MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

FISHERIES DIVISION
JOB PROGRESS REPORT

STATE: MONTANA PROJECT TITLE: STATEWIDE FISHERIES INVESTIGATION
PROJECT NO: F-12-R-35 STUDY TITLE: SURVEY AND INVENTORY OF COLDWATER STREAMS
JOB NO: I-B, SEGMENT 1 JOB TITLE: WEST CENTRAL MONTANA COLDWATER STREAM INVESTIGATIONS
PROJECT PERIOD: JULY 1, 1988 THROUGH JUNE 30, 1989

## ABSTRACT

A fishery inventory of the Blackfoot River from headwaters to mouth was conducted during 1988 to evaluate angler concerns of a declining fishery in recent years. Sampling of young-of-the-year trout throughout the mainstem, repeating fish population surveys conducted in the headwaters during the early 1970's, establishing three new population inventory sections, conducting a voluntary creel census, and evaluating species of special concern in the river were completed in 1988.

Fish populations in the Blackfoot River vary greatly in terms of species composition and overall fish density. The differing fisheries of the Blackfoot River are a product of habitat characteristics, recruitment sources, and human influences such as environmental degradation and fishery exploitation. Fisherman concerns over a declining fishery are centered in the middle and lower reaches of the river, from roughly Nevada Creek to the mouth of the Blackfoot River. This report addresses possible reasons for angler dissatisfaction, and identifies potential management strategies to remedy fisheries problems in the Blackfoot River. Special consideration was given to effects of the current drought and resulting record low stream flows on fishing opportunities.

Fishery management tools including stock enhancement (naturally or artificially), harvest regulation changes, and habitat improvement appear to have potential to improve low fish densities in some reaches of the river. Due to the complexity of the fishery, and the factors that influence it, no single management tool is likely to be successful in correcting problems. In addition, future fish management decisions should consider specific reaches of river which vary in fisheries potential. Given that fishing pressure continues to increase, more restrictive harvest regulations will likely be necessary to maintain catch rates and abundance of spawning aged fish. This is particularly true for the native trout species, cutthroat and bull trout, present in the Blackfoot River.

## OBJECTIVES AND DEGREE OF ATTAINMENT

JOB OBJECTIVES:

1. Ensure within legal and hydrologic constraints that flows in trout streams do not fall below 1975-1985 averages.

A record breaking drought in 1988 prompted our notification of junior water right holders in the Blackfoot and Rock Creek that they needed to suspend use of junior water rights. We responded to serious drought conditions with region-wide bag limit reductions.

2. Maintain existing trout populations at or above the current densities in 5 to 10 test streams.

Field data collections necessary for evaluating attainment of this objective were not completed. A lack of man-power, operating expenses, and equipment prevented completion of the field work.

3. Maintain 100% of the region's stream banks and channels in their present or better condition.

Stream bank and channel alteration permits submitted for Hydraulic Notices under the Stream Protection Act and 310 permits under the Natural streambed and land preservation Act were responded to during the year. Seven conservation districts' 310 permits were reviewed during the year and recommendations were made to protect fish habitat.

4. Maintain water quality at current or improved conditions as reported in the 1986 Montana 305(b) Water Quality Report to the U. S. Environmental Protection Agency.

Development Projects detrimental to maintenance of water quality in Rock Creek, the Clark Fork River, and the Blackfoot River were reviewed and permit conditions were recommended where necessary to protect water quality for trout. Violations of water quality standards that were observed were documented and reported to Water Quality Bureau for enforcement action.

5. Maintain fish populations and habitat in streams affected by resource development at levels at least as good as current status.

Plum Creek, Champion, and USFS timber sales were reviewed for various fish habitat preservation concerns. We participated in interagency meetings for preservation of fish habitat on Rock Creek and the Clark Fork River.

6. Implement the Bitterroot River/Painted Rocks Water Management Plan and provide minimum instream flows at Bell Crossing consistent with the plan and water availability.

With record breaking drought conditions within this Western basin stream flows were maintained above 100 cfs at Bell Crossing. Although less than optimum for the Bitterroot River, a great success in reducing low flow impacts that could have been much more severe.

7. Maintain genetically pure WsCt populations with population structures at least as diverse as presently exists.

Blackfoot River cutthroat populations appear to be in need of additional protective management from over-harvest. Management strategies are being developed and protective measures will be in place by March 1990. Population simulation modeling indicates a long-term recovery period due to slow growth, low adult population, and environmental degradation.

Several stream populations of cutthroat were sampled and electrophoretic analysis completed on liver proteins to test for genetic purity.

8. Develop a voluntary catch and release program for westslope cutthroat trout in rivers and streams to maintain genetically pure populations at least at current levels wherever they exist.

Recommended placement of voluntary regulations on the Fishing regulations and helped I&E shoot video footage for promotional films.

9. Maintain bull trout populations at least at current levels.

Bull trout numbers appear to be declining in the Blackfoot and re-evaluation of the management program is in progress.

10. Increase the number of trout over 14 inches long in the Rock Creek population to at least 200 per mile.

In the spring of 1989 the Fish and Game section of Rock Creek was sampled and found to contain 178 $\pm$ 92 rainbow trout larger than 14 inches long. Drought conditions and lack of spring flushing flows probably contributed to failure to meet our target. No management action is planned.

11. Determine if a problem exists between floating and walking anglers on Rock Creek.

Float fishing increased in Rock Creek between 1986 and 1988. A thorough coverage of various aspects of the float fishing issue on Rock Creek are contained in Segment 2 of this report.

12. Maintain the combined number of wild rainbow and brown trout 14 inches and larger in the Darby section of the Bitterroot River at 100 per mile and in the Tucker Section at 160 per mile. Maintain rainbow standing crop of 300, of all sizes, in the Poker Joe Section downstream from Stevensville.

Man-power necessary to monitor Bitterroot River trout populations were not available during this report period. We do not know if objective was met.

13. Determine the extent of fry loss to irrigation ditches in key spawning tributaries in the Bitterroot. Determine time period during which ditches pose the greatest threat to migrating fry.

We did not accomplish this objective due to lack of man-power and equipment.

14. Increase the number of rainbows 12 inches and larger in the Johnsrud section of the Blackfoot River to at least 300 per mile.

Number of rainbow trout larger than 12 inches is below 300 per mile and management changes are being drafted for public review.

15. Maintain trout populations at least at current levels in the Blackfoot River upstream from Johnsrud Park.

Long-term study objective addressed in Segment 1 of this report.

16. To develop, in cooperation with the U.S. Forest Service, a five-year management plan for Rock Creek.

## PROCEDURES

### FISH POPULATION ESTIMATES

Fish populations were estimated using a mark and recapture method. Population estimates were calculated using Chapman's modification of the Peterson formula (Ricker 1975). Variance estimates were also made using Chapman's formula. Total length of captured fish was measured to the nearest mm, and weight was measured to the nearest gram. Trout longer than 8.0 in were tagged with individually numbered T-tags in sections downstream from Lincoln.

We duplicated five electrofishing sections sampled by Spence (1975) which included: Below Pop's Place, Flesher, Hogum, Poorman-Dalton, and Canyon section (Figure 1). We remeasured the lengths of sampling sections to account for potential channel changes and errors in identifying previous section boundaries. We also established three new study sections in the Blackfoot River: below the Raymond Bridge, below the Scotty Brown Bridge, and below River Bend FAS (Figure 1).

Fish sampling equipment was fitted to the type of water conditions each section presented. In the small stream sections (Below Pop's Place, Flesher, and Hogum) a Coffelt Model BP-1C, gas-powered backpack electrofishing unit was used. We used the wire hoop positive and a multistrand cable for the negative electrode. We used a Coffelt Model 2C-2000 rectifying unit with a 1500 watt gas-powered generator mounted in an 8 foot long rubber raft in the Poorman-Dalton section. Our positive electrode was a hand-held 1-foot diameter hoop with a braided copper wire negative. On the larger river sections (Canyon, Raymond Bridge, Scotty Brown Bridge, and River Bend FAS) we used an aluminum drift boat mounted with booms; there were four cable droppers per boom. Two rectifying units, a Coffelt Model 2C-2000 and a VVP-15, and a 3500 watt generator provided the electrical fields necessary for fish sampling. We also used a Boston whaler with a combination of hand-held and boom mounted electrodes which could be lowered to the stream bottom in an attempt to improve sampling efficiency in the deep pools of the lower river.

### YOUNG-OF-THE-YEAR SAMPLING

Young of the year (YOY) trout densities were surveyed in the Blackfoot River during early August from the mouth to Aspen Grove Campground near Lincoln. A single habitat type, riffle areas with rock border, was sampled to allow comparisons of YOY densities between sections. This habitat type was chosen because: 1) it provided the most consistent selection of sampling

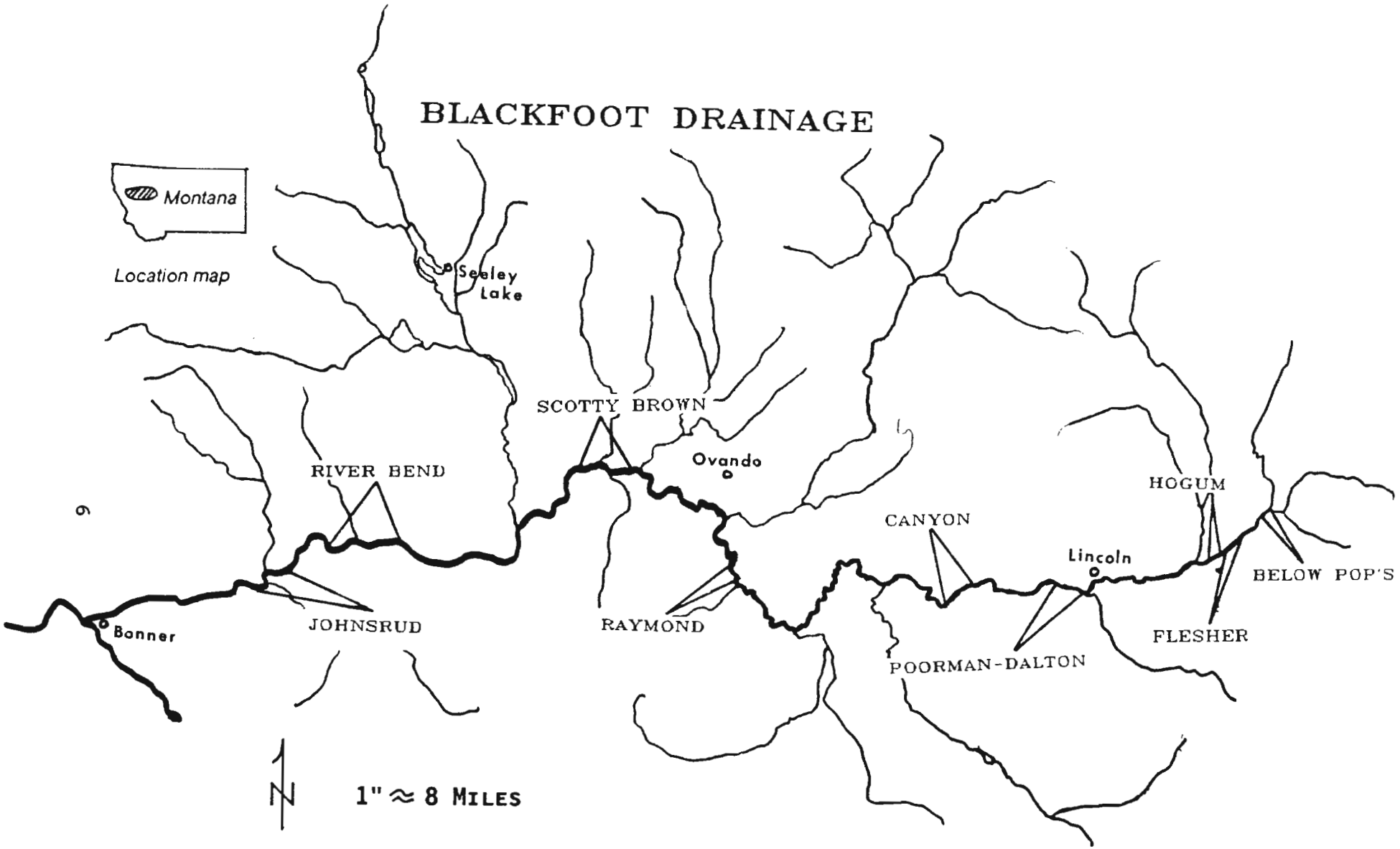


Figure 1. Map of Blackfoot River drainage and location of study sections.

sites; 2) it was present in all sections below Nevada Creek; and 3) it was known to be desirable rearing habitat. Riffle areas with rock border, however, provide a better comparison of rainbow trout YOY densities than brown trout YOY. Brown trout YOY appear to prefer root/brush borders over rock borders (Spoon 1987). Above Nevada Creek the rock borders were not generally available and sampling was confined more to the root/brush borders.

