MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
FISHERIES DIVISION

JOB PROGRESS REPORT

STATE: MONTANA PROJECT TITLE: STATEWIDE FISHERIES INVESTIGATIONS

PROJECT NO.: F-46-R-5 STUDY TITLE: SURVEY AND INVENTORY OF COLDWATER STREAMS

JOB NUMBER: I-d

JOB TITLE: CLARK FORK/BLACKFOOT RIVER FISHERY INVESTIGATION

PROJECT PERIOD: JULY 1, 1991 THROUGH JUNE 30, 1992

ABSTRACT

A fishery inventory and planning study was continued on the middle Clark Fork River system. Rainbow trout comprise the bulk of the sport fishery along with a few brown, westslope cutthroat and bull trout.

Preliminary estimates in five study sections on the Clark Fork River indicate the river supports from 170 to 681 catchable rainbow trout per mile. Catchable brown, westslope cutthroat and bull trout were present in all study sections, at much lower densities. This density of catchable trout is less than expected for comparable trout streams the size of the Clark Fork. However, estimates of catchable rainbow trout population densities have generally increased in the Clark Fork River since the inception of this study in 1984-85.

Fish trapping surveys revealed significant rainbow trout spawning runs in Belmont, Gold, Monture, Cottonwood and Johnson Creeks. Trout fry outmigrations from seventeen tributaries in the upper Clark Fork and Blackfoot River drainages were monitored during this report period.

OBJECTIVES AND DEGREE OF ATTAINMENT

The long range objective of the study is to follow inventory procedures developed in earlier studies (Wipperman 1973, Berg 1975, 1981 and 1983) and use the resulting data to prepare recommendations for aquatic resource management on this section of the Clark Fork River. Specific objectives during this report period were:

1. Determine species distribution and abundance and relative condition of fish populations in the Clark Fork River and its tributaries.

2. Measure physical trout habitat parameters in the Clark Fork River and its tributaries and evaluate correlations with trout population characteristics.

3. Maintain trout populations and habitat conditions in the Clark Fork River and its major tributaries at levels at least as good as present status (state funded).

4. Monitor spawning migrations of rainbow, cutthroat, brown and bull trout in tributaries of the Clark Fork River.

5. Monitor out migrations of juvenile trout from tributaries to the main stem of the Clark Fork River and determine the relative importance of various tributaries in providing recruitment to the trout population in the main river.

6. Evaluate whether recruitment is a limiting factor for trout populations in the Clark Fork River and identify factors which may contribute to the scarcity of a brown trout fishery in the Clark Fork River below Missoula.

7. Correlate parameters identified in water quality studies conducted by DFWP and other agencies with relative abundance of the fishery in the Clark Fork River (state funded).

8. Maintain water quality at or above 1984-86 average levels as measured at Montana Department of Health and Environmental Sciences water quality monitoring stations (state funded).

9. Determine and maintain adequate instream flow levels in the Clark Fork River and its major tributaries (state funded).

10. Define fish movement patterns and relative angler harvest and maintain a trout fishery on the Clark Fork River of at least 40,000 man-days per year with an average catch rate of 0.2 fish per hour.

Completion of this project is expected to result in a trout fishery sustaining 40,000 angler-days of use per year with a total catch rate of 0.2 fish per hour. Trout habitat and water quality and quantity will be maintained at levels at least as good as present status. Management recommendations will be made and implemented to enhance trout reproduction and recruitment to increase densities of catchable trout.

PROCEDURES

Water Temperature

Thirty-day continuous recording thermographs were used to monitor water temperature on the Clark Fork River stations at Milltown Dam and Petty Creek. The recorder box was positioned on the stream bank as far above the high water mark as possible. A thermocouple lead, varying in length from 8 to 23 m, was extended into the water through flexible, plastic sewer pipe. Water temperature data for the St. Regis River, Fish Creek and the Clark Fork River stations at Superior and below St. Regis were supplied by the U.S. Geological Survey (USGS).

Stream Flow and Water Velocity

Stream flow and water velocity were measured with Marsh-McBirney instantaneous or Price AA current meters, except on the main stem of the Clark Fork River where stream flow was monitored by continuous recording USGS gage stations.

Juvenile and Adult Fish Populations

Fry Nets

Timing and abundance of fry outmigration from tributaries were evaluated using square framed 0.68 m^2 drift nets with graduated mesh ranging from 6.4 mm (1/4 in.) immediately inside the net opening to 1.6 mm (1/16 in.) in the conical shaped collecting bag. The drift nets were fished in a stationary position in the water column overnight at each site. The volume of water filtered was measured with a current meter positioned at the center of the net orifice.

After the net was retrieved from the stream, trout fry and other fish species were identified and counted. Trout fry were measured to the nearest millimeter in total length and released at the capture site. The fry drift nets were primarily effective for sampling age 0 and I outmigrants.

"Idaho Weir" Fish Traps

Idaho weir fish traps set in the lower reaches of tributaries were used to monitor trout spawning migrations from the river into tributaries. The traps were developed from specifications provided by the Region I Office, Idaho Fish and Game, 2320 Government Way, Coeur d'Alene, ID 83814 (Greg Mouser, personal communication). A detailed description of construction of these traps and procedures for their installation and use will be provided in the completion report for this project. The Idaho weir fish traps were primarily effective for monitoring upstream and downstream movements of adult trout.

Boom-suspended Electrofishing

A boom-suspended electrofishing system was used to sample fish populations on the main stem of the Clark Fork River and in the lower reach of the Bitterroot River. The electrofishing system was adapted from Novotny and Priegel (1974) and is described by Berg (1981). The electrofishing apparatus were mounted on a 4.5 m (14.6 foot) aluminum drift boat powered by a 9.9 horsepower outboard and a 6.1 m (20 foot) aluminum jet boat powered by a 215 horsepower inboard.

The boom-suspended electrofishing apparatus was the most effective technique for sampling fish in the Clark Fork main stem and lower Bitterroot rivers. Much of the boom-suspended electrofishing was accomplished at night due to increased efficiency.

Mobile Electrofishing

A mobile electrofishing system was used to sample fish in tributaries larger than about 10 cfs. The system was also used to sample juvenile and forage fish along shoreline areas of the Clark Fork River.

The mobile electrofishing system consisted of a hand-held mobile positive electrode, a stationary negative electrode mounted on a 1.0 m^2 float

attached to the boat and a portable 1350-watt, 115 volt (60 Hz single phase) alternating current generator. A Coffelt model VVP-2C rectifying unit was used to change the alternating current to pulsed direct current. Output from the rectifying unit was adjustable from 0 to 300 volts half-wave 60 Hz in 25 to 50 volt increments. The electrofishing system was carried in a 5.8 m (19 foot) aluminum freight canoe. In tributaries where the freight canoe could not be floated, electrofishing with this system was accomplished by bank shocking with 76.2 m (250 feet) of 16/2 electrical cord.

Backpack Electrofishing

A backpack electrofishing system was used to sample fish in tributaries smaller than about 10 cfs. Coffelt model BP-6 and Smith-Root Type V A backpack electrofishers were utilized. The backpack electrofishing system consisted of a hand-held mobile positive electrode, a negative electrode consisting of braided copper wire and the portable backpack rectifying and battery or generator unit.

Fish Sample Processing and Tagging

Fish captured by various methods were measured to the nearest mm in total length and weighed to the nearest 10g. Sex and spawning condition (gravid, ripe or spawned) were recorded for fish captured during their spawning season. Several thousand catchable game fish were marked with individually numbered Floy t-tags to evaluate growth rate, movement and angler harvest. All fish were released near the capture site.

