCDELL CASCDELL CASCDELL CASCDELL CASCDERB CASCDERB CASCDERB CASCDERB CASCDERB CASCDE

LENGTH (IN)	TOT #	#/MILE	WT (LBS)	LBS/MILE	CF	TOT #	#/MILE	WT (LBS)	LBS/MILE	CF
6.0	19	5	2	0.5	43.29	72	17	7	1.7	42.31
6.5	16	4	3	0.7	67.69	127	31	15	3.6	40.36
7.0	0	0	0	0.0		398	96	61	14.8	41.25
7.5	12	3	2	0.5	30.08	675	163	124	30.0	40.46
8.0	8	2	2	0.5	36.03	995	241	216	52.3	39.34
8.5	37	9	10	2.4	39.5	1085	263	292	70.7	41.13
9.0	37	9	11	2.7	39.11	1153	282	370	89.6	40.95
9.5	33	8	11	2.7	36.02	775	188	286	69.2	40.82
10.0	41	10	17	4.1	39.48	472	114	199	48.2	39.64
10.5	41	10	18	4.4	36.85	252	61	117	28.3	38.42
11.0	47	11	23	5.6	35.98	120	29	65	15.7	38.93
11.5	29	7	17	4.1	37.79	63	15	37	9.0	36.82
12.0	16	4	11	2.7	37.34	55	13	37	9.0	36.89
12.5	19	5	15	3.6	37.99	79	19	57	13.8	35.19
13.0	21	5	18	4.4	37.92	126	31	105	25.4	36.43
13.5	14	3	14	3.4	38.91	113	27	106	25.7	37.08
14.0	10	2	10	2.4	37.37	131	32	131	31.7	34.95
14.5	15	4	18	4.4	39.35	186	45	212	51.3	36.14
15.0	26	6	35	8.5	39.11	269	65	330	79.9	35.25
15.5	19	5	31	7.5	41.16	263	64	351	85.0	34.65
16.0	18	4	30	7.3	39.87	257	62	375	90.8	34.56
16.5	34	8	65	15.7	41.64	204	49	341	82.6	36.17
17.0	23	6	48	11.6	41.65	133	32	233	56.4	34.57
17.5	28	7	63	15.3	41.02	74	18	146	35.4	36.09
18.0	14	3	30	7.3	35.73	35	8	76	18.4	35.51
18.5	24	6	62	15.0	39.58	9	2	19	4.6	32.36
19.0	22	5	60	14.5	39.19	9	2	21	5.1	34.58
19.5	20	5	57	13.8	37.78	3	1	9	2.2	38.65
20.0	16	4	50	12.1	38.11					
20.5	4	1	16	3.9	45.01					
21.0	4	1	13	3.1	33.15					
21.5	2	0	8	1.9	41.48					
22.0	2	0	7	1.7	34.37					
22.5	0	0	0	0.0						
23.0	2	0	8	1.9	33.53					
23.5	0	0	0	0.0						
24.0	4	1	18	4.4	31.93					
24.5					27.21					
25.0					25.86					

Brown trout: TOT #= 677 #/MILE= 164 LBS #= 803.0 LBS/MILE= 194.4 AVG CF= 38.97

Rainbow trout: TOT #= 8143 #/MILE= 1972 LBS #= 4338.0 LBS/MILE= 1050.4 AVG CF= 37.49

763 645 76 135 240 65

1970

1924

7-9	763	40%
9-11	645	34%
11-13	76	4%
13-15	135	7%
15-17	240	12%
>17	65	3%

per mile

#/mile
- ≥8" → 1663
- ≥10" → 689
- ≥12" → 970
- ≥14" → 380
- ≥16" → 174
- ≥18" → 13