We used a Coffelt Model BP-1C gas-powered backpack electrofishing unit; 50 to 150 watts were required to capture fish. All observed as well as captured YOY were used to calculate catch per unit effort. Sections were measured with a tape to determine length of shoreline sampled. Recruitment potential of selected tributaries was also determined using this YOY sampling method.

## WATER TEMPERATURE

Water temperature recorders were installed at Raymond Bridge, Scotty Brown Bridge, and at the inactive USGS station above Belmont Creek. We used 30-day chart recorders manufactured by Partlow and Taylor. Thermographs were calibrated with laboratory thermometers at the time of installation and several times after installation. Recorders were operated from approximately mid July through September, 1988.

## CREEL CENSUS

A voluntary creel census was initiated in July to gather catch information. Incidental fisherman contacts during field activities were made and mail-in cards handed to these fisherman. We also used one weekend day per week to contact fisherman and hand-out creel census cards. Cards were also given to game wardens and selected businesses making fisherman contacts in the area.

## BULL TROUT REDD SURVEY

Bull trout redd counts were made in the North Fork of the Blackfoot and Monture Creek by walking known spawning areas at or near completion of the spawning period.

## RESULTS

The Blackfoot River changes in character several times throughout its length. Available fish habitat in the river is a function of the river's physical characteristics, which in turn, is influenced by the adjacent geologic features. Based on relatively distinct breaks in physical characteristics, the river was divided into five reaches: Reach 1, Headwaters to Lincoln; Reach 2, Lincoln to Nevada Creek; Reach 3, Nevada Creek to Monture Creek; Reach 4, Monture Creek to Belmont Creek; and Reach 5, Belmont Creek to the mouth of the Blackfoot River. These reach breaks also correspond with relatively distinct changes in the composition of the Blackfoot River fishery.

### PHYSICAL CHARACTERISTICS OF THE BLACKFOOT RIVER

**Reach 1: Headwaters to Lincoln**
(RM 132.4 to 110)

Stream gradient of the Blackfoot River appears to play a significant role in the changes in fish habitat. Gradient of the Blackfoot River generally is steep in the headwaters averaging 24.56 ft/mi to Poorman Creek (Figure 2). In this reach, beaver dams are common in the main channel and the stream flows through large meadow areas. Pools are deep and riffles normally appear gravelly (0.125 to 2.99 in. dia.) with some rubble sized (3.00 to 11.9 in. dia.) particles. The Blackfoot river goes underground upstream from Lincoln almost annually and reappears again with major ground water inflows and spring type creeks just below Lincoln.

**Reach 2: Lincoln to Nevada Creek**
(RM 110 to 67.8)

Gradient decreases below Poorman Creek (below Lincoln) to an average of 10.2 ft/mi maintaining that grade to Arrastra Creek about 20 miles downstream. Deposition of large quantities of fine sediments in pools and riffles is a commonly observed feature in this reach. The stream channel develops a strong meandering pattern and log and debris jams are common. Stream bank cover is predominately coniferous forest with lots of woody brush cover. This reach is largely in a natural condition because of frequent flooding and a well developed riparian zone. The pools are frequently greater than 6 ft in depth. Fish cover is predominately provided by the woody debris in the channel. High water clarity, lack of water surface roughness, and fine sediment (< 0.125 in. dia.) accumulation on the bottom make open water observation of fish easy. From Arrastra creek to below Nevada Creek gradient declines to 4.2 ft/mi. Fish habitat remains similar to the Poorman to Arrastra section with possibly

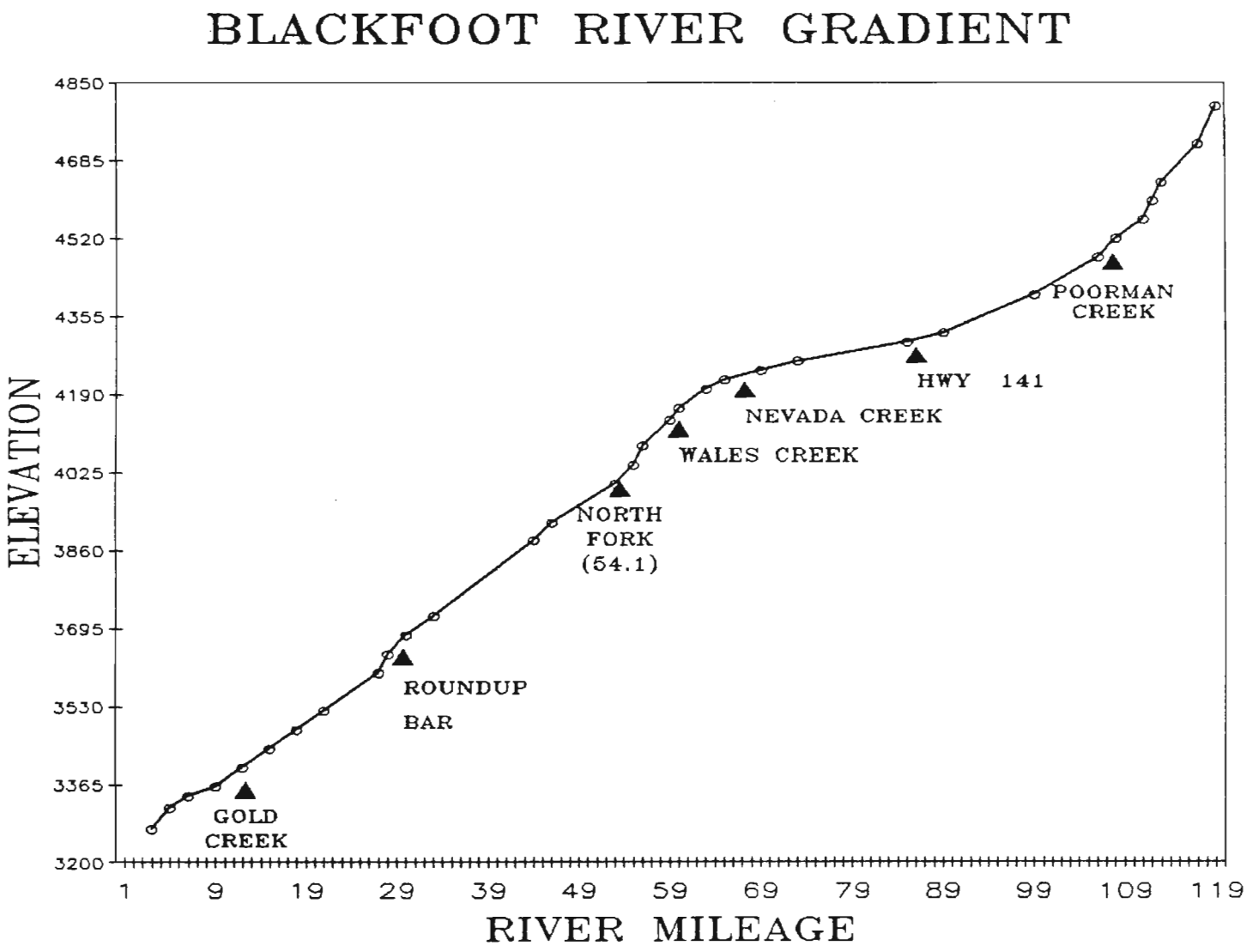


Figure 2. Gradient of Blackfoot River from headwaters to mouth (River Mileage from DNRC, 1984).

more fine sediment deposition.

**Reach 3: Nevada Creek to Monture Creek**
(RM 67.8 to 45.9)

In the Wales Creek area, about 4 miles below Nevada Creek, the Blackfoot River takes a sharp drop in grade increasing to 20.2 ft/mi to the North Fork of the Blackfoot. Boulders (> 12.0 in. dia.) and rubble reappear in the bottom substrate. Woody debris jams are less common, strong meandering disappears, and the riffle-pool sequence becomes noticeable. This section had dense growths of filamentous green algae and rooted aquatic plants covering much of the bottom in 1988. Local residents indicated that 1987 was the first time these dense growths were observed in the river. Fine sediments are abundant in eddies, behind boulders, along the banks and in the interstitial spaces in the riffle substrate. Aquatic plant masses throughout the channel appear to encourage sediment deposition in and downstream from the mass. Stream bank cover is dominated by grasses with some brush in this section. Below the North Fork gradient moderates to 14.8 ft/mi for most of the remaining 52 miles to the Milltown pool.

**Reach 4 and 5: Monture Creek to Mouth of Blackfoot River**
(RM 45.9 to 0)

These two reach possess similar habitat characteristics except that the river increases in size in Reach 5 due to significant tributary inflows. In this river segment, gradient remains moderate at 14.8 ft/mi except for some short reaches of higher gradient near the Roundup Bar and below Whittaker Bridge. The bottom substrate in this reach are dominated by boulder and rubble sized particles. Fine sediment is easily observed in the interstitial spaces in the wide riffle areas, and is relatively absent in the narrow riffles with high current velocities. This reach of the Blackfoot has deep boulder runs and deep pools tailing into broad riffles. Several major tributaries feed the Blackfoot River in Reach 4 and 5 including: Monture, Cottonwood, Clearwater, Belmont, Gold, E. and W. Twin Creeks, Johnson Gulch, and a few more smaller creeks.

## STREAMFLOW

Stream discharge in Blackfoot river has been recorded at the USGS gaging station near Bonner (RM 7.9) since 1939. The maximum recorded flow of 19,200 cfs occurred on June 10, 1964. The lowest recorded flow of 200 cfs occurred on Jan. 4,5, 1950.