Fish Population Estimates

Population estimates were made using the Peterson mark-recapture formula as modified by Chapman (1951):

$$N = \frac{(M+1)\ (C+1)}{(R+1)} - 1$$

where: N = population estimate
M = the number of marked fish
C = the number of fish in the recapture sample
R = the number of marked fish in the recapture sample (C)

Multiple marking and recapture runs were often needed to collect an adequate sample size. A partial fin clip or fin punch was used to mark the fish. A minimum of two weeks was allowed before recapture runs were made. Additional methods used for population and standing crop estimates are described by Vincent (1971 and 1974).

Fish Aging

Scales were collected from some fish for age determination. The scale samples were imprinted on an acetate slide, and the imprints were projected at 44X on a Norwest nmi 90 microfiche reader. Annuli were identified and ages assigned following procedures described by Jearld (1983) and Tesch

(1971).

FINDINGS, RESULTS AND DISCUSSION

Description of Area and Location of Study Sections

This study area lies in west central Montana and includes a 192.1 - kilometer (km) (119.4 - mile) reach of the main stem of the Clark Fork River from Milltown Dam to the confluence of the Flathead River. Five study sections, Milltown Dam, Missoula, Huson, Superior, St. Regis and Quinn Hot Springs, were established in this reach (Figure 1). In addition, perennial tributaries to the Clark Fork River in this reach were studied. The principal tributaries include the Bitterroot, Blackfoot, and St. Regis rivers and Rattlesnake, Ninemile, Sixmile, Petty, Fish, Trout, Cedar and Tamarack creeks.

The Clark Fork River forms at the confluence of Silver Bow and Warm Springs creeks near Anaconda, Montana, and flows northwestward approximately 560 km (350 river miles) to Lake Pend Oreille in northern Idaho. The 192 km reach of the Clark Fork covered by this study is entirely free-flowing. The drainage area in this reach is mountainous and is covered with large forested tracts, the continuity of which is broken by grazing and cropland areas which are situated in valleys at lower elevations.

The Clark Fork Basin has been widely known for its mining and smelting industries. The copper mines at Butte and smelters at Anaconda, located in the headwaters of this drainage, are internationally famous. The smelters at Anaconda are presently shut down, while mining operations at Butte were resumed in July, 1986, after being shut down for several years. Logging, lumbering and paper manufacturing industries are supported by forests of the basin. Tourist trade is a large contributor to the economy. The basin is nationally known for its scenic beauty, fishing, hunting and other recreational features. Agriculture is also an important industry in the basin.

Four hydropower dams are located on the main stem of the Clark Fork River upstream from Lake Pend Oreille. Milltown Dam, the upstream boundary of the present study area, is located 362 km upstream from Lake Pend Oreille. Thompson Falls, Noxon Rapids and Cabinet Gorge dams are situated on the lower Clark Fork River 113, 50 and 18 km upstream from Lake Pend Oreille. Thompson Falls Dam is located 57 km downstream from the lower boundary of the present study area. The four main stem dams contain little storage capacity and have little influence on seasonal discharge patterns.

Drainage Area and Stream Discharge

The drainage area of the middle Clark Fork River increases from 15,537 km^2 to 27,736 km^2, or by about 79 percent, between Milltown Dam and the confluence of the Flathead River (USGS 1983). Average stream discharge increases from 86.38 m^3/sec (3050 ft^3/sec) to 214.75 m^3/sec (7,583 ft^3/sec), or by about 149 percent between these boundaries. The drainage area and stream discharge statistics do not include the Flathead River drainage.

Stream flow is monitored by the USGS at gages located 4.5 km downstream from Milltown Dam (Milltown Dam gage), 1.6 km downstream from the confluence of the Bitterroot River (Missoula gage), and 0.6 km downstream from the confluence of the St. Regis River (St. Regis gage). Mean annual discharges for 54-year periods of record are 2.72 km^3/year (2,210,000 acre-feet/yr) at Milltown Dam and 4.95 km^3/year (4,014,000 acre-feet/yr) at Missoula compared to 6.77 km^3/year (5,494,000 acre-feet/yr) at St. Regis for a 73-year period of record.

Stream Gradient

The Clark Fork River enters the study area immediately below Milltown Dam at an elevation of 987.6 m (3,240 ft) msl, dropping 231.6 m (760 ft) to an elevation of 755.9 m (2,480 ft) msl near the confluence of the Flathead River (Table 1). Stream gradient averages 1.23 m/km (6.48 ft/mi) and varies from 0.81 m/km (4.26 ft/mi) between Cedar and Dry creeks to 2.81 m/km (14.81 ft/mi) between Milltown Dam and Marshall Creek. Stream gradients were determined by measurements taken from USGS topographic maps.

Table 1. Stream gradients of the middle Clark Fork River from Milltown Dam to confluence of the Flathead River.

Kilometer	Approximate Location	Elevation (meters, msl)	Gradient (m/km)	Gradient (ft/mi)
586.3	Milltown Dam	987.6	-	-
582.0	Marshall Creek	975.4	2.81	14.81
574.4	Rattlesnake Creek	963.2	1.61	8.51
564.1	Bitterroot River	944.9	1.78	9.38
549.8	Harper's Bridge	929.6	1.06	5.62
540.6	Mill Creek	920.5	1.00	5.26
508.3	Petty Creek	890.0	0.94	4.98
491.7	Fish Creek	853.4	2.21	11.65
462.3	Cedar Creek	816.9	1.24	6.56
447.1	Dry Creek	804.7	0.81	4.26
422.8	Tamarack Creek	780.3	1.00	5.30
397.6	Flathead River	755.9	0.97	5.10

Water Temperature

Water temperatures were monitored on the Clark Fork River near Milltown Dam, Petty Creek, Superior and St. Regis and in the lower reaches of Fish Creek and the St. Regis River during the report period. The data are on file and will be presented in the completion report for this project.

Fish Species Composition

Fifteen species representing six families of fish occur in the middle Clark Fork River between Milltown Dam and the confluence of the Flathead River (Table 2). The bulk of the sport fishery in this 192.1-kilometer (119.4-mile) reach of the river is provided by rainbow trout along with a few brown, bull and westslope cutthroat trout. Mountain whitefish provide an important winter sport fishery. Common nongame fish species found in this reach include squawfish, redside shiners, longnose dace, largescale suckers and slimy sculpins.

Trout Population Estimates

Trout populations have been estimated by electrofishing and mark/recapture procedures in six study sections on the Clark Fork River. The study sections are located in the vicinities of Milltown Dam, Missoula, Huson, Superior, and St. Regis, and Quinn Hot Springs (Table 3). Estimates in the six study sections indicate the river supports from 170 to 681 catchable rainbow trout per mile (Table 4). Rainbow comprise more than 80 percent of the catchable trout population in all of the study sections. Catchable westslope cutthroat trout population densities range from 15 to 55 fish per mile. Brown trout estimates vary from 4 to 33 catchable fish per mile. Catchable bull trout are found in the river, but their numbers have been too low to estimate.

This density of catchable trout is less than expected for comparable trout streams the size of the Clark Fork. While the Clark Fork River supports an average of three to five hundred catchable trout per mile, other large trout rivers in Montana often support two to three thousand or more catchable trout per mile (Berg 1984).

Major tributaries to the Clark Fork River support larger populations of catchable trout than the main stem of the river. The mean number of catchable rainbow trout per mile in the Blackfoot River over a three-year period from 1983 to 1985 was 445 percent larger than the mean number of catchable rainbow per mile in the Clark Fork River during a three-year period from 1984 to 1986 (Tables 4 and 5). The comparison of the Blackfoot River with the Clark Fork is appropriate since both rivers have similar physical habitat characteristics. Higher water quality in the Blackfoot River appears to be the major difference between the two rivers.