04/08/92 10:20

Rainbow Trout

Mo Riv @ Cascade

Fall '91

25-Nov-91

Brown Trout | Rainbow Trout

MISSOURI RIVER - CASCADE SECTION - FALL 1991

LENGTH (IN)	BROWN TROUT CC#491011 CASCDELL TOT #	BROWN TROUT CC#491011 CASCDELL #/MILE	BROWN TROUT CC#491011 CASCDELL WT (LBS)	BROWN TROUT CC#491011 CASCDELL LBS/MILE	BROWN TROUT CC#491011 CASCDELL CF	RAINBOW TROUT CC#491011 CASCDERB TOT #	RAINBOW TROUT CC#491011 CASCDERB #/MILE	RAINBOW TROUT CC#491011 CASCDERB WT (LBS)	RAINBOW TROUT CC#491011 CASCDERB LBS/MILE	RAINBOW TROUT CC#491011 CASCDE CF
6.0	21	5	2	0.5	40.08	12	3	1	0.2	40.42
6.5	2	0	0	0.0	38.26	6	1	1	0.2	40.66
7.0	8	2	1	0.2	36.35	37	9	6	1.5	44.06
7.5	2	0	0	0.0	38.54	118	29	325 25	6.1	44.32
8.0	6	1	1	0.2	35.32	361	87	93	22.5	45.73
8.5	15	4	4	1.0	43.99	826	200	248	60.0	45.28
9.0	42	10	14	3.4	42.18	1283	311	455	110.2	45.41
9.5	52	13	20	4.8	40.14	1016	246	310 409	99.0	44.33
10.0	73	18	32	7.7	40.55	741	179	346	83.8	44.05
10.5	113	27	56	13.6	40.5	327	79	173	41.9	43.3
11.0	86	21	50	12.1	41.2	128	31	75	18.2	42.16
11.5	79	19	51	12.3	40	103	25	172 66	16.0	40.49
12.0	42	10	29	7.0	39.25	205	50	145	35.1	38.66
12.5	2	0	1	0.2	32.99	271	66	219	53.0	39.28
13.0	6	1	6	1.5	40.04	323	78	288	69.7	38.78
13.5	14	3	15	3.6	41.18	250	61	213 247	59.8	39.53
14.0	14	3	17	4.1	42.35	184	45	202	48.9	38.43
14.5	28	7	34	8.2	38.34	119	29	137	33.2	36.6
15.0	14	3	18	4.4	37.47	74	18	96	23.2	37.24
15.5	10	2	17	4.1	40.8	77	19	72 105	25.4	34.95
16.0	17	4	30	7.3	41.19	83	20	123	29.8	34.81
16.5	3	1	7	1.7	40.79	64	15	109	26.4	36.49
17.0	21	5	42	10.2	40.11	55	13	96	23.2	34.81
17.5	0	0	0	0.0		29	7	53	12.8	33.2
18.0	17	4	44	10.7	41.88	16	4	26 32	7.7	33.12
18.5	17	4	47	11.4	41.65	10	2	23	5.6	35.52
19.0	17	4	45	10.9	37.19					
19.5	17	4	51	12.3	38.49					
20.0	10	2	34	8.2	39.4					
20.5	14	3	48	11.6	38.57					
21.0	3	1	14	3.4	41.14					
21.5	7	2	27	6.5	37.04					
22.0	3	1	15	3.6	38.44					
22.5	7	2	30	7.3	36.85					
23.0	0	0	0	0.0						
23.5	3	1	17	4.1	35.75					
24.0	7	2	40	9.7	41.18					
24.5										
25.0										

1623/mi

TOT #=	#/MILE=	LBS #=	LBS/MILE=	AVG CF=
792	192	859.0	208.0	39.41

TOT #=	#/MILE=	LBS #=	LBS/MILE=	AVG CF=
6718	1627	3773.0	913.6	39.64

≥ 8" → 1585

#/mile

≥ 10" → 741

≥ 12" → 427

≥ 14" → 172

≥ 16" → 61

≥ 18" → 6

#/mile

≥ 10" → 154

≥ 12" → 69

≥ 14" → 55

≥ 16" → 40

≥ 18" → 30

7-9	325	20%
9-11	815	50%
11-13	172	11%
13-15	213	13%
15-17	72	4%
>17	26	2%

BLACKFOOT
SPRING '89

Montana Department of Fish, Wildlife & Parks
CONDITION FACTOR REPORT
9:26:21 7/5/1989

3.6
3/8 MILES

BLACKFOOT RIVER JOHNSRUD
Collection Code: 289001 001W RAINBOW TROUT
Marked 05/23/89