Both the seasonal high and low flows over the last 5 years (1983 - 1988) have been below the historic 50% exceedance level (ie. the level you would expect to exceed 50% of the time based

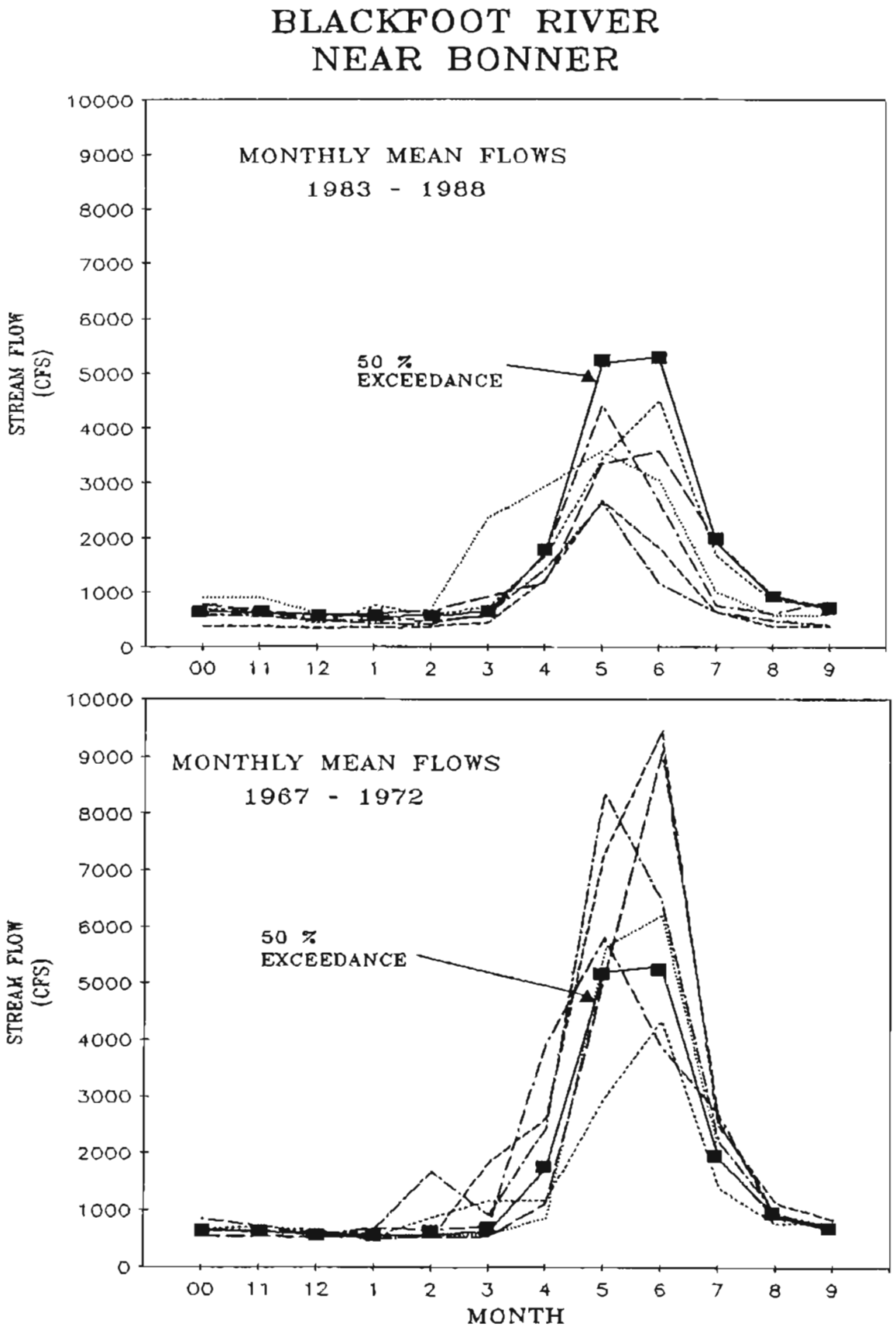


Figure 3. Comparison of mean monthly discharge to 50% exceedance flows at the USGS gauge near Bonner for the years 1983-88 (top) and 1967-72 (bottom).

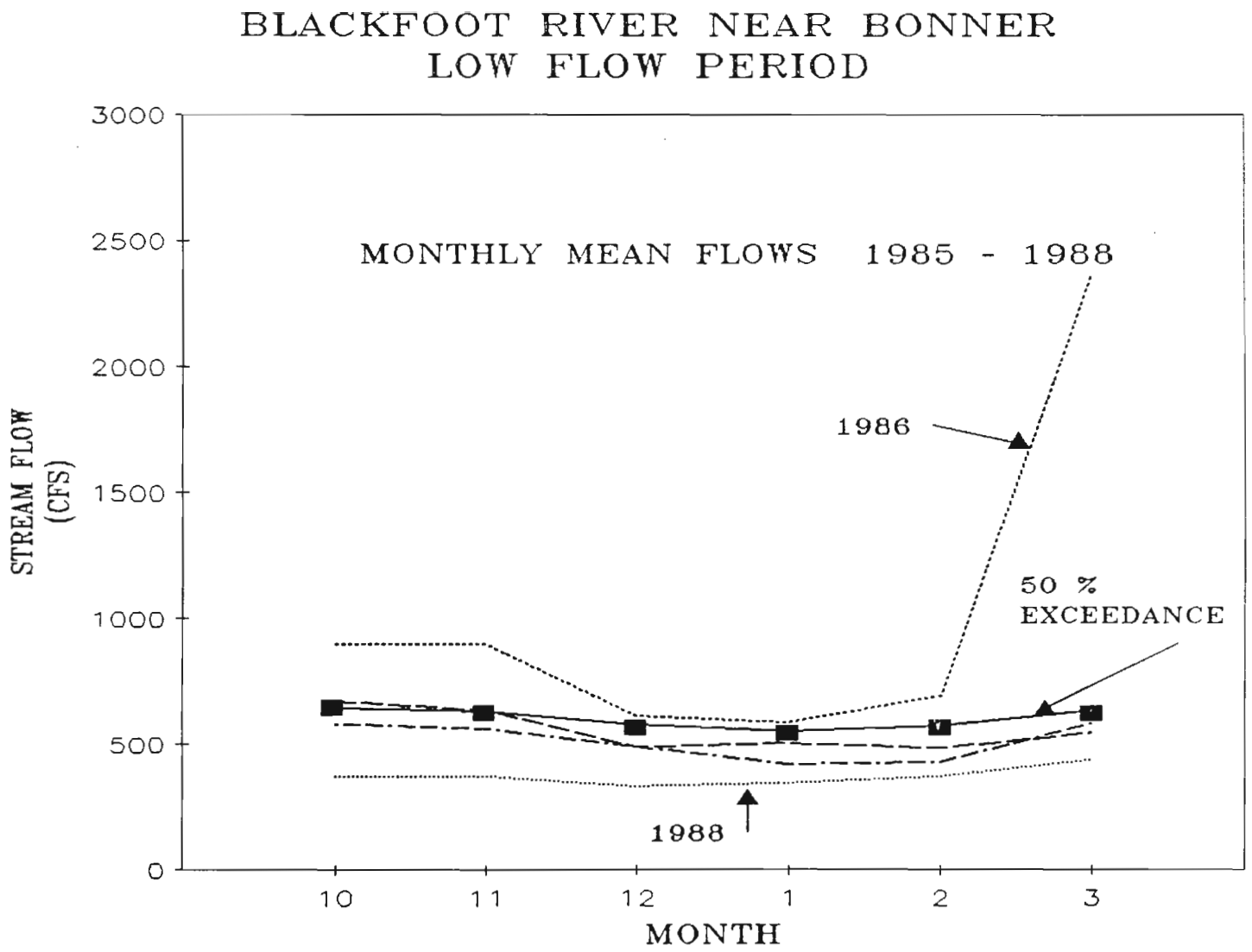


Figure 4. Mean monthly discharge and 50% exceedance flows at the USGS gauge near Bonner for the low flow periods, 1985 through 1988.

on the previous record) (Figure 3). Low flows in the summer of 1988 approached and may have exceeded record daily low flow levels based upon provisional USGS flow records (Figure 4). In contrast, discharge during the low flow period in the years 1967 to 1972 (years preceding and during previous fisheries work in the Blackfoot River) were about average. Spring runoff flows during this period were generally far above average (Figure 3). Early fall stream flows at selected sites in the upper Blackfoot River were consistently less in 1988 than in the 1970's (Table 1). Contrasting streamflows during these two periods of fish sampling are important to consider when interpreting observed changes in fish populations between the early 1970's and 1988.

Table 1. Comparison of September stream flows at selected sites in the headwaters of the Blackfoot River.

| Location | Year | Date | Stream flow (cubic feet/sec) |
|---|---|---|---|
| Blackfoot River | 1988 | 9/8 | 1.1 |
| Below Pop's Place | 1970 | 9/8 | 3.8 |
| | 1969 | 9/8 | 4.0 |
| Blackfoot River | 1988 | 9/8 | 0.8 |
| Flesher | 1973 | 8/17 | 3.0 |
| | 1972 | 8/31 | 5.0 |
| Blackfoot River | 1988 | 9/8 | .2 |
| Hogum | 1972 | 9/8 | 24.0 |
| | 1971 | 9/8 | 20.0 |
| Blackfoot River | 1988 | 9/6 | 71.0 |
| Dalton bridge | 1973 | 9/25 | 95.0 |
| | 1972 | 9/8 | 133.0 |
| Blackfoot River | 1988 | 9/8 | 111.0 |
| Canyon campground | 1973 | 9/14 | 127.0 |
| | 1972 | 9/8 | 197.0 |
| Alice Creek | 1988 | 9/8 | 4.6 |
| | 1973 | 9/25 | 6.5 |
| | 1972 | 9/13 | 12.0 |
| Copper Creek | 1988 | 9/8 | 11.5 |
| | 1973 | 9/27 | 16.0 |
| Landers Fork | 1988 | 9/8 | 34.0 |
| at HWY 200 bridge | 1973 | 9/27 | 36.0 |
| | 1972 | 10/18 | 26.0 |

## WATER TEMPERATURE

Maximum daily water temperatures equaled or exceeded 70 F at each of the three stations where temperature was monitored (Figure 5). The influence of the North Fork of the Blackfoot River (RM 54.1) on temperatures in the Blackfoot River are apparent at Scotty Brown Bridge (downstream 8.5 miles) where temperatures were 4 to 5 F less than at Raymond Bridge (6 miles upstream from the North Fork). Water temperatures monitored near Belmont Creek (32.2 miles below the North Fork) were more similar to temperatures at Raymond Bridge than at Scotty Brown Bridge.

Water temperatures greater than 68 F are generally considered to be above the optimal level for salmonid growth. From mid-July to late August, maximum daily water temperatures exceeded 68 F at the Raymond Bridge, Scotty Brown Bridge, and Belmont Stations 38, 11, and 44 days, respectively.

Despite low streamflow levels, spot checks of water temperatures in reaches 1 and 2 did not detect temperature problems in 1988. Significant groundwater inflows in these reaches appear to moderate water temperature.

Water temperatures in the Clearwater River are significantly influenced by the Clearwater chain of lakes. Warm water leaving these lakes during 1988, however, was largely diverted for irrigation near highway 200. Water remaining near the mouth of the Clearwater River primarily originated from groundwater recharge. Consequently, the Clearwater River did not elevate water temperatures of the Blackfoot River as expected.

Low stream substrate temperatures resulting in anchor ice (ice formed on the stream bottom) in the Raymond Bridge area were observed in late November, 1988. In December, 1988 an estimated 90% of the Raymond section had anchor ice. Anchor ice occurred in pools, runs and riffle areas.

## TROUT POPULATIONS OF THE BLACKFOOT RIVER

The Blackfoot river possesses a diverse wild trout fishery. Species composition throughout the river varies greatly depending upon location within the drainage. Cutthroat and brook trout dominate the headwaters, followed by several miles of brown trout fisheries, and finally becoming a trout fishery dominated by rainbow trout in the lower two reaches (Table 2). Accordingly, results from fish sampling have been arranged to address distinct river reaches, which were identified based on