Estimates of catchable rainbow trout population densities have generally increased in the Clark Fork River since the inception of this study in 1984-

85 (Figures 2-7). This may be due to efforts by Montana Power Company to eliminate releases of toxic sediments from Milltown Reservoir into the river downstream and restrictive drought fishing regulations in effect from March 1, 1988, to March 1, 1990. A series of low water years which may have greatly reduced quantities of toxic metals entering the Clark Fork River in the upper basin may also be an operative factor.

Trout population densities were estimated by electrofishing and mark/recapture procedures in five study sections on Ninemile Creek and in three study sections in the Fish Creek drainage (Tables 6 and 7). Data were gathered on Ninemile Creek prior to a major sediment mitigation project which is being funded in the drainage by the U.S. Environmental Protection Agency. Follow up data will be gathered in the Ninemile study sections after the sediment mitigation projects are fully implemented to evaluate potential changes in trout population densities. Trout population densities were estimated in the Fish Creek drainage to provide information in making management decisions on bull trout and fishing regulations.

Table 2. Fish species found in the Clark Fork River in Montana between Milltown Dam and the confluence of the Flathead River.

SALMONIDAE (Trout Family)	
Prosopium williamsoni - Mountain whitefish	A[1/]
Onchorhynchus clarki lewisi - Westslope cutthroat trout	R*
Onchorhynchus mykiss - Rainbow trout	C
Salmo trutta - Brown trout	R*
Salvelinus fontinalis - Brook trout	R*
Salvelinus confluentus -Bull trout	R
ESOCIDAE (Pike Family)	
Esox lucius - Northern pike	R
CYPRINIDAE (Minnow Family)	
Mylocheilus caurinus - Peamouth	R
Ptychocheilus oregonensis - Squawfish	A
Rhinichthys cataractae - Longnose dace	C
Richardsonius balteatus - Redside shiner	A
CATOSTOMIDAE (Sucker Family)	
Catostomus catostomus - Longnose sucker	R
Catostomus macrocheilus - Largescale sucker	A
CENTRARCHIDAE (Sunfish family)	
Micropterus salmoides - Largemouth bass	R
COTTIDAE (Sculpin Family)	
Cottus cognatus - Slimy Sculpin	C

1/ Relative Abundance - A = Abundant, C = Common, R = Rare.
* Common in some tributaries of the Clark Fork in the study area.

Table 3. Location, length and river mile index boundaries of fish population study sections on the Clark Fork River.

Section Name	Description of Location	Section Length (mi)	River Mile Index Boundaries
Milltown Long Sec.	Milltown Dam to 2.8 miles upstream from confluence of Rattlesnake Cr.	3.4	364.4 to 361.0
Milltown ShortSec.	0.2 mile downstream from Milltown Dam to 3.4 mile upstream from Rattlesnake Creek	2.6	364.2 to 361.6
Missoula	Confluence of Bitterroot R. to 0.5 mile upstream from Harper Bridge	8.6	350.5 to 341.9
Huson	Confluence of Sixmile Cr. to 4.0 miles upstream from confluence of Petty Cr.	4.5	328.2 to 323.7
Superior	Confluence of Cedar Cr. to confluence of Dry Cr.	6.3	286.6 to 280.3
St. Regis Short Sec.	Confluence of St. Regis R. to 1.6 miles downstream	1.6	270.7 to 269.1
St. Regis Long Sec.	2.7 miles upstream from confluence of St. Regis R. to 1.6 miles downstream from confluence	4.3	273.4 to 269.1
Quinn	5.6 miles upstream from confluence of Flathead R. to confluence of Flathead R.	5.6	252.7 to 247.1

Table 4. Trout population estimates in five study sections of the Clark Fork River.

Study Section	Date of Estimate	Fish Species	Section Length(mi)	Catchable 1/ Trout/Section	Catchable 1/ Trout/Mile
Missoula	Sept. 1984	Rainbow	8.6	1506	175
Missoula	June 1985	Rainbow	8.6	1804	210
Milltown	June 1985	Rainbow	3.6	1035	288
Superior	July 1985	Rainbow	6.3	1382	219
Huson	Sept. 1985	Rainbow	4.5	1749	389
Missoula	Sept. 1986	Rainbow	8.6	3461	402
		Brown	8.6	137	16
		W.S.Cutthroat	8.6	187	22
Huson	Sept. 1986	Rainbow	4.5	1504	334
St. Regis	Sept. 1987	Rainbow	1.6	345	216
Milltown ShortSec.	Oct. 1988	Rainbow	2.6	1080	415
		Brown	2.6	86	33
Huson	Oct. 1988	Rainbow	4.5	3064	681
Superior	Oct. 1988	Rainbow	6.3	3354	532
		W.S.Cutthroat	6.3	167	27
Huson	May 1989	Rainbow	4.5	1906	424
Superior	May 1989	Rainbow	6.3	2424	385
		W.S.Cutthroat	6.3	92	15
Superior	Sept. 1989	Rainbow	6.3	3298	523
		W.S.Cutthroat	6.3	124	20
St. Regis	Sept. 1989	Rainbow	4.3	1154	268
		Brown	4.3	74	17
		W.S.Cutthroat	4.3	235	55
Quinn	Sept. 1989	Rainbow	5.6	1293	231
		W.S.Cutthroat	5.6	124	22

Table 4. Cont'd.

Study Section	Date of Estimate	Fish Species	Section Length(mi)	Catchable 1/ Trout/Section	Catchable 1/ Trout/Mile
Huson	May 1990	Rainbow	4.5	2465	548
		Brown	4.5	72	16
St. Regis	May 1990	Rainbow	4.3	1067	248
		Brown	4.3	63	15
Quinn	May 1990	Rainbow	5.6	1168	209
		Brown	5.6	49	9
		W.S.Cutthroat	5.6	236	42
St. Regis	Aug. 1990	Rainbow	4.3	956	222
		Brown	4.3	85	20
		W.S.Cutthroat	4.3	145	34
Quinn	Sept. 1990	Rainbow	5.6	952	170
		Brown	5.6	23	4
		W.S.Cutthroat	5.6	155	28
Milltown Long Sec.	Sept. 1991	Rainbow	3.6	1657	518
		Brown	3.6	128	40

1/ Catchable trout 7-inches total length and larger.

Table 5. Trout population estimates in the Johnsrud section of the Blackfoot River, approximately 13 miles upstream from Bonner.

Date of Estimate	Fish Species	Section Length (mi)	Catchable 1/ Trout/Section	Catchable 1/ Trout/Mile
June 1985	Rainbow	3.6	5,225	1,451
June 1984	Rainbow	3.6	3,186	885
June 1983	Rainbow	3.6	5,445	1,512
		Mean ($\bar{x}$)	4,618	1,282

1/ Catchable trout 7-inches total length and larger.