Size Class Interval	Estimated Number		Estimated Weight		Condition Factor
2.50 - 2.99	0		0		91.74
3.00 - 3.49	0		0		61.11
3.50 - 3.99	0		0		46.97
4.00 - 4.49	0	total	0	per mi	40.03
4.50 - 4.99	0		0		41.99
5.00 - 5.49	294		17		38.17
5.50 - 5.99	532		41		39.77
6.00 - 6.49	571	1438	538	51	46% 36.53
6.50 - 6.99	541			58	35.09
7.00 - 7.49	480			62	34.34
7.50 - 7.99	229			37	34.39
8.00 - 8.49	186	1094	304	36	26% 34.17
8.50 - 8.99	199			47	35.40
9.00 - 9.49	177			50	35.49
9.50 - 9.99	199			63	34.54
10.00 - 10.49	152	657	183	57	16% 35.05
10.50 - 10.99	129			53	32.85
11.00 - 11.49	143			66	32.15
11.50 - 11.99	125			63	31.38
12.00 - 12.49	80	413	115	46	10% 31.59
12.50 - 12.99	65			41	31.02
13.00 - 13.49	21			15	31.13
13.50 - 13.99	18			15	30.97
14.00 - 14.49	21	81	23	19	2% 32.05
14.50 - 14.99	21			20	29.00
15.00 - 15.49	0			0	0.00
15.50 - 15.99	5			6	31.64
16.00 - 16.49	3			3	30.78
16.50 - 16.99	3			3	25.24
17.00 - 17.49	0		4	0	< 1% 0.00
17.50 - 17.99	0	14		0	0.00
18.00 - 18.49	0			0	0.00
18.50 - 18.99	0			0	0.00
19.00 - 19.49	0			0	0.00
19.50 - 19.99	3			8	42.78
TOTAL	4135	1149	1167	879	37.25

≥ 7.0 219 = 61%

≥ 6.0 =334 71%

Blackfoot Spring '90

Montana Department of Fish, Wildlife & Parks
CONDITION FACTOR REPORT
17:32:0 7/6/1990

BLACKFOOT RIVER JOHNSRUD 19008 FEET
Collection Code: 290013 001W RAINBOW TROUT Marked 06/06/90

Size Class Interval	Estimated Number		Estimated Weight		Condition Factor
3.00 - 3.49	0		0		57.53
3.50 - 3.99	0		0		64.57
4.00 - 4.49	0		0		53.20
4.50 - 4.99	0	total	0	per mi.	51.96
5.00 - 5.49	88		5		43.46
5.50 - 5.99	80	514	7	143	48.42
6.00 - 6.49	157		17	15%	44.14
6.50 - 6.99	189		23		39.77
7.00 - 7.49	364		53		38.29
7.50 - 7.99	319	1247	59	346	39.45
8.00 - 8.49	314		66	43%	37.68
8.50 - 8.99	250		62		37.20
9.00 - 9.49	226		67		37.34
9.50 - 9.99	234	774	78	215	36.10
10.00 - 10.49	169		66	26%	35.75
10.50 - 10.99	145		64		35.55
11.00 - 11.49	134		69		36.24
11.50 - 11.99	73	295	41	82	34.81
12.00 - 12.49	54		35	10%	35.33
12.50 - 12.99	34		23		33.49
13.00 - 13.49	28		22		34.94
13.50 - 13.99	32	84	26	23	32.08
14.00 - 14.49	18		17	3%	32.43
14.50 - 14.99	6		6		33.40
15.00 - 15.49	4		5		31.61
15.50 - 15.99	2	12	3	3	35.29
16.00 - 16.49	0		0	< 1%	0.00
16.50 - 16.99	6		8		28.78
TOTAL	2857	794/.812	822		39.85

27.0 2343 85#/m

26.0 2639 94#/m

Blackfoot
Spring '91

Montana Department of Fish, Wildlife & Parks
CONDITION FACTOR REPORT
7:49:5 6/4/1991

BLACKFOOT RIVER JOHNSRUD
Collection Site: 27.30S 001W RAINBOW TROUT

3.6 MILES
Marked 05/21/91

Size Class Interval	Estimated Number		Estimated Weight		Condition Factor	
0.50 - 0.99	0		0		37328.20	
1.00 - 1.49	0		0		0.00	
1.50 - 1.99	0		0		0.00	
2.00 - 2.49	0		0		0.00	
2.50 - 2.99	0		0		73.64	THREE YEAR AVE
3.00 - 3.49	0		0		68.92	
3.50 - 3.99	0		0		77.51	
4.00 - 4.49	0		0		60.16	
4.50 - 4.99	0		0		39.98	
5.00 - 5.49	65		4		43.18	
5.50 - 5.99	146	628 174	11	19%	39.42	285
6.00 - 6.49	140		14		39.17	
6.50 - 6.99	277		34		38.88	
7.00 - 7.49	352		50		37.51	
7.50 - 7.99	270		47		36.80	
8.00 - 8.49	241	1075 259	47	33%	35.04	316
8.50 - 8.99	212		52		36.20	
9.00 - 9.49	182		53		36.94	
9.50 - 9.99	166	675 166	59	24%	38.37	174
10.00 - 10.49	147		58		36.38	
10.50 - 10.99	180		77		34.40	
11.00 - 11.49	180		87		33.87	
11.50 - 11.99	127	624 173	71	24%	34.57	173
12.00 - 12.49	188		117		34.01	
12.50 - 12.99	129		90		33.84	
13.00 - 13.49	101		79		34.43	
13.50 - 13.99	72	212 54	58	21%	31.50	325
14.00 - 14.49	22		20		31.86	
14.50 - 14.99	17		16		29.22	
15.00 - 15.49	15		17		32.79	
15.50 - 15.99	2		3		29.08	
16.00 - 16.49	5		6		29.82	5
16.50 - 16.99	0		0		0.00	
17.00 - 17.49	2	34 9	4	4%	29.88	
17.50 - 17.99	5		8		28.33	
18.00 - 18.49	0		0		0.00	
18.50 - 18.99	0		0		0.00	
19.00 - 19.49	0		0		0.00	
19.50 - 19.99	0		0		0.00	
20.00 - 20.49	0		0		0.00	
20.50 - 20.99	5		13		28.82	
TOTAL	3218	902	1093		67.60	960