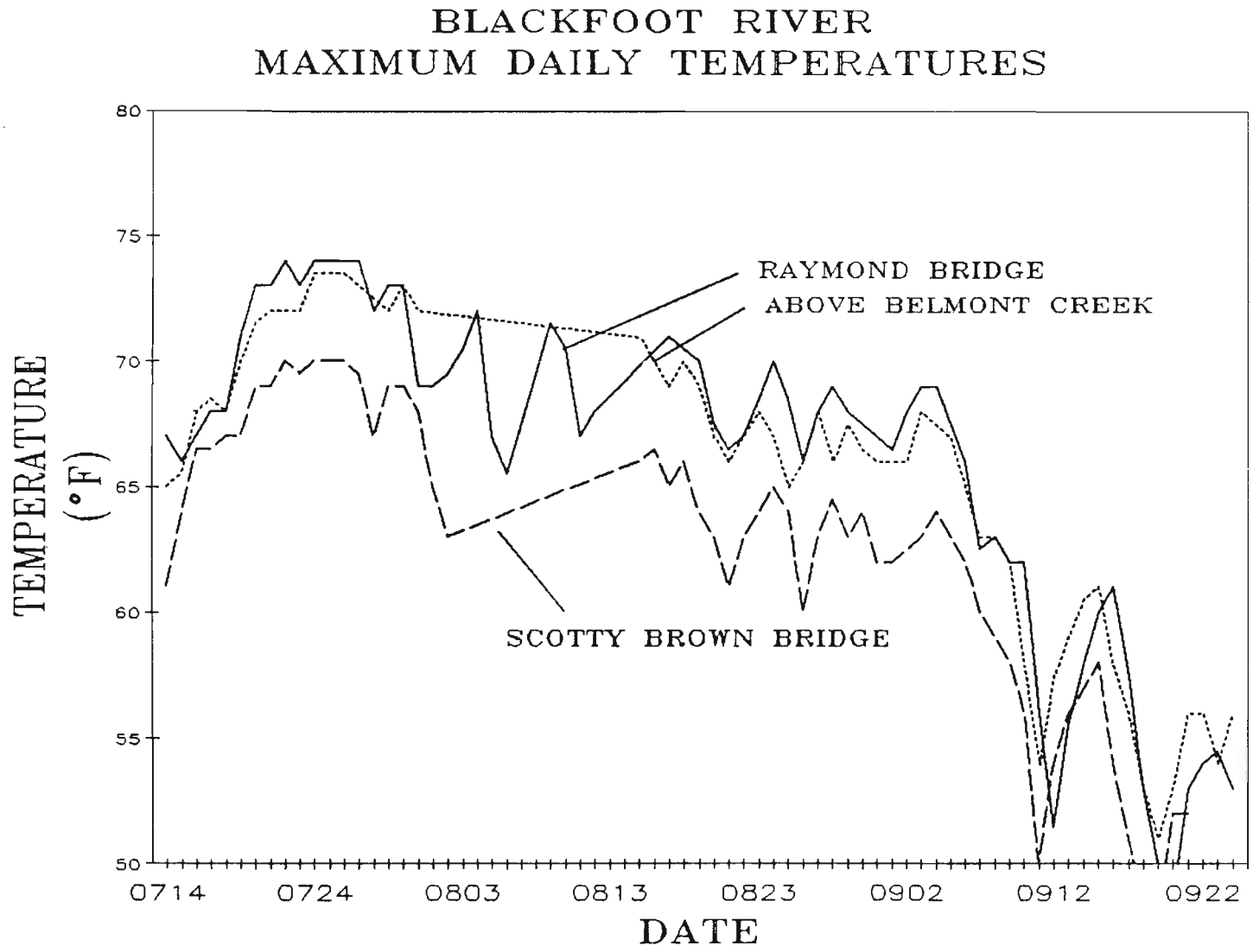


Figure 5. Maximum daily water temperature recorded at three locations in the Blackfoot River, 1988.

physical habitat characteristics and attributes of fish populations.

Table 2. Gamefish species composition in five reaches of the Blackfoot River based on data from 1981 through 1988.

| | Percentage | | | | |
|---|---|---|---|---|---|
| Reach | Rb | LL | Ct | DV | Eb |
| Mouth to Belmont Cr. | 86 | 1 | 9 | 4 | 0 |
| Belmont Cr. to Monture | 58 | 38 | 2 | | 0 |
| Monture Cr. to Nevada Cr | 20 | 71 | 9 | 0 | |
| Nevada Cr. to Lincoln | 0 | 97 | 1 | | |
| Lincoln to Headwaters | 0 | 53 | 1 | 46 | |

Species codes: Rb = rainbow trout; LL = brown trout; Ct = cutthroat trout; DV = bull trout; Eb = eastern brook trout.

**Reach 1: Headwaters to Lincoln**
(RM 132.4 to RM 110)

Fish populations were sampled in three sections of this reach including: Below Pop's Place, Flesher, and Hogum sections. Each of these sections was sampled during the early 1970's as well as 1988. Westslope cutthroat trout and eastern brook trout dominate the headwaters of the Blackfoot River above Lincoln averaging 53 and 46% of the trout population, respectively.

Cutthroat trout densities have declined significantly since estimates were conducted during the early 1970's (Figure 6). The Below Pop's Section declined from 101 cutthroat age I and older in 1971 to 15 per 1,000 ft of stream in 1988. A similar trend was observed in the Flesher section where densities declined from 69 per 1,000 ft in 1973, to 30 in 1975, and 15 per 1,000 ft in 1988. In the Flesher section the 1975 sampling occurred after the Mike Horse Mine tailings pond failure, which released large quantities of toxic metals into the upper Blackfoot River.

The density of cutthroat trout in the Hogum section has not significantly changed between sampling periods. Cutthroat density (yearlings and older) ranged from 14 to 17 per 1,000 ft of stream. This section is dominated by shallow riffle habitat with very little cover which probably explains the low densities observed there.

Eastern brook trout populations have significantly declined in three of the four sampling sections in this reach (Figure 7). Brook trout (yearlings and older) in the Below Pop's Place section, the uppermost sampling site in the drainage, did not significantly change compared to the 1971 sampling. Densities of YOY brook trout in 1988, however, were significantly higher

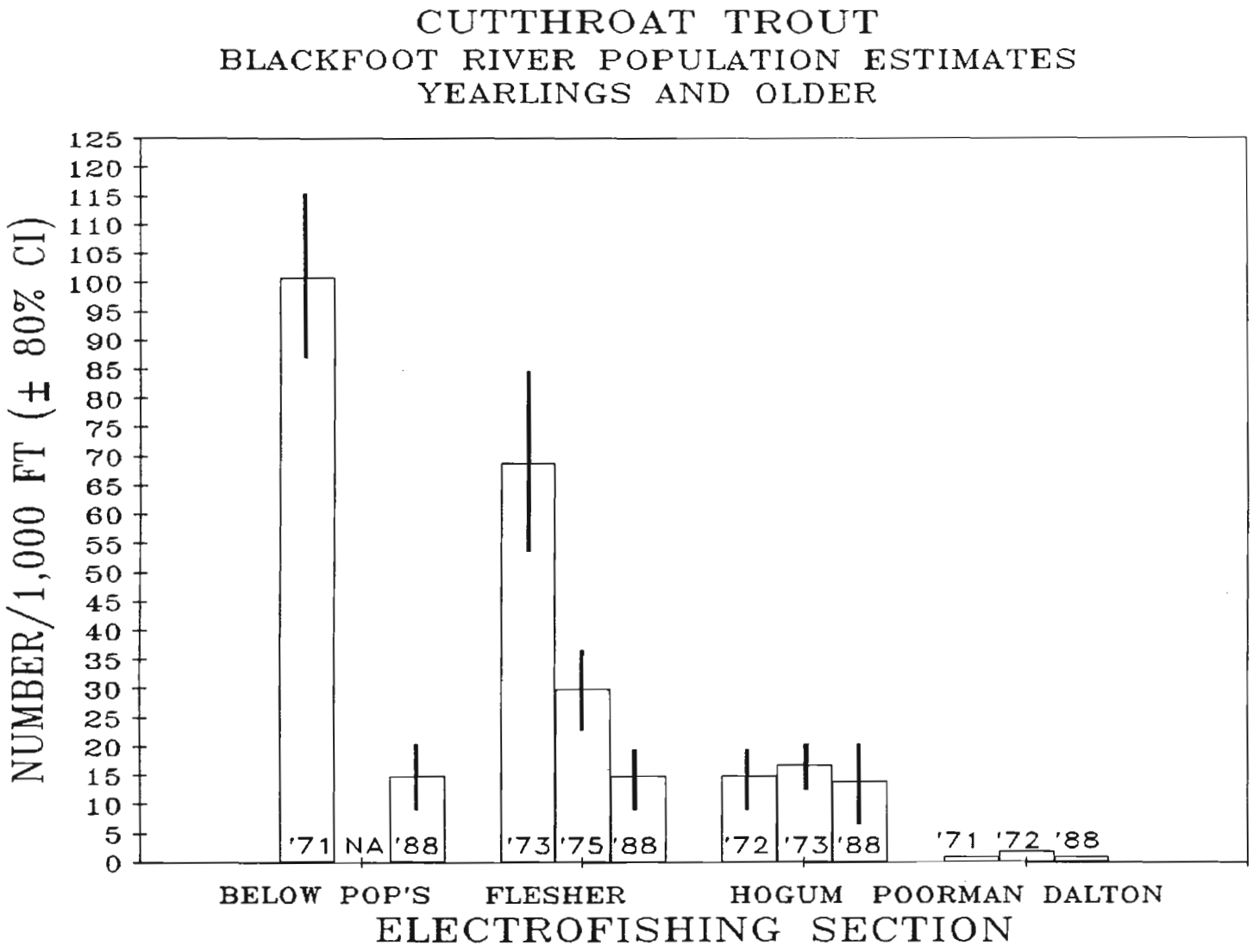


Figure 6. Comparisons of westslope cutthroat trout population estimates (yearlings and older) in four sections of the Blackfoot River from 1971 through 1988.

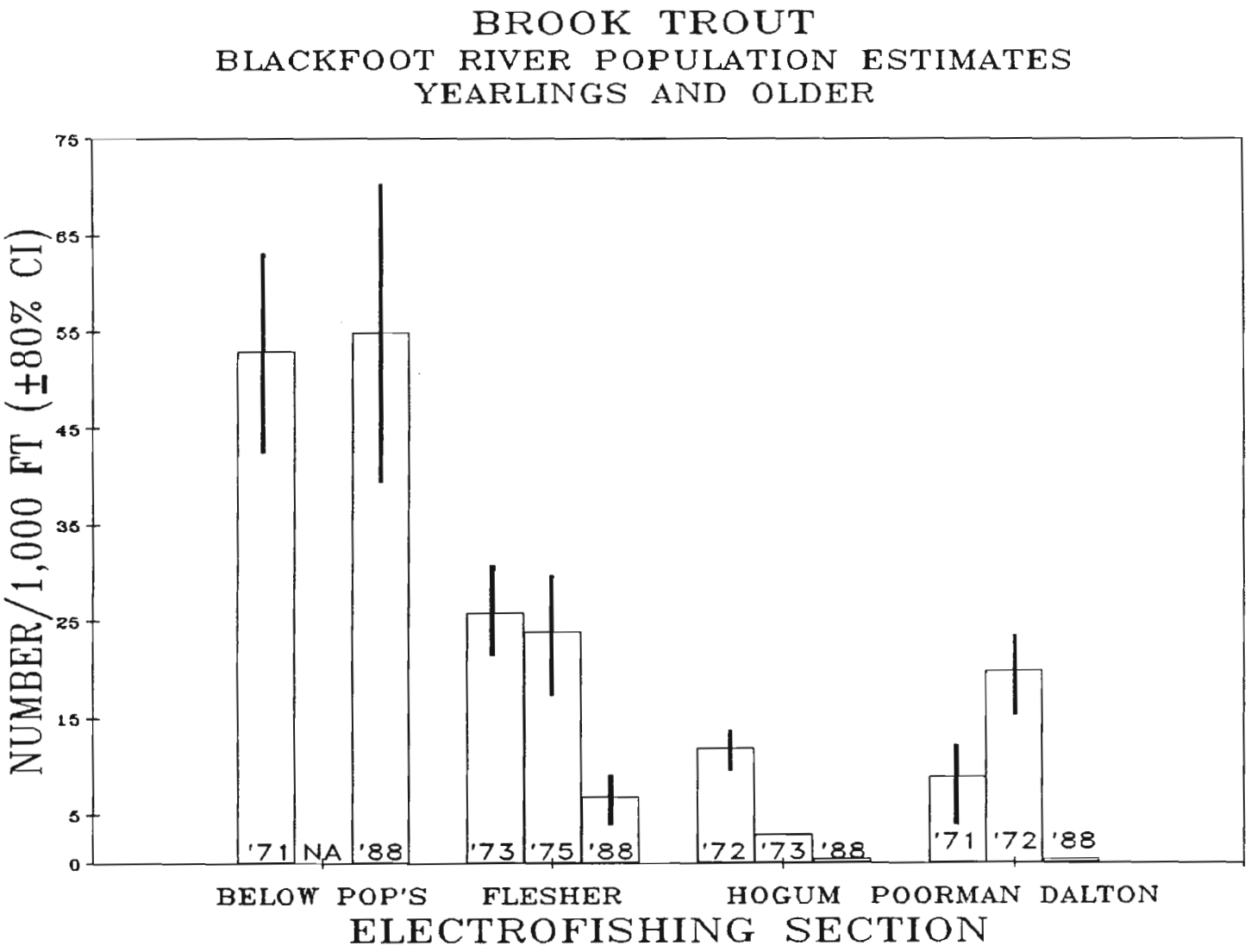


Figure 7. Comparisons of eastern brook trout population estimates (yearlings and older) in four sections of the Blackfoot River from 1971 through 1988.

compared to the 1971 sample (Appendix Table 3).