MILLTOWN SECTION CATCHABLE TROUT POPULATION DENSITY

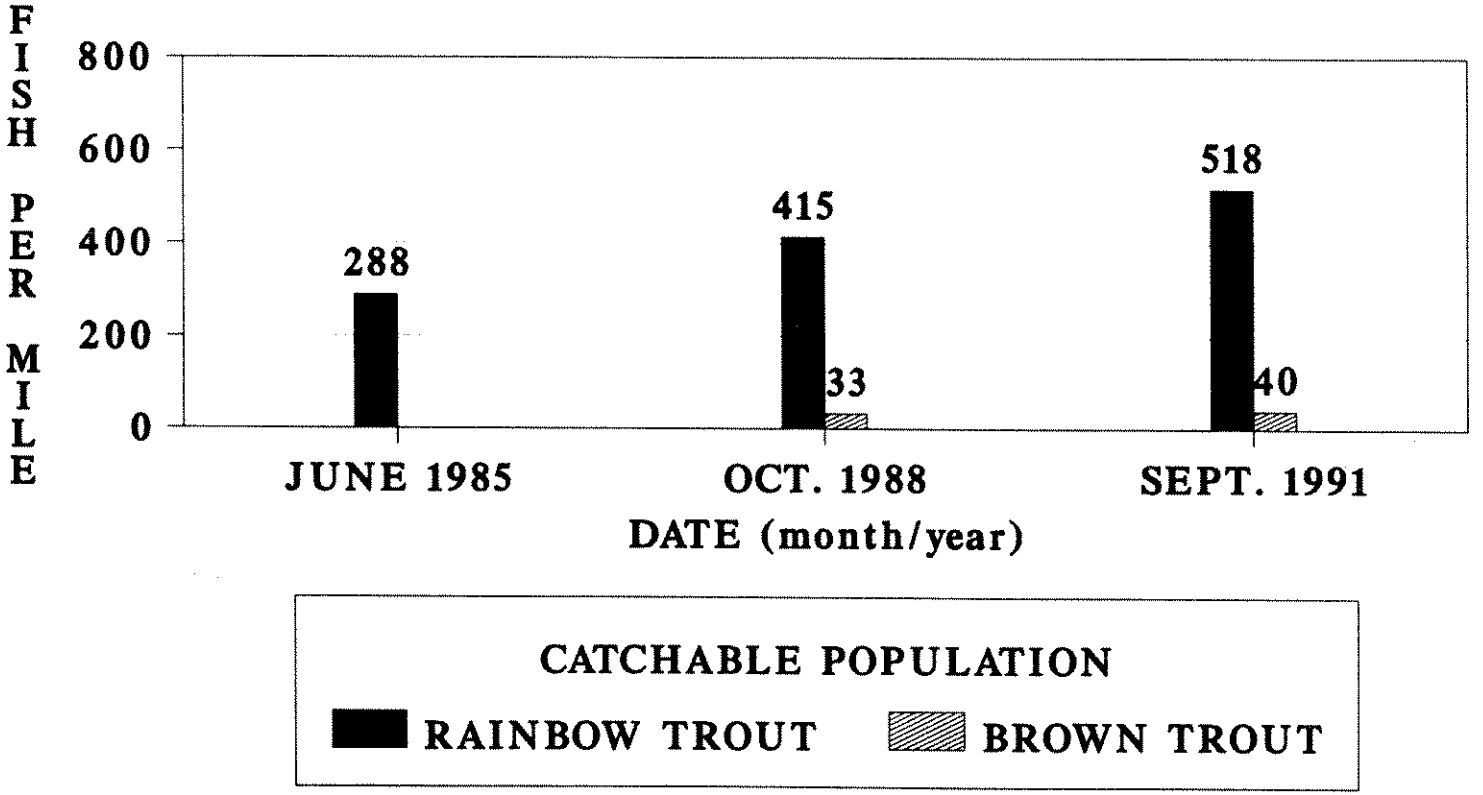

Figure 2. Catchable trout population density trends in the Milltown study section.

MISSOULA SECTION CATCHABLE TROUT POPULATION DENSITY

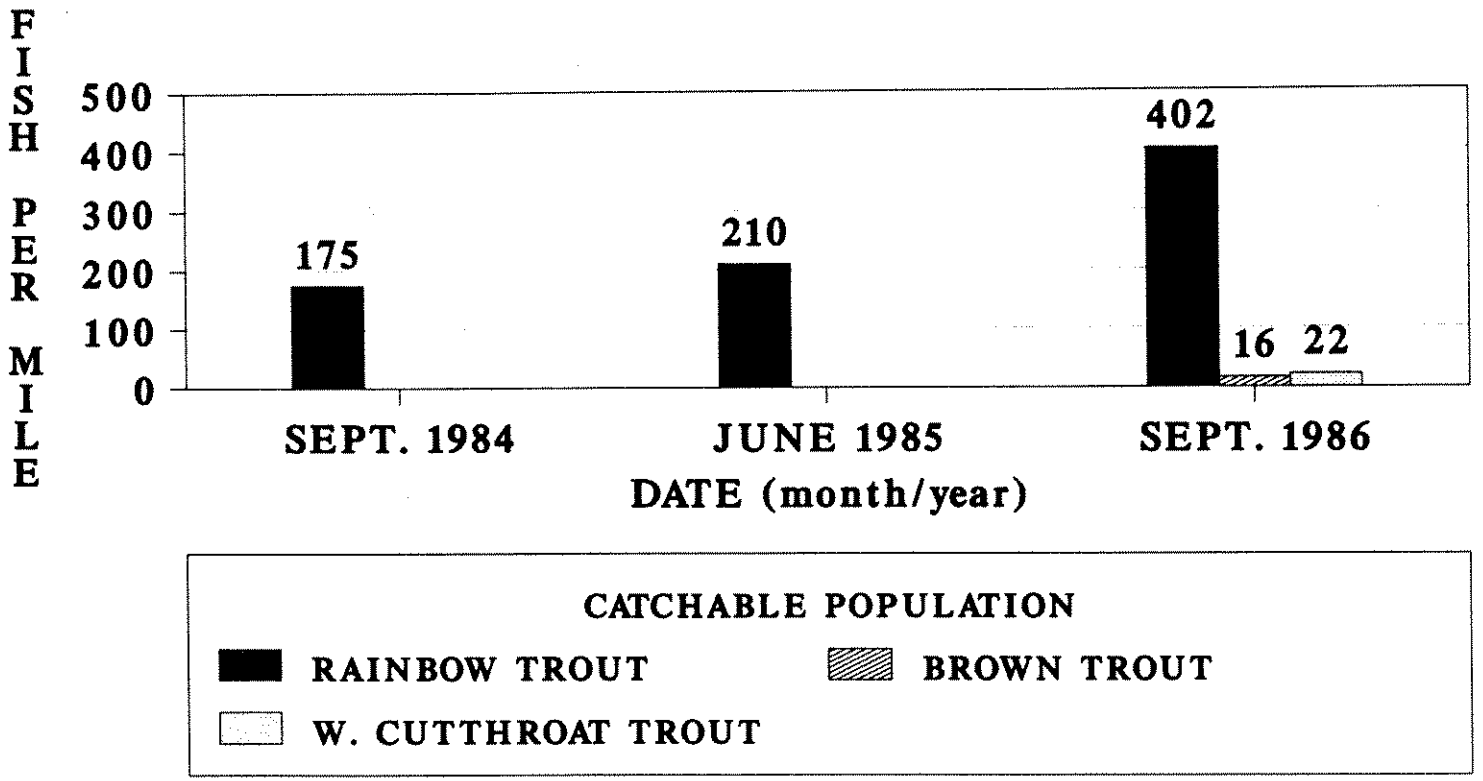

Figure 3. Catchable trout population density trends in the Missoula study section.