For Entire Sample — Mean Length 239 mm; Mean Weight 462 gr } 1991

Mean Length 213; Mean Weight 121 } 1990

Milltown Fall '00

Montana Department of Fish, Wildlife & Parks
CONDITION FACTOR REPORT
9:12:58 5/1/1900

2.6 mi
4.0 KM
Marked 10/06/00

LARK FORK RIVER MILLTOWN
ollection Code: 298801 001W

Size Class Interval	Estimated Number		Estimated Weight		Condition Factor
	0		0		39.80
6.50 - 6.99	25		8		36.55
7.00 - 7.49	46	213	82 (19%)		35.20
7.50 - 7.99	67		13		39.19
8.00 - 8.49	75		19		37.91
8.50 - 8.99	67		15		36.15
9.00 - 9.49	75		22		34.55
9.50 - 9.99	46	253	97 (23%)		34.56
10.00 - 10.49	65		17		34.33
10.50 - 10.99	108		23		33.54
11.00 - 11.49	92	403	160 (37%)		33.43
11.50 - 11.99	107		50		32.93
12.00 - 12.49	101		85		33.74
12.50 - 12.99	81		71		33.33
13.00 - 13.49	59	212	82 (19%)		33.60
13.50 - 13.99	48		61		32.63
14.00 - 14.49	24		45		33.95
14.50 - 14.99	9		26		33.21
15.00 - 15.49	7	16	10	6 (1%)	33.62
15.50 - 15.99	0		10		0.00
16.00 - 16.49	0		0		32.38
16.50 - 16.99			0		
TOTAL	1080		576		34.52

355
137/mi
415/mi
427

Size distribution
milltown 98 & 91 NZ

5-7	13	3%
7-9	135	29%
9-11	80	17%
11-13	~~142~~	30%
13-15	93	20%
15+	9	2%
	472	

Milltown Fall '91

Stream Name: [illegible] RIVER
Section Name: MILLTOWN
Species: RAINBOW TROUT
Date of Data Collection: 09/20/91

Size Group (mm)	Size Group (in)	M	C	R	Number Estimate (N)	95 % CI	Biomass Estimate kg	95 % CI
130 181	5.1 7.1	83	19	3	33.00	56.31	[illegible]	3.42
182 233	7.2 9.2	143	154	54	403.84	144.26	[illegible]	14.70
234 285	9.2 11.2	59	65	19	177.00	87.73	[illegible]	17.68
286 337	11.3 13.3	159	130	52	394.47	94.24	[illegible]	30.04
338 389	13.3 15.3	126	115	43	338.32	82.31	[illegible]	28.70
390 441	15.4 17.4	11	9	2	39.00	26.40	[illegible]	17.72
442 493	17.4 19.4	1	2	0	0.00	0.00	[illegible]	0.00

Size Group (mm)	Size Group (in)	Number Per 100 ft	95 % CI	Number Per 1000 ft	95 % CI	Number Per Mile	95 % CI
130 181	5.1 7.1	0.49	0.34	4.91	3.36	33.94	17.75
182 233	7.2 9.2	3.56	0.65	35.64	8.54	188.20	45.08
234 285	9.2 11.2	1.17	0.34	11.66	3.42	61.56	18.04
286 337	11.3 13.3	2.33	0.39	23.35	3.94	123.27	20.80
338 389	13.3 15.3	1.96	0.37	19.76	3.69	104.32	19.47
390 441	15.4 17.4	0.23	0.17	2.21	1.68	12.19	8.88
442 493	17.4 19.4	0.00	0.00	0.00	0.00	0.00	0.00

515/mi

Ken these are the 1991 Milltown Estimates broken into two inch groups.

Eric