Bull trout were rare in reach 1. Only one fingerling size bull trout was captured in the Hogum, Flesher, and Below Pop's sections combined in 1988. During 1972, seven bull trout were captured in these sections (Appendix Table 1).

Catchable sized rainbow trout were planted throughout the Blackfoot River during the early 1970's. These hatchery fish were recovered in the Hogum section during 1972 and 1973, but were absent from samples in all sections of reach 1 during 1988.

**Reach 2: Lincoln to Nevada Creek**
(RM 110 to RM 67.8)

Fish populations were sampled in two sections of reach 2 including: Poorman-Dalton (RM 108.0 to 109.1) and Canyon section (RM 94.3 to 95.8). These sections were electrofished in 1988 as well as during the early 1970's. Brown trout dominated the fishery in this reach comprising 97% of the trout population.

The highest density of brown trout in the Blackfoot River was observed in the Poorman-Dalton section. Brown trout YOY density estimated in 1988 was not significantly different from previous estimates. The density of YOY ranged from 220 to 360 per 1,000 ft during the three population surveys (Figure 8). YOY brown trout were found utilizing the downstream edges of beaver dams, concentrations of rooted aquatic plants, and shallow debris piles for day time summer cover.

Densities of adult brown trout (age II and older) also were not significantly different between sampling years, ranging from 44 to 61 per 1,000 ft (Figure 8). Yearling brown trout densities, however, declined 53 percent from the 1971-1972 average of 73.5 per 1,000 ft to 39 per 1,000 ft in 1988. Similar to YOY, yearling brown trout used brush associated with beaver dams and shallow debris piles for summer day time cover.

Brown trout redd counts in the Poorman-Dalton section were 50% higher during the fall of 1988 compared to counts during 1971 and 1972 (Figure 9). The increase in the number of redds observed in 1988 was probably related to relatively low flow conditions restricting upstream movement of spawners, rather than being a result of increased numbers of spawning fish.

Densities of adult brown trout were significantly lower in the Canyon section (15/1,000 ft) compared to the Poorman-Dalton section (44/1,000 ft) during 1988 (Figures 8 and 9). Decreased densities of adult trout in the Canyon section may be related to relatively low numbers of juvenile trout observed in this section.

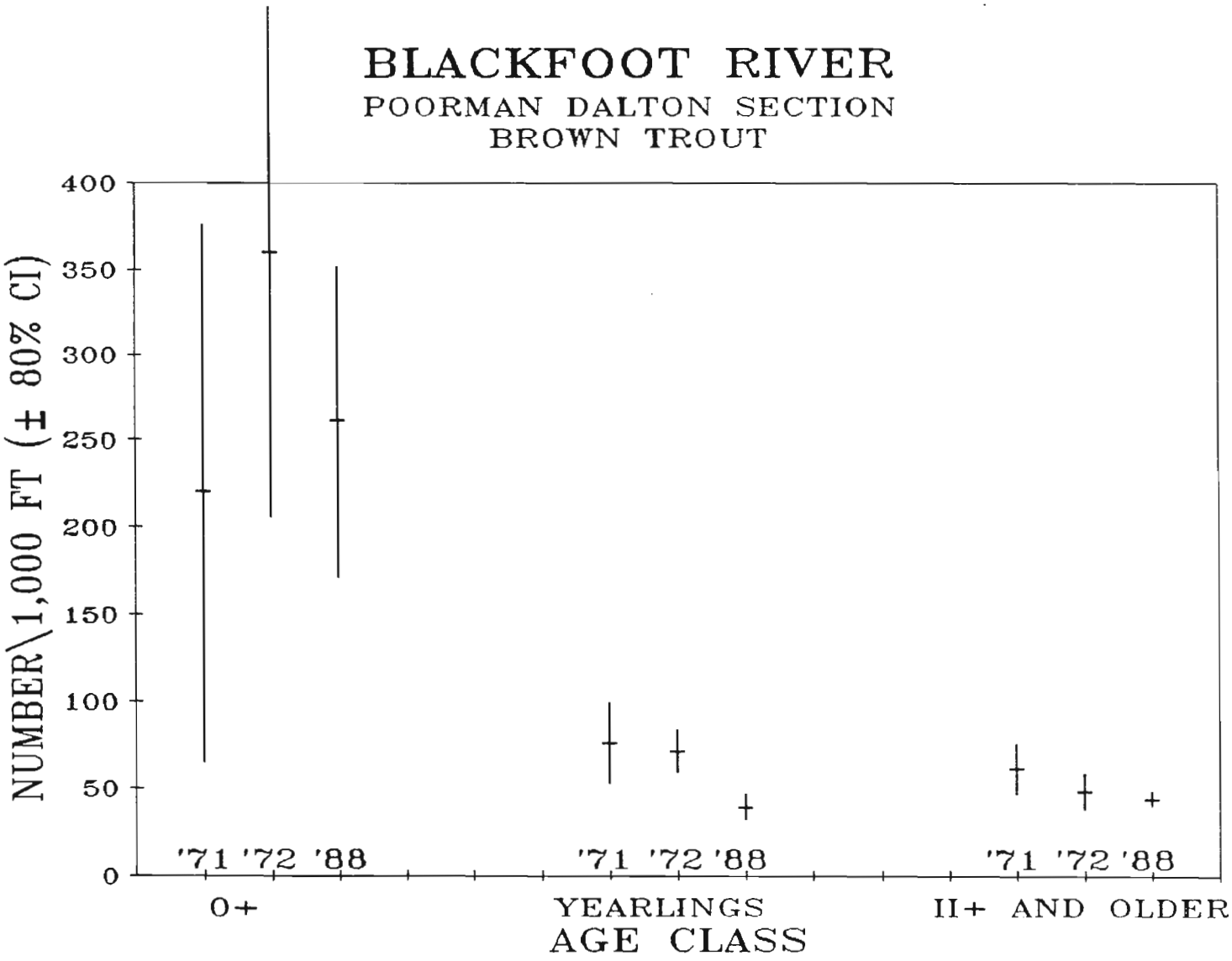


Figure 8. Comparisons of brown trout population estimates in the Poorman Dalton section of the Blackfoot River, 1971 through 1988.

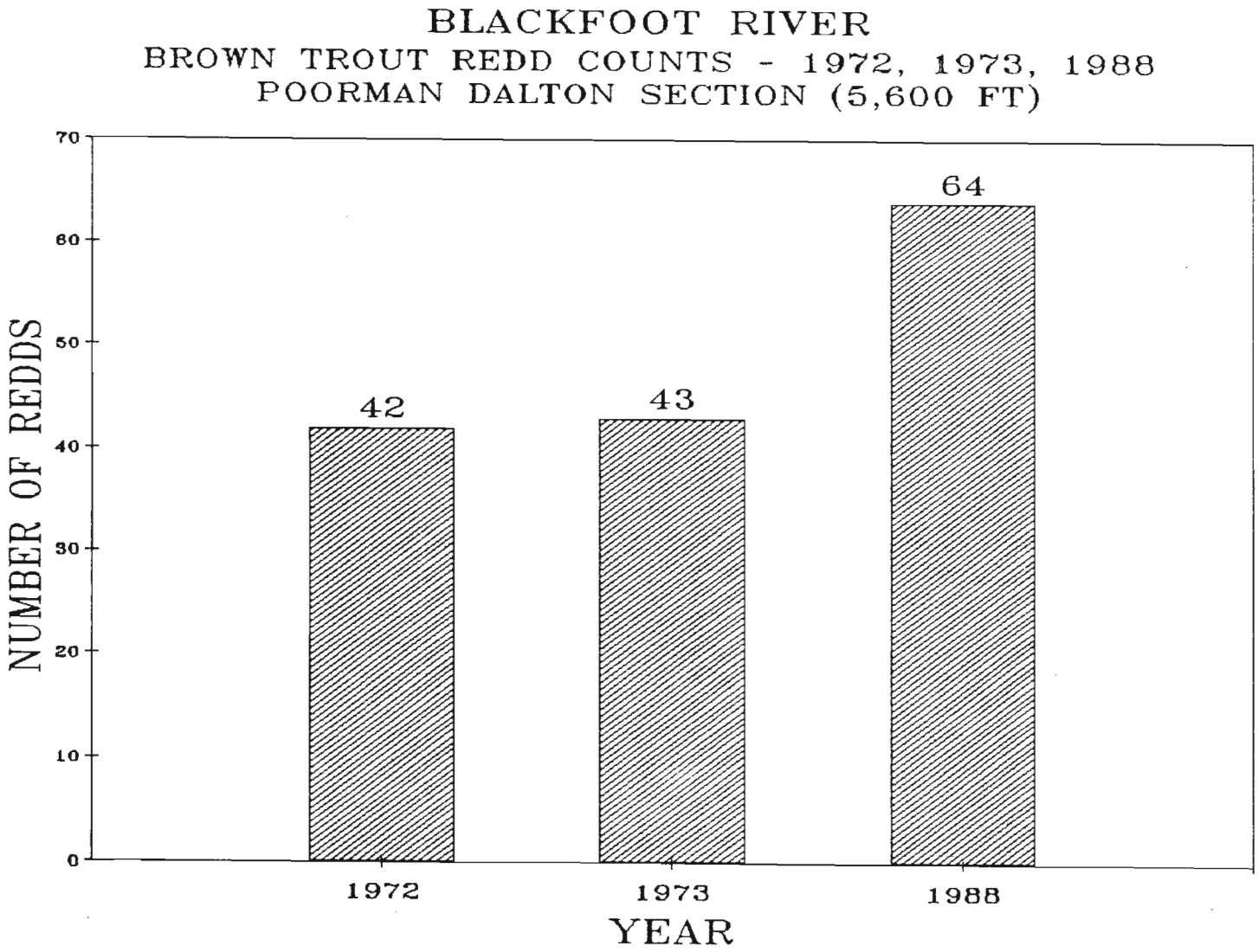


Figure 9. Comparison of the number of brown trout redds located in the Poorman-Dalton section (5,600 ft) of the Blackfoot River, 1972 through 1988.

In general, estimated numbers of brown trout have declined since 1971. No estimate was made on YOY in 1988 because of poor capture efficiency and/or low densities (Figure 10). Similar to the Poorman-Dalton section, yearling densities declined significantly between 1971 (21/1,000 ft) and 1988 (3/1,000 ft) in the Canyon section. Although not significant, the density of adults (age II and older) was slightly lower during 1988 (15/1,000 ft) compared to 1971 (19/1,000 ft).

A limited number of cutthroat and bull trout (designated as species of special concern) were present in reach 2. Two bull trout (12 to 15 inches) were captured in 1988 and four (7.2 to 7.8 inches) in 1971 in the Canyon and Poorman-Dalton population inventory sections. Four westslope cutthroat trout (8.9 to 15.1 inches) were captured in 1988, and 12 (3.5 to 11.6 inches) were captured in 1971 (Appendix Table 2). Bull and Westslope Cutthroat trout each account for about 1% of the total trout catch in reach 2.

**Reach 3: Nevada Creek to Monture Creek**
(RM 67.8 to RM 45.9)

Trout populations were sampled in a 1.1 mile electrofishing section in reach 3. The Raymond Bridge section (RM 58.9 to 60.0) is located about six miles above the mouth of the North Fork of the Blackfoot River. Fish sampling was not conducted in this reach prior to 1988.

Brown trout were the dominant trout species in this section, comprising 71% of the electrofishing catch. This was the uppermost section where rainbow trout were observed during 1988. A trout population estimate was not obtained after three electrofishing runs in the Raymond Bridge section due to very low densities of trout and apparent movement of fish out of the section. In three sampling trips through the Raymond Bridge section, only 32 brown trout, 9 rainbow trout, and 4 cutthroat trout were captured.

**Reach 4: Monture Creek to Belmont Creek**
(RM 45.9 to RM 21.9)

Trout populations in reach 4 were sampled in the Scotty Brown Bridge section (RM 45.6 to 41.8) during 1988. No fisheries inventories were conducted in this reach prior to 1988.