HUSON SECTION
CATCHABLE TROUT POPULATION DENSITY

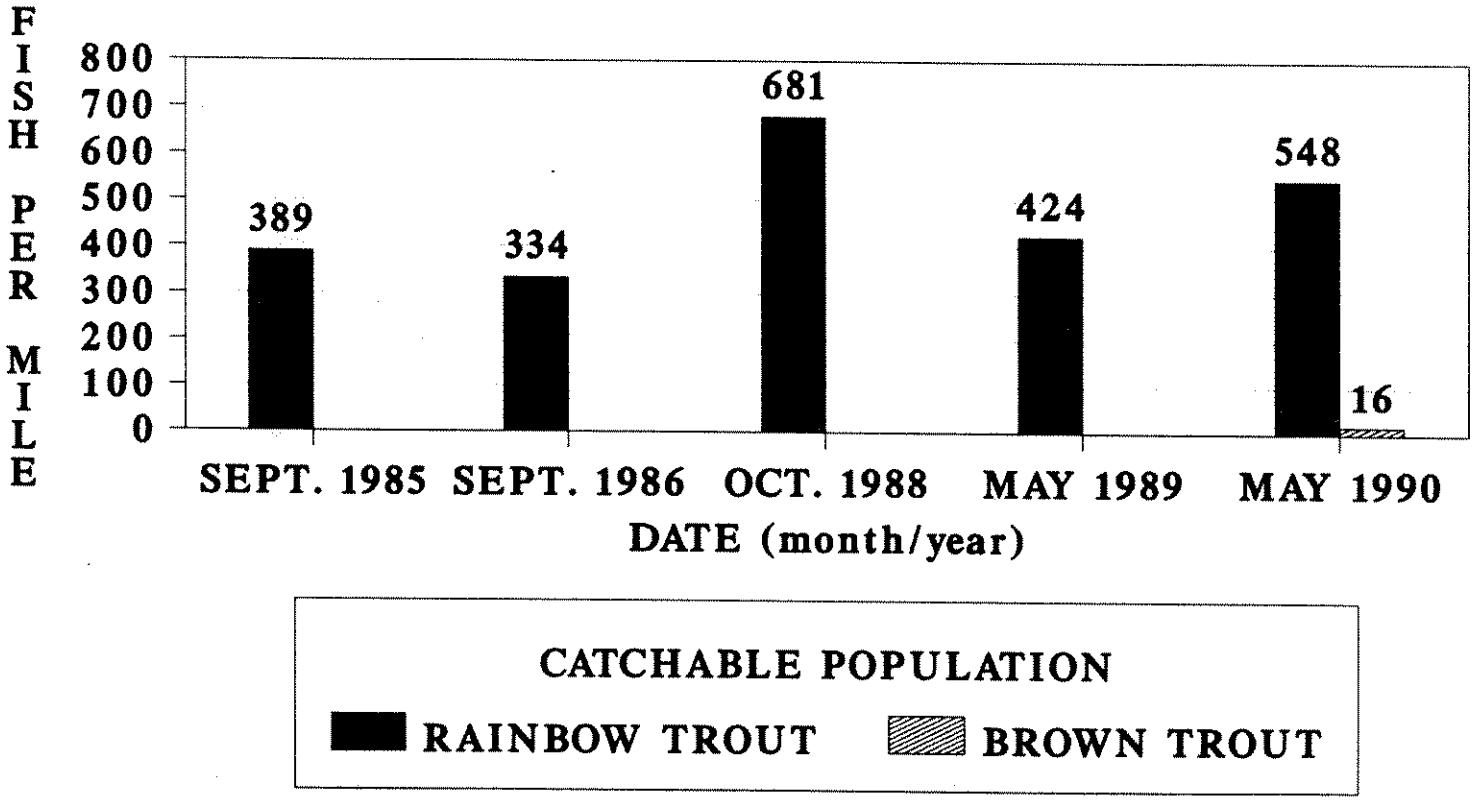

Figure 4. Catchable trout population density trends in the Huson study section.

SUPERIOR SECTION CATCHABLE TROUT POPULATION DENSITY

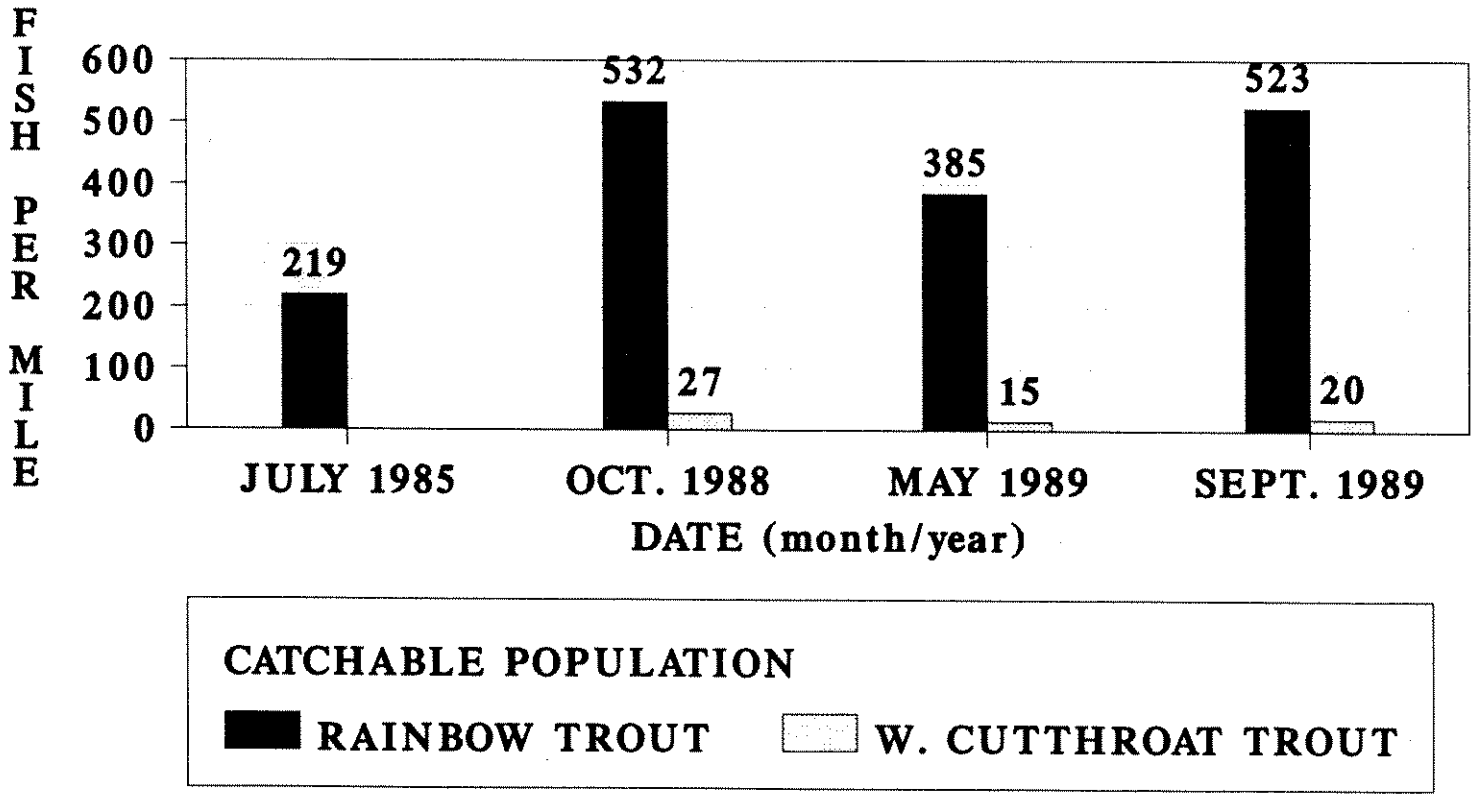

Figure 5. Catchable trout population density trends in the Superior study section.

ST. REGIS SECTION CATCHABLE TROUT POPULATION DENSITY

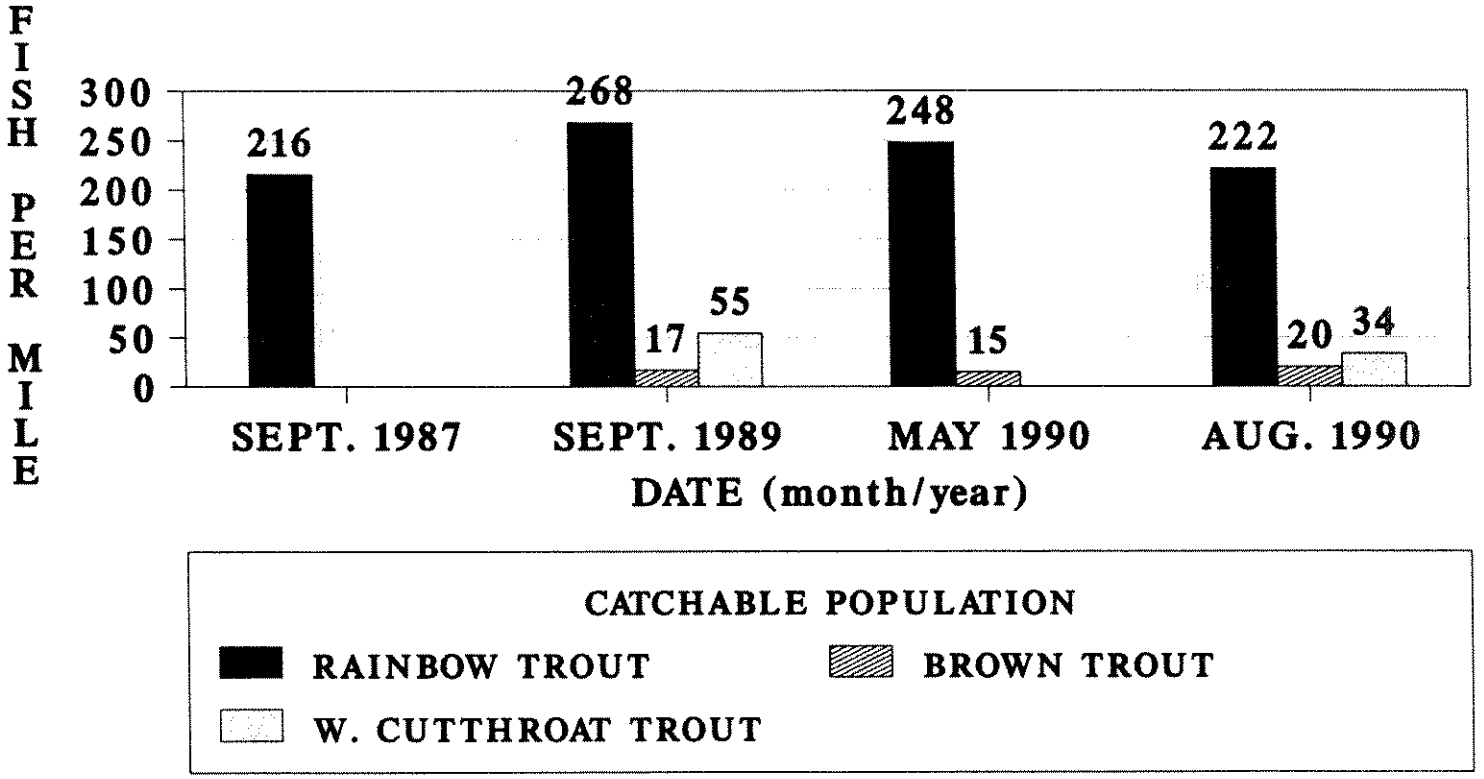

Figure 6. Catchable trout population density trends in the St. Regis study section.

QUINN SECTION
CATCHABLE TROUT POPULATION DENSITY

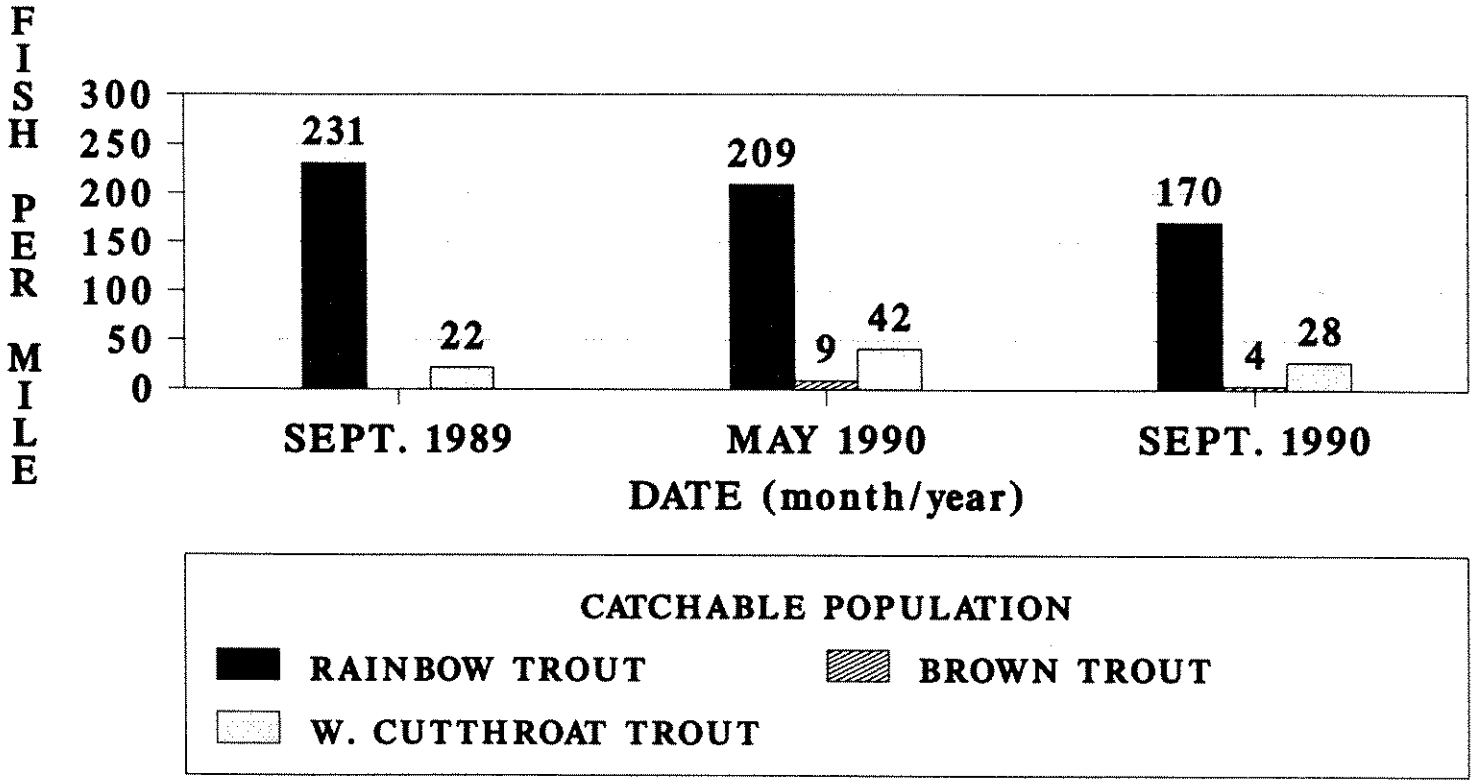

Figure 7. Catchable trout population density trends in the Quinn study section.

Table 6. Trout population estimates in five mainstem study sections of the Nine Mile Creek drainage.