The upstream boundary of reach 4 (Monture Creek) marks the beginning of the lower Blackfoot River fishery which is dominated by rainbow trout. Although brown trout accounted for a significant portion of the electrofishing catch (38%) in the Scotty Brown Bridge section, the majority of fish were observed

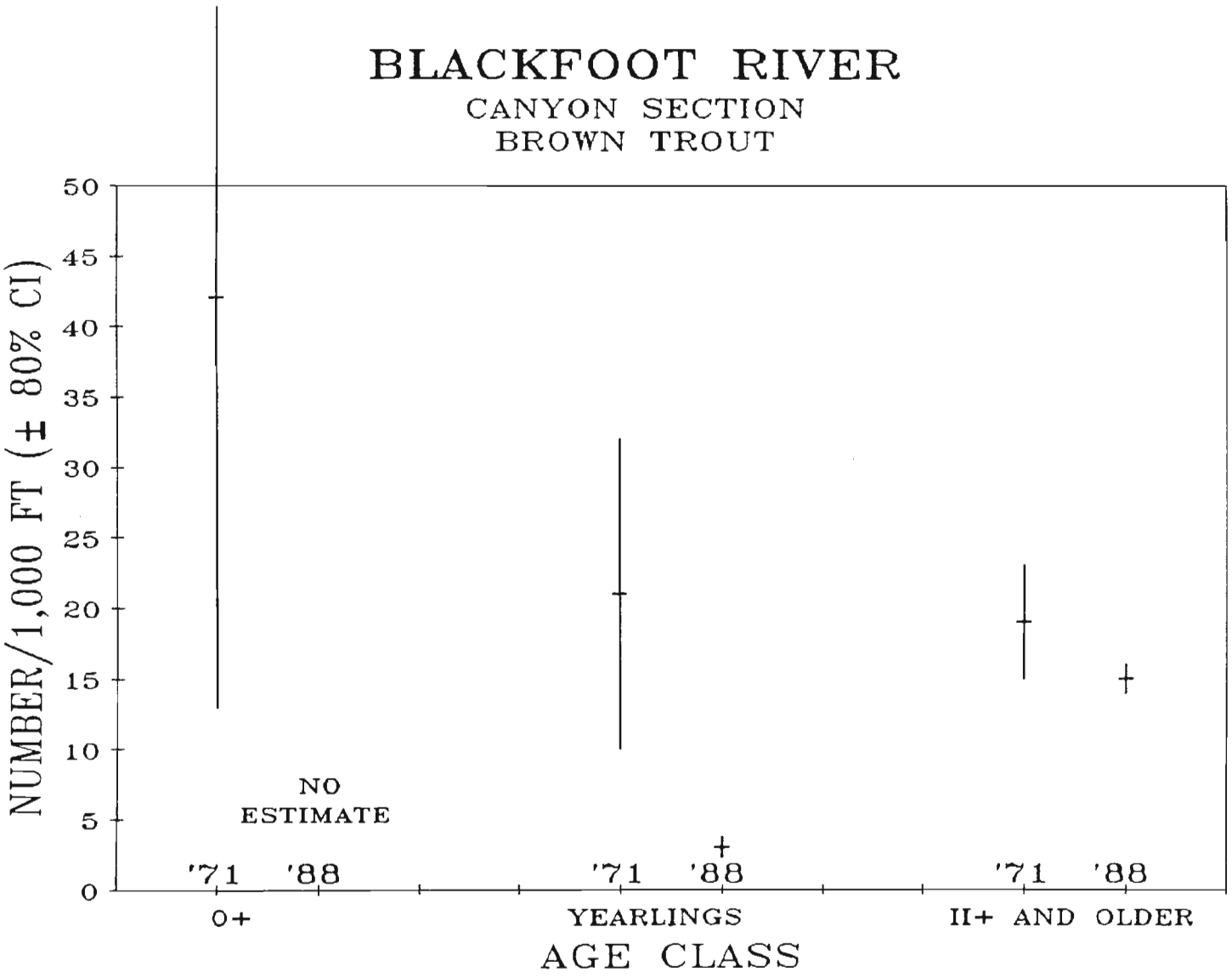


Figure 10. Comparisons of brown trout population estimates in the Canyon section of the Blackfoot River, 1971 and 1988.

staging near spawning tributaries and may not have been residents of this section.

Six electrofishing runs were required to obtain a sufficient number of fish to calculate a rainbow trout population estimate in the Scotty Brown section. Despite this effort, the rainbow trout estimate in this section should be evaluated with caution. The confidence intervals are wide, and the ability to split the population into small length groups is limited due to low recapture rates.

The density of rainbow trout in the Scotty Brown section was significantly lower than previous estimates (1980 to 1985) in the Johnsrud section. Although estimates for the Johnsrud section are not current and are for the late spring - early summer period and are not directly comparable to the Scotty Brown fall estimate, the differences in population are so large that a comparison is meaningful. In the size group 4.0 to 10.9 inches, there were 10 times more fish in the Johnsrud section than the Scotty Brown section. Similarly, the estimated population of adult rainbow trout (11.0 to 18.9 inches) was seven times larger in the Johnsrud section (60/1,000 ft) than the Scotty Brown section (8/1,000 ft) (Figure 11).

The low numbers of rainbow trout in the Scotty Brown section is difficult to explain, particularly for the small size groups. The number of trout from 4.0 to 10.9 inches was considerably below expected levels considering the large number of YOY rainbow trout observed in this section during 1988 (Figure 11).

Compared to other rainbow trout fisheries in western Montana, the Scotty Brown section demonstrates much lower than expected population levels for a variety of size groups (Figure 12). The low number (23/1,000 ft) of rainbows 4.0 to 10.9 inches in length indicates that the large number of YOY in this river segment experience high mortality, year classes prior to 1988 were considerably smaller or extensive movement prior to their second summer of residence occurred. There does not appear to be adequate numbers of juvenile fish to provide recruitment to the catchable size classes in this river segment.

In addition to low densities of rainbow trout in the Scotty Brown section, trout are in relatively poor condition compared to other rainbow trout fisheries in western Montana. In each of three size groups where condition factors were compared, rainbow trout in the Scotty Brown section demonstrated poorer condition than rainbow trout in Rock Creek and the Bitterroot River (Figure 13). Size groups were selected to evaluate potential changes in trout condition as a response to growth and shifts in diet.

Ten bull trout were captured and two large adults observed with six days of electrofishing effort on the Scotty Brown

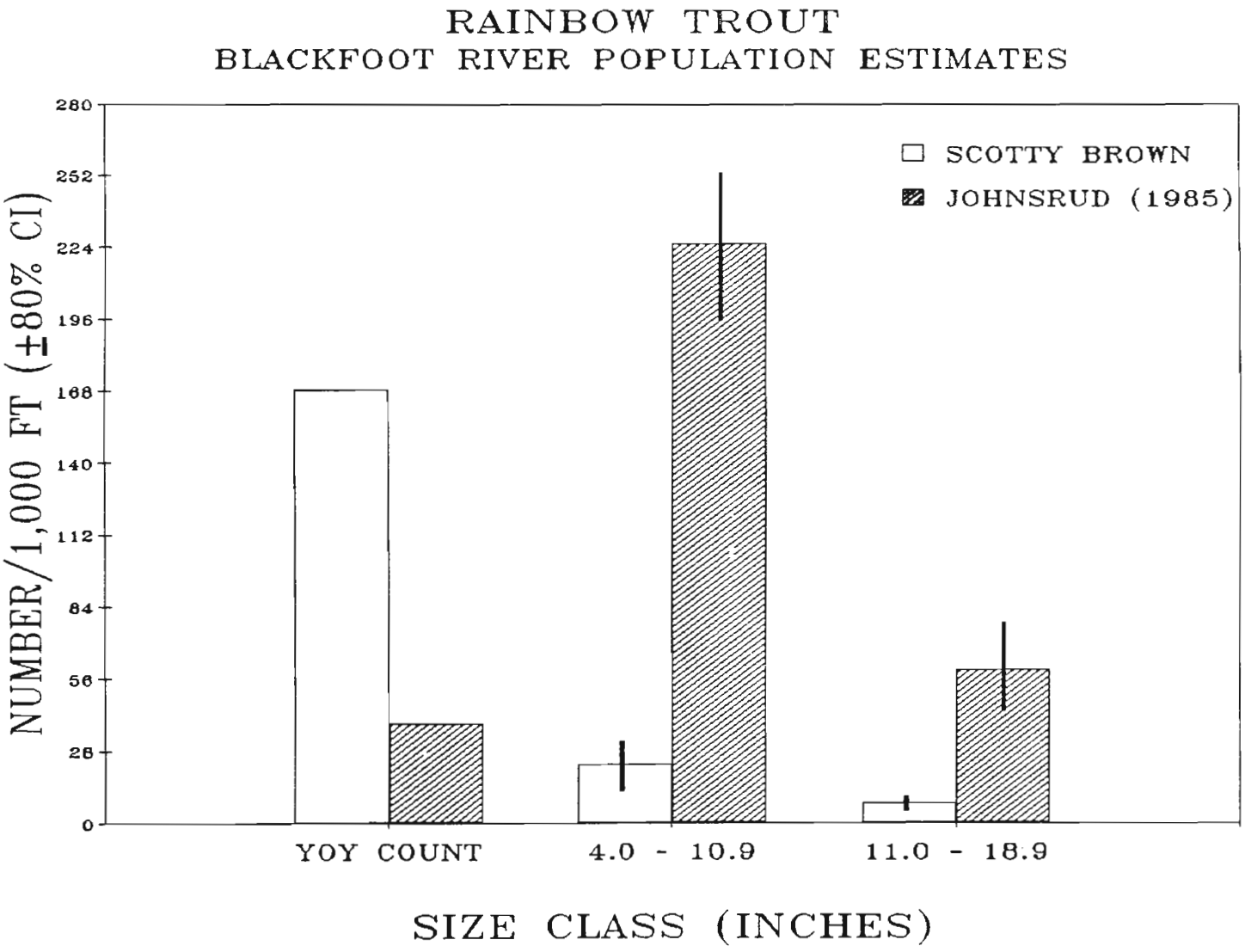


Figure 11. Comparisons of rainbow trout population estimates in the Scotty Brown section (1988) and the Johnsrud section (1985) of the Blackfoot River.