Study Section	Stream Mileage	Location Coordinates	Date of Estimate	Fish Species	Section Length(ft)	Catchable 1/ Trout/Section	Catchable 1/ Trout/Mile
Section #1	1.8 - 2.3	T15N,R22W,17B	August 1991	Rainbow	2,640	299	598
Section #2	5.8 - 7.0	T15N,R23W,1D	August 1991	Rainbow	6,336	940	783
				Brown	6,336	476	396
				Brook	6,336	22	18
Section #3	8.6 - 9.4	T16N,R23W,34A & 35B	August 1991	Brown	4,224	273	341
Section #4	17.0 - 17.8	T16N,R24W,1D & T16N,R23W,6C	August 1991	Rainbow	4,224	366	458
				Brown	4,224	340	424
				Brook	4,224	332	415
Section #5	22.4 - 23.5	T17N,R24W,22D	Sept. 1991	Rainbow	5,808	446	405
				Brown	5,808	45	42
				Brook	5,808	145	132

Table 7. Trout population estimates in three study sections in the Fish Creek drainage.

Study Section	Stream Mileage	Location Coordinates	Date of Estimate	Fish Species	Section Length(ft)	Catchable 1/ Trout/Section	Catchable 1/ Trout/Mile
Fish Creek Section #1	4.2 - 5.6	T14N,R24W,20BA - 17DA	Sept. 1991	Rainbow	7,392	954	681
				Brook	7,392	60	43
Fish Creek, S.Fk. Section #2	17.5 - 18.6	T12N,R24W,6BD - 8BB	Sept. 1991	Rainbow	5,808	862	784
				Brook	5,808	73	66
Cache Creek Section #3	1.4 - 1.7	T12N,R25W,18DA	Sept. 1991	WsCt	1,584	366	1220
				Brook	1,584	39	130
				Bull	1,584	64	213

Scales were collected from trout during population estimates to determine growth rates and age structure of the trout populations. 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. Additional estimates of size and age composition, growth rates, biomass, and condition factors of trout populations in the middle Clark Fork River will be presented in the completion report for this project.

Tributary Trout Spawning Migrations

In an effort to evaluate spawning periodicity and sources of trout recruitment in the middle Clark Fork River, the lower reaches of several tributaries were electrofished or trapped during trout spawning periods to locate spawning migrants from the Clark Fork River.

Most members of the trout family migrate during the spawning season in search of suitable spawning sites (Hubbs and Lagler 1970). Spawning movements of lake dwelling salmonid populations into inlet or outlet streams have been extensively documented for rainbow (Raynor 1942, Hartman et al. 1962, Calhoun 1966, Scott and Crossman 1973) and brown trout (Fenderson 1958, Stuart 1957) and mountain whitefish (Snyder 1918, Calhoun 1966).

Less information is available on spawning movements of river dwelling salmonid populations into feeder streams. Calhoun (1966) reports resident rainbow trout populations in streams tend to move upstream, and if possible into tributaries to spawn. River dwelling brown trout in Ontario normally seek tributary streams for spawning purposes (MacKay 1963). Spawning movements of mountain whitefish from larger streams into some tributaries have been observed in Montana (Liebelt 1970, Brown 1971).

Electrofishing and "Idaho weir" fish trapping surveys indicate rainbow, brown and westslope cutthroat trout migrate from the Clark Fork River into tributaries to spawn (Berg 1986). "Idaho weirs" were set in the lower reaches of Belmont, Gold, Monture, Cottonwood, and Johnson Creeks in Spring 1990 to monitor rainbow trout spawning migrations from the Blackfoot River, a primary tributary which enters the Clark Fork River at Milltown Reservoir. Migrant rainbow trout spawning runs were found in all five tributaries (Table 6).

Since fish traps were operated in the tributaries during only a small portion of the rainbow trout spawning period, numbers of migrants shown in Table 6 represent only a small subsample of the entire run. In addition, the traps were not always "fish tight" during the time period when they were installed. Therefore, in tributaries where migrant rainbows were captured, our data document only the presence of a run and do not accurately estimate its magnitude.

Table 8. Upstream migrant rainbow trout captured in five tributaries of the Blackfoot River during Spring 1990 using "Idaho weir" fish traps.

Stream	Trap Dates	Trap Nights	Total Rainbow Trout Male	Mature Rainbow Trout Female	Total	x Mature Rainbow/Trap Night
Belmont Creek	3-19-4/27	34	107	14	121	3.56
Gold Creek	3/12-4/16	22	25	2	27	1.23
Monture Creek	3/5-4/3	25	16	1	17	0.68
Cottonwood Creek	3/5-4/20	43	8	3	11	0.26
Johnson Creek	3/5-4/25	49	14	3	17	0.35

Tributary Trout Fry Outmigrations

Trout fry outmigrations from several tributaries, monitored with fry traps, indicate tributaries provide recruitment of juvenile trout to the Clark Fork River (Berg 1986). Trout fry outmigrations from tributaries in the upper Clark Fork River and Blackfoot River drainages were monitored during this report period. Trap site locations are shown in Tables 9 and 10, and results are presented in Tables 11 and 12.

Table 9. Fry trap locations at thirteen sampling sites in the Upper Clark Fork River Drainage.

Water Name	Legal Description
Willow Creek	T.4 N. R.10 W. SEC. 11DB
Mill Creek	T.4 N. R.10 W. SEC. 11AC
Warm Springs Creek	T.5 N. R.9 W. SEC. 18CA
M/W Bypass above Pond 2 discharge	T.5 N. R.9 W. SEC. 18CD
M/W Bypass below Pond 2 discharge	T.5 N. R.9 W. SEC. 18DA
Lost Creek	T.5 N. R.9 W. SEC. 6AA
Dempsey Creek	T.7 N. R.9 W. SEC. 33CB
Little Blackfoot River	T.9 N. R.10 W. SEC. 24DB
Gold Creek	T.10 N. R.10 W. SEC. 31BB
Flint Creek	T.10 N. R.12 W. SEC. 6AD
Harvey Creek (Below fish barrier)	T.11 N. R.14 W. SEC. 16CB
Harvey Creek (Above fish barrier)	T.11 N. R.14 W. SEC. 16CC
Schwartz Creek	T.11 N. R.17 W. SEC. 34CD

Table 10. Fry trap locations at eight sampling sites in the Big Blackfoot River Drainage.

Water Name	Legal Description
Johnson Gulch	T.13 N. R.18 W. SEC. 14BA
W. Twin Creek	T.13 N. R.17 W. SEC. 2CA
Gold Creek	T.13 N. R.16 W. SEC. 6BB
Belmont Creek (Below culvert)	T.14 N. R.16 W. SEC. 24CB
Belmont Creek (Above culvert)	T.14 N. R.16 W. SEC. 24BC
Cottonwood Creek	T.15 N. R.13 W. SEC. 29CB
Monture Creek	T.15 N. R.13 W. SEC. 27CC
Chamberlain Creek	T.15 N. R.13 W. SEC. 32AC

Table 11. Number of emigrating trout captured in fry traps at twelve tributary locations in the upper Clark Fork River drainage, Spring/Summer 1991.

Tributary	Trapping Dates	Number Of Complete Trapnights	Species	Total Number Captured YOY*	Age 1+**	Number Captured Per Trapnight YOY*	Age 1+**
M/W Bypass (Above Pond 2 Discharge)	5/15-6/4	13	LL	0	32	0	2.46
M/W Bypass (Below Pond 2 Discharge)	6/24-7/17	13		0	0	0	0
Mill Creek	4/29-7/3	39	LL	1	5	0.03	0.13
Warm Springs Creek	4/29-5/17	12	LL	45	9	3.75	0.75
	6/26-7/17	10	LL	0	0	0	0
Gold Creek	4/30-7/17	43	LL	29	1	0.67	0.02
Willow Creek	5/22-7/12	28	LL	5	0	0.18	0
L. Blackfoot River	4/29-5/10	8	LL	0	1	0	0.13
	6/17-7/17	13	LL	1	0	0.08	0
Flint Creek	4/30-5/19	11		0	0	0	0
	6/17-7/17	13		0	0	0	0
Lost Creek	5/22-5/24	2		0	0	0	0
Dempsey Creek	5/28-6/14	11		0	0	0	0
Harvey Creek (Below Fish Barrier)	7/8-7/17	6	RB	51	0	8.5	0
			LL	0	1	0	0.17
	7/30-8/9	6	RB	8	0	1.33	0
			CT	0	1	0	0.17

Table 11. (Continued)

Tributary	Trapping Dates	Number Of Complete Trapnights	Species	Total Number Captured YOY*	Age 1+**	Number Captured Per Trapnight YOY*	Age 1+**
Harvey Creek	7/15-7/17	2		0	0	0	0
(Above Fish Barrier)	7/30-8/9	6	RB	4	0	0.67	0
Schwartz Creek	7/9-8/9	15	RB	638	2	42.53	0.13
			LL	3	1	0.2	0.07
			EB	1	3	0.07	0.2
	9/4-9/6	2	RB	4	0	2	0
			LL	2	0	1	0
			EB	1	0	0.5	0

Table 12. Number of emigrating trout captured in fry traps at twelve tributary locations in the Big Blackfoot River drainage, Spring/Summer 1991.

Tributary	Trapping Dates	Number Of Complete Trapnights	Species	Total Number Captured YOY*	Age 1+**	Number Captured Per Trapnight YOY*	Age 1+**
Johnson Gulch	6/12-8/9	25	RB	1,372	8	54.88	0.32
			EB	0	3	0	0.12
			CT	0	3	0	0.12
	9/4-9/6	2	RB	16	0	8	0
Twin Creek, West	6/25-8/9	21	RB	937	2	44.62	0.09
			CT	0	1	0	0.05
	9/4-9/6	2	RB	3	0	1.5	0
Gold Creek	5/14-8/9	25	RB	694	0	27.76	0
			LL	0	4	0	0.16
			EB	2	0	0.08	0
Belmont Creek (Below Culvert)	5/14-8/9	32	RB	1,009	3	31.53	0.09
			DV	0	3	0	0.09
	9/4-9/6	2	RB	67	0	33.5	0
Belmont Creek (Below Culvert)	7/23-8/9	10	RB	1673	0	167.3	0
	9/4-9/6	2	RB	127	0	63.5	0
Cottonwood Creek	5/14-8/9	28	RB	229	5	8.18	0.18
			LL	15	3	0.54	0.11
Chamberlain Creek	6/25-8/9	21	LL	1	0	0.05	0
			CT	6	6	0.29	0.29
Monture Creek	7/30-8/9	7	RB	19	0	2.71	0
			LL	4	0	0.57	0

Juvenile Brown Trout Saturation Plants

Saturation plants of 10,000 hatchery reared young-of-the-year brown trout were made in the Huson study section during the early summer of 1986 and late summer of 1987 to aid in evaluating whether recruitment is a limiting factor for trout populations in the Clark Fork River. A third saturation plant was made in the Huson section on September 28, 1988. Juvenile brown trout were distributed in rearing habitat along the periphery of the Clark Fork River in a three mile reach from the confluence of Sixmile Creek downstream toward Ninemile Creek during each plant. Spawn were taken from a wild stock of brown trout at Harrison Lake, Montana, for the 1986 plant and from a wild stock of brown trout from Warm Springs Creek, Montana for the 1987 and 1988 plants. The eggs were fertilized and incubated at the Washoe Park State Fish Hatchery. The brown trout were reared in the hatchery until they were 2 to 4 inches in total length before being planted in the Huson section.

Due to the acclimatization problems resulting from significant differences in water temperatures between the hatchery truck and the river, the 1986 saturation plant experienced essentially 100% mortality. Excellent acclimatization during the 1987 and 1988 plants resulted in high initial survival rates approaching 100%.

The 1987 and 1988 saturation plant fish were marked with an adipose fin clip made about one month before planting. The adipose fin clip retention rates at planting time were 94% for the 1987 plant and 92% for the 1988 plant. The average length of brown trout planted in 1988 was 3.26 inches compared to 2.7 inches for the 1987 plant. There were 72.2 fish per pound in the 1988 plant compared to 123.78 fish per pound in 1987.

Electrofishing surveys and population estimates will be continued in the Huson section to determine whether these fish eventually recruit into the adult population. No recruitment of brown trout from the saturation plants was observed in an estimate made in the Huson section during May 1990. This is the only estimate which has been made since recruitment from the saturation plant could have been expected.

Angler Harvest Rates and Fish Movement Patterns

A total of about 7,000 trout have been marked with individually numbered Floy T-tags since the inception of this study. Tags recovered during our surveys will be used to evaluate trout movement patterns in the middle Clark Fork River drainage.

An indication of angler harvest of trout in the Clark Fork River and its tributaries is being provided by angler-returned fish tags. Preliminary estimates suggested westslope cutthroat and bull trout were relatively more vulnerable to harvest than rainbow and brown trout (Berg 1986).

Since large numbers of tagged trout are still at large in the study area, tag returns are being updated on a daily basis. A computer program is being developed to analyze trout movement patterns and angler harvest rates. A summary of findings will be presented in the report for this project.

CONCLUSIONS

The middle Clark Fork River and its tributaries support a fishery with substantial recreational value. The sport fishery is provided mainly by rainbow trout and a few brown, bull and westslope cutthroat trout. However, catchable trout population numbers are considerably lower than expected for a river of its size.

A variety of factors probably contribute toward suppressing the fishery in this reach of river. Water quality degradation factors which may be influencing the fishery include the Frenchtown pulp mill and Missoula sewage treatment plant effluents, potentially toxic metals originating from mine tailings in the upper Clark Fork drainage and fine sediments originating from various human related activities which could impair trout food production or trout reproductive success. Stream dewatering and water temperature affects from irrigation water withdrawals also influence the river fishery particularly through indirect effects on tributary streams which typically are more severely dewatered than the main river. This may account for the apparent shortage of suitable spawning habitat and the low numbers of young trout in the main stem populations.

Trout population estimates presently cannot be used to differentiate the effects of the various factors on the sport fishery. However, the estimates do indicate that trout populations are depressed in the Clark Fork River from Milltown Dam to St. Regis despite the inflow of major tributaries with relatively high water quality. Findings from studies conducted to date suggest that if water quality is improved in the middle Clark Fork River, it should be capable of supporting larger populations of catchable trout.

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Waters Referred to:

Clark Fork River, Sec. 02	05-1456
Clark Fork River, Sec. 03	06-1121
Belmont Creek	04-0420
Gold Creek	04-2610
Monture Creek	04-3690
Cottonwood Creek	04-1470
Johnson Creek	04-3000
Ninemile Creek	05-5168
Fish Creek	05-2768
Twin Creek, West	04-5850
Chamberlain Creek	04-1140
Schwartz Creek	06-
Harvey Creek	06-2945
Flint Creek	06-2242
Willow Creek	06-7144
Mill Creek	06-4142
Warm Springs Creek	06-6859
Mill/Willow Bypass	06-
Lost Creek	06-3705
Little Blackfoot River	06-
Dempsey Creek	06-1615

Key Words:

Trout spawning - Tributaries/mainstem
Trout fry outmigrations
Trout population estimates

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