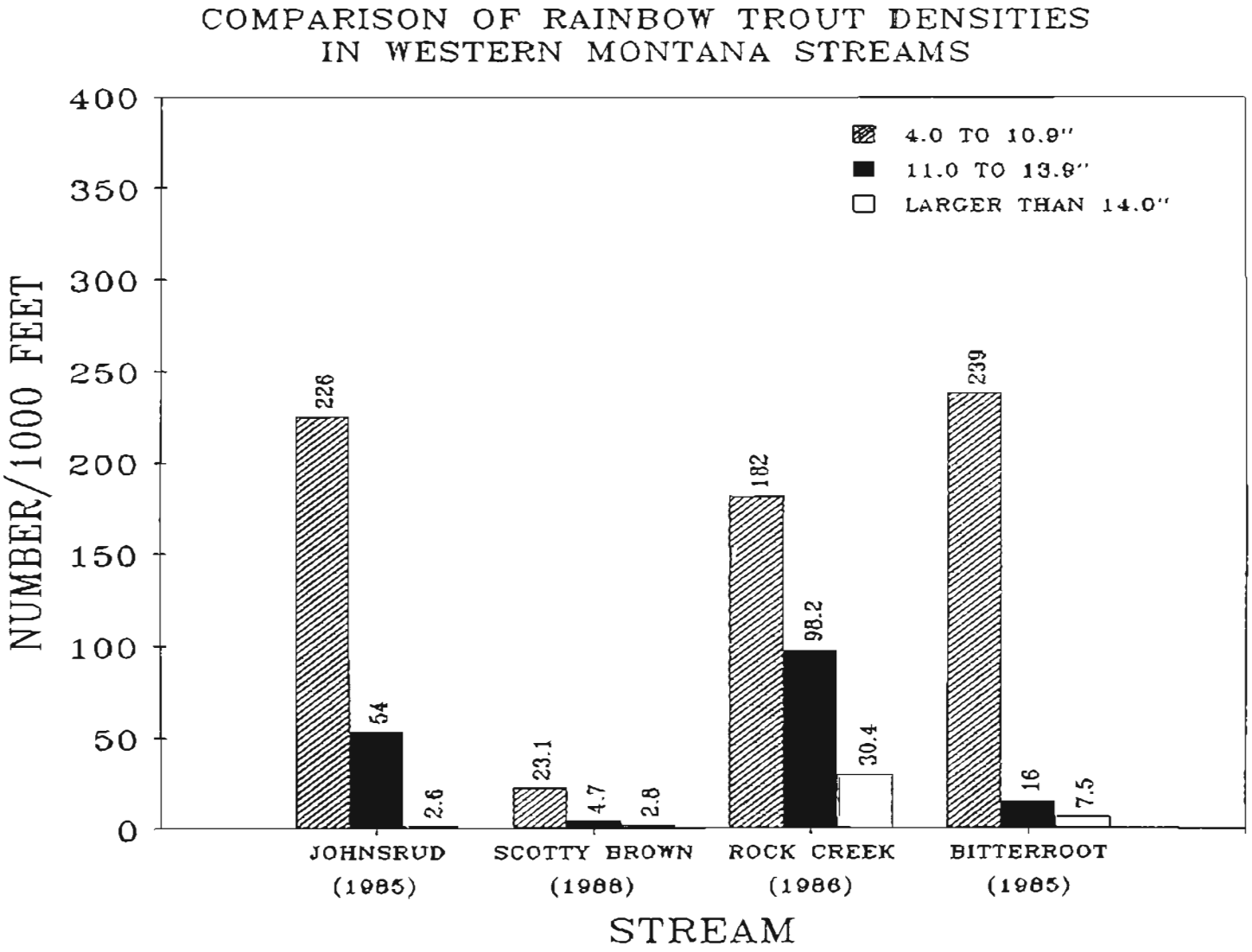


Figure 12. Size class comparisons of rainbow trout population estimates in Rock Creek, Bitterroot River, and two sections of the Blackfoot River.

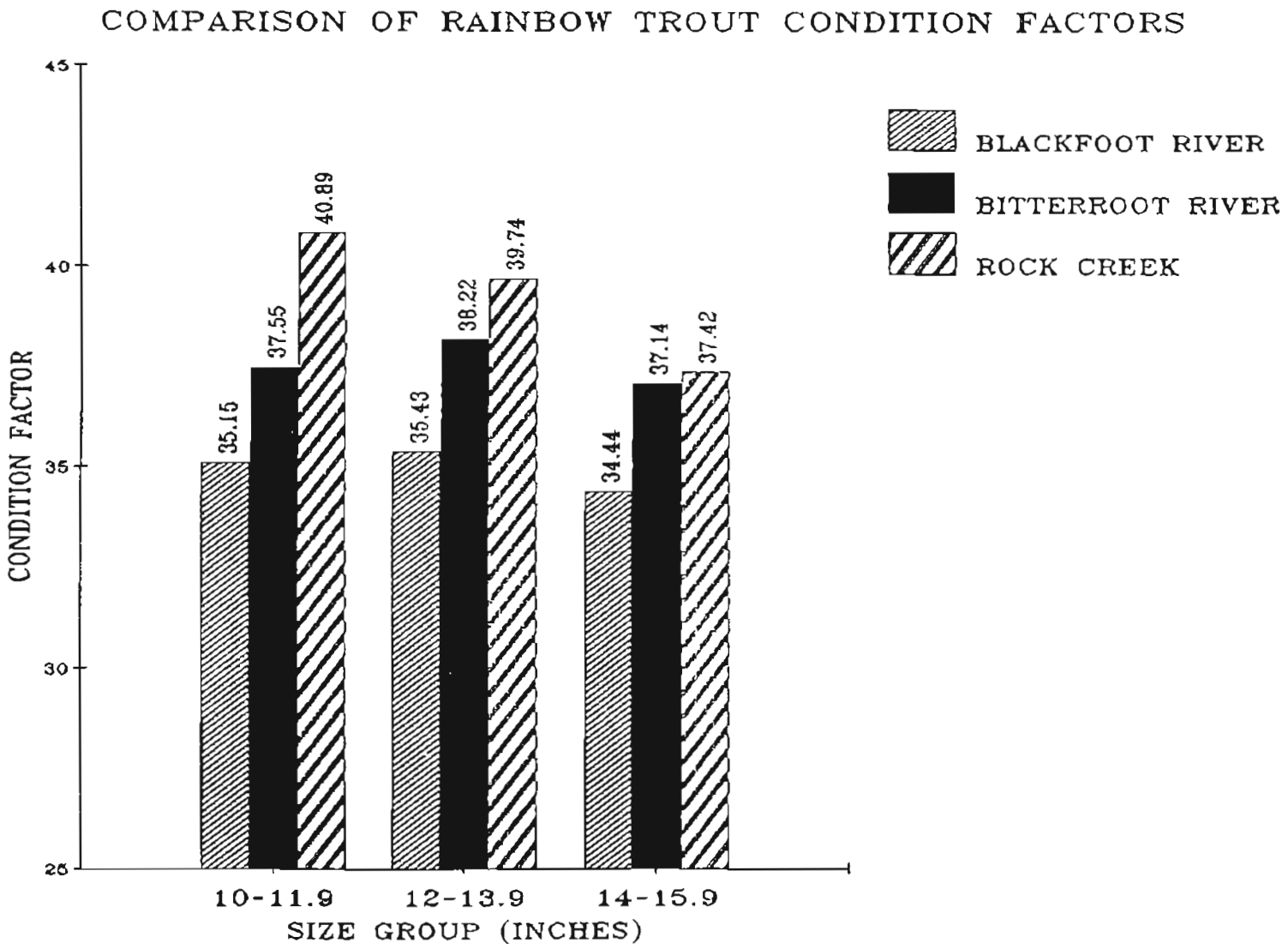


Figure 13. Comparisons of condition factors for three size groups of rainbow trout in Rock Creek, Bitterroot River near Darby, and the Blackfoot River in the Scotty Brown section.

section and one day on the River Bend section in 1988. Eight of the twelve bull trout were larger than 15 inches in length. Westslope cutthroat trout accounted for 2% of the trout captured in the Scotty Brown section during 1988.

**Reach 5: Belmont Creek to Mouth of Blackfoot River**
(RM 21.9 to RM 0)

Fisheries information in this reach is based on sampling of the Johnsrud Section (RM 11.7 to 15.3). Population inventories were not conducted during 1988 due to time constraints resulting from poor electrofishing efficiency during the late-summer and fall. Fieldworker time allocated for 1988 was saved for spring 1989 to update fisheries information collected during the spring and summer periods from 1980 to 1985. Electrofishing surveys were conducted in the Johnsrud section, and from River Bend FAS to Whitaker Bridge during 1988 to compare sampling efficiency in this reach to reach 4.

Unlike the Scotty Brown section, high densities (226/1,000 ft) of subadult rainbow trout (4.0 to 10.9 inches) reside in the Johnsrud section of reach 5 (Table 3).

Table 3. Trout population estimates for the Johnsrud section of the Blackfoot River, June 1985.

| species | Size class (in) | Number estimate (N) | 80% confidence interval | Number per 1,000 ft |
|---|---|---|---|---|
| Rainbow | 4.0-10.9 | 4,328 | 868 | 226 |
| | 11.0-13.9 | 1,034 | 486 | 54 |
| | 14.0-15.0 | 50* | | 3* |
| Cutthroat | 6.0-14.9 | 197 | 50 | 10 |
| Brown | 6.0-24.0 | 115* | 90 | 6* |
| Bull | 6.0-34.0 | 75* | 69 | 4* |

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

Despite high densities of rainbow trout less than 11.0 inches in the Johnsrud section, there appears to be fewer than expected numbers fish larger than 11.0 inches. Compared to other western Montana streams, the number of rainbow trout larger than 14.0 inches (2.6/1,000 ft) is very low (Figure 12).

The Johnsrud section shows signs of high losses (mortality

or movement) in the size group of rainbows 4.0 to 10.9 inches. The Johnsrud section carries slightly more (24%) 4.0 to 10.9 inches rainbows as Rock Creek, but only 55% of the numbers of rainbows 11.0 to 13.9 inches found in Rock creek (Figure 10). In addition, Rock Creek carries 30.4 rainbows/1,000 ft larger than 14 inches, compared to approximately 2.6 rainbows/1,000 ft in the Johnsrud section.

The Blackfoot river along with Rock Creek and the Clark Fork River contain small populations of large fluvial bull trout (Table 4). The best population of large adult fish appears to reside in the Blackfoot River. Due to the extremely low density of the large adult fish estimates are difficult to obtain. However based upon available population sampling data the estimated density in the Johnsrud section was only two adult fish per mile in 1985 (Table 5).

Westslope cutthroat trout account for 9% of the estimated trout population in this reach. Several tributaries to the Blackfoot River in reach 5 contain good cutthroat populations.

## YOUNG-OF-THE-YEAR SAMPLING

Young-of-the-year (YOY) densities were sampled at 53 selected sites throughout the Blackfoot river from the near the mouth to Aspen Grove Campground near Lincoln (RM 117.6). This survey was conducted to assess trout recruitment trends throughout the drainage. Major tributaries were also sampled.

Species composition of rainbow trout and brown trout YOY were similar to trends in species composition observed during sampling of adult trout in the Blackfoot River (Figure 14). The presence/absence of YOY, therefore, appears to have a significant influence on the species composition and abundance of adult trout observed in the Blackfoot River.

### Reach 1: Headwaters to Lincoln

Cutthroat and brook trout YOY were captured in three of the five sections sampled in reach 1. No YOY were observed at the Aspen Grove campground. Rainbow and bull trout YOY were not present in the five sections sampled in this reach. Brown trout YOY were present just above the Stemple Bridge near Lincoln-this location approximates the upstream boundary of the brown trout distribution in the Blackfoot River.

### Reach 2: Lincoln to Nevada Creek

Trout YOY were sampled at six locations in reach 2. Brown trout represented 100% of the YOY catch in this reach

Table 4. Four stream sections in the headwaters of the Clark Fork River Basin known to produce large fluvial bull trout (Salvelinus confluentus) and relative abundance in the electrofishing catch.

| Stream Name | River mile location | Date sampled | Electrofishing catch bull trout size class 4.0-12.0 | 12.0-18.0 | >18.0 | Electrofishing catch ≥6.0 Rb | Ct | LL | Eb |
|---|---|---|---|---|---|---|---|---|---|
| Blackfoot R. (Johnsrud Park section) | 13 | June,1985 | 17 | 1 | 7 | 1,098 | 114 | 36 | 0 |
| Clark Fork R. (Superior Section) | 286 | June,1984 | 14 | 16 | 9 | 2,396 | 208 | 26 | 1 |
| Clark Fork R. (Milltown Section) | 364 | June,1984 | 0 | 1 | 1 | 531 | 19 | 39 | 0 |
| Rock Creek (Hogback Section) | 30 | Sept.,1982 | 22 | 33 | 2 | 389 | 83 | 0 | 20 |

Table 5. Population abundance estimates of large bull trout from the Clark Fork River and the Blackfoot River.

| Stream name | Section length (miles) | Size class (in.) | Marked | Captured | Re-captured | Number estimate | 80% C.I. | Density per mile |
|---|---|---|---|---|---|---|---|---|
| Clark Fork R. (Superior Sec.) River Mile 286 | 13.7 | 15.0 to 31.0 | 9 | 9 | 5 | 16 | ± 5 | 1.2 |
| Blackfoot R. (Johnsrud Sec.) River Mile 13 | 3.6 | 17.0 to 36.0 | 7 | 1 | 1 | | | ~ 2.0 |

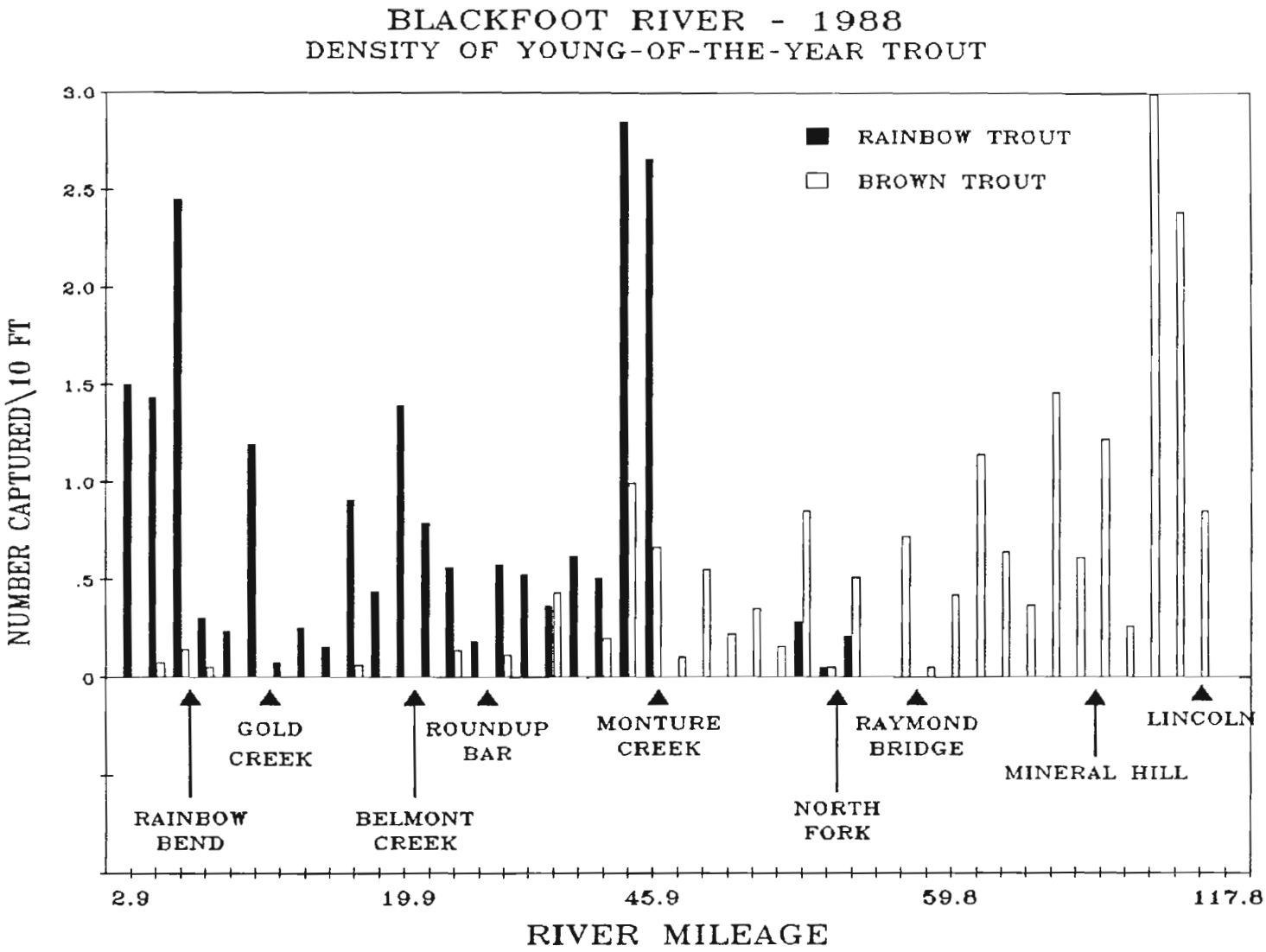


Figure 14. Young-of-the-year brown and rainbow trout densities at 43 sites in the Blackfoot River from near Lincoln to the mouth, August 1988.

The highest density of brown trout YOY (4.58/10 ft) occurred near an area of concentrated brown trout spawning activity located below Poorman creek (RM 108) (Figure 14). The density of brown trout YOY gradually decreased downstream from this spawning area. The average brown trout YOY density was 1.66/10 ft at six sampling locations in this reach.

**Reach 3: Nevada Creek to Monture Creek**

Trout YOY were sampled at sixteen locations in reach 3. Brown trout YOY were captured at all but one sampling station, and averaged 0.48/10 ft in this reach.

Rainbow trout YOY were observed in three sampling locations of this reach (Figure 14). Three stations near the mouth of the North Fork of the Blackfoot River (RM 54.1) were the only locations rainbow trout YOY were observed in reach 3, indicating that this stream provides at least a limited source of rainbow trout recruitment to the main river. Rainbow trout YOY density in this reach averaged 0.03/10 ft.

The North Fork of the Blackfoot River at RM 2.0 (Harry Morgan FAS) had YOY rainbow and brown trout densities of 0.78 and 0.11 fish/10 ft respectively.

No bull or cutthroat trout YOY were observed in Reach 3.

**Reach 4: Monture Creek to Belmont Creek**

Trout YOY densities were sampled at eight stations in reach 4. Species composition of YOY abruptly changes below the mouth of Monture Creek as rainbow trout become the dominant species in the Blackfoot River trout fishery.

The highest rainbow trout YOY density (2.86/10 ft) observed in the Blackfoot River was just below the mouth of Monture Creek (Figure 14). Brown trout YOY density also increased in the upper segment of this reach, indicating that observed spawning activity in Cottonwood Creek and suspected spawning use of Monture Creek results in recruitment of brown trout to the main river. Rainbow trout YOY density averaged 1.09/10 ft and brown trout 0.30/10 ft in the eight sampling locations in this reach.

Densities of rainbow and brown trout YOY in the Clearwater River (RM 34.7) near the mouth were 0.44 and 0.37/10 ft, respectively. In Monture Creek, densities of rainbow and brown trout YOY near the mouth were 1.70 and 0.57/10 ft, respectively.

No bull or cutthroat trout YOY were observed in Reach 4.

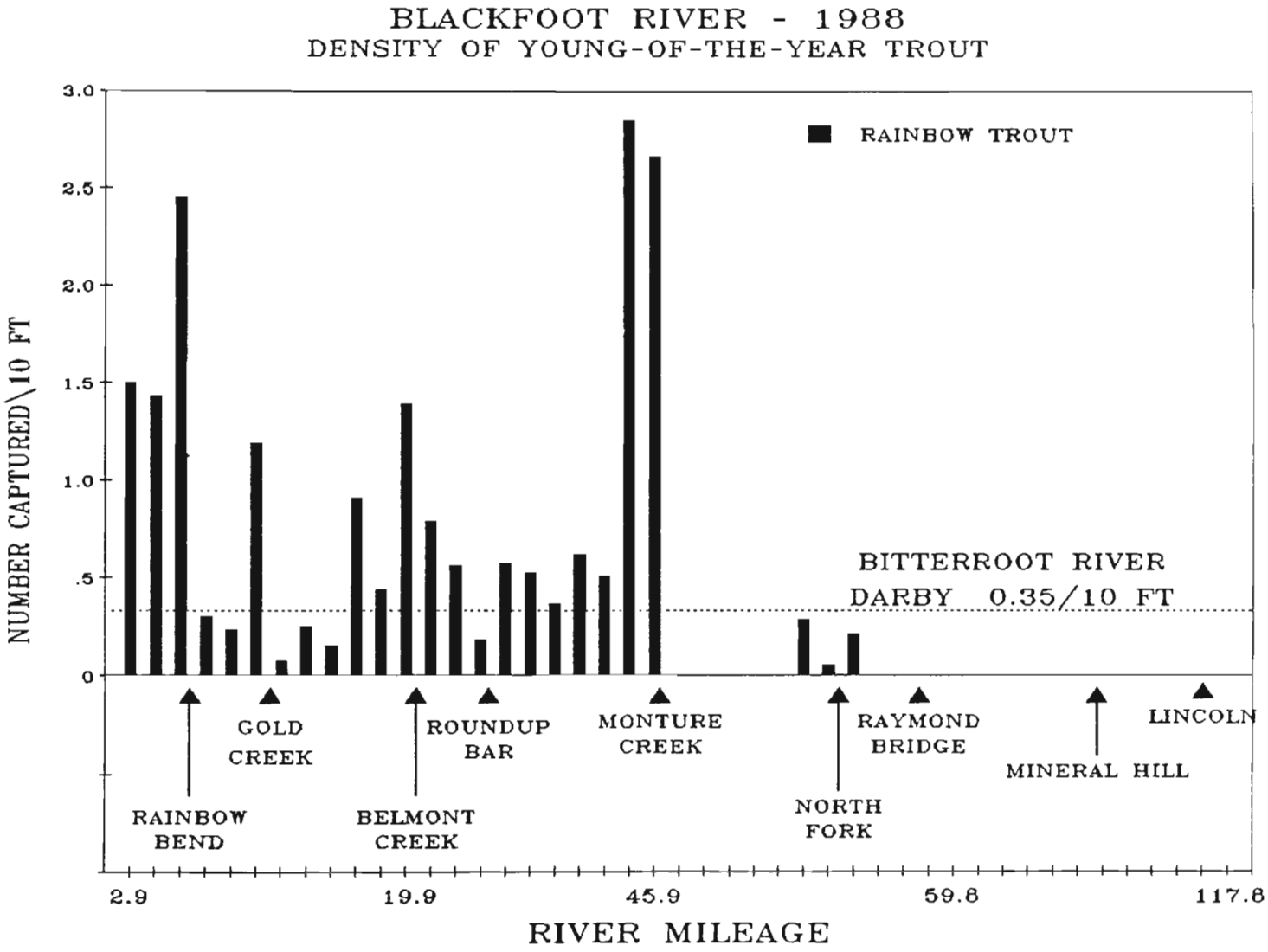


Figure 15. Young-of-the-year rainbow trout densities in the Blackfoot River (1988) compared to densities observed in the Bitterroot River near Darby (1986).

### Reach 5: Belmont Creek to Mouth of Blackfoot River

Trout YOY were sampled at thirteen locations in reach 5. Rainbow trout YOY were present at all sampling stations, but brown trout YOY were only observed at four stations. Large fluctuations in YOY abundance were observed in this reach, with the highest densities occurring downstream of spawning tributaries (Figure 14).

YOY density of rainbow trout in this reach averaged 0.80/10 ft. and brown trout 0.02/10 ft. for the thirteen sections sampled. Rainbow trout YOY abundance in reach 5 was generally lower than densities in reach 4, but higher than those observed in reaches 1 through 3. The densities of rainbow trout YOY were also generally higher in reaches 4 and 5 than densities of rainbow trout in the Bitterroot River near Darby (0.35/10 ft) (Figure 15). The rainbow trout fishery near Darby is generally considered to be a healthy fishery with large numbers of juvenile fish. In contrast, brown trout YOY densities in reach 5 were the lowest observed in the five reaches of the Blackfoot River.

Significant rainbow trout spawning is known to occur in the in the following tributaries of Reach 1: Belmont, Gold, East and West Twin Creeks, Johnson Gulch, and Heyers Gulch. Abundant YOY at the mouth of Bear Creek may indicate spawning use in that creek. At the mouth of Gold Creek, rainbow trout YOY densities (4.0/10 ft) were the highest observed for all Blackfoot River tributaries sampled.

No YOY bull or cutthroat trout were observed in Reach 1.

## CREEL CENSUS

### Reach 5: Belmont Creek to Mouth

We obtained 106 creel census interviews from mid-July to October. Most of the fisherman contacts (95%) were made below Belmont creek. The results, therefore, represent fishing in the lower segment of the Blackfoot river. Anglers resident to Montana comprised 81% of our sample.

The terminal gear used by anglers sampled included: flyfishing 20%, lures 17%, bait 42%, and combinations 21%. Bait fishing accounted for as much as 63% of the sampled anglers. Although bank anglers dominated (93%) our sample of anglers, the number of float fishermen were probably underestimated due to a lack of sampling during late spring/early summer and low streamflows during 1988 which likely discouraged floating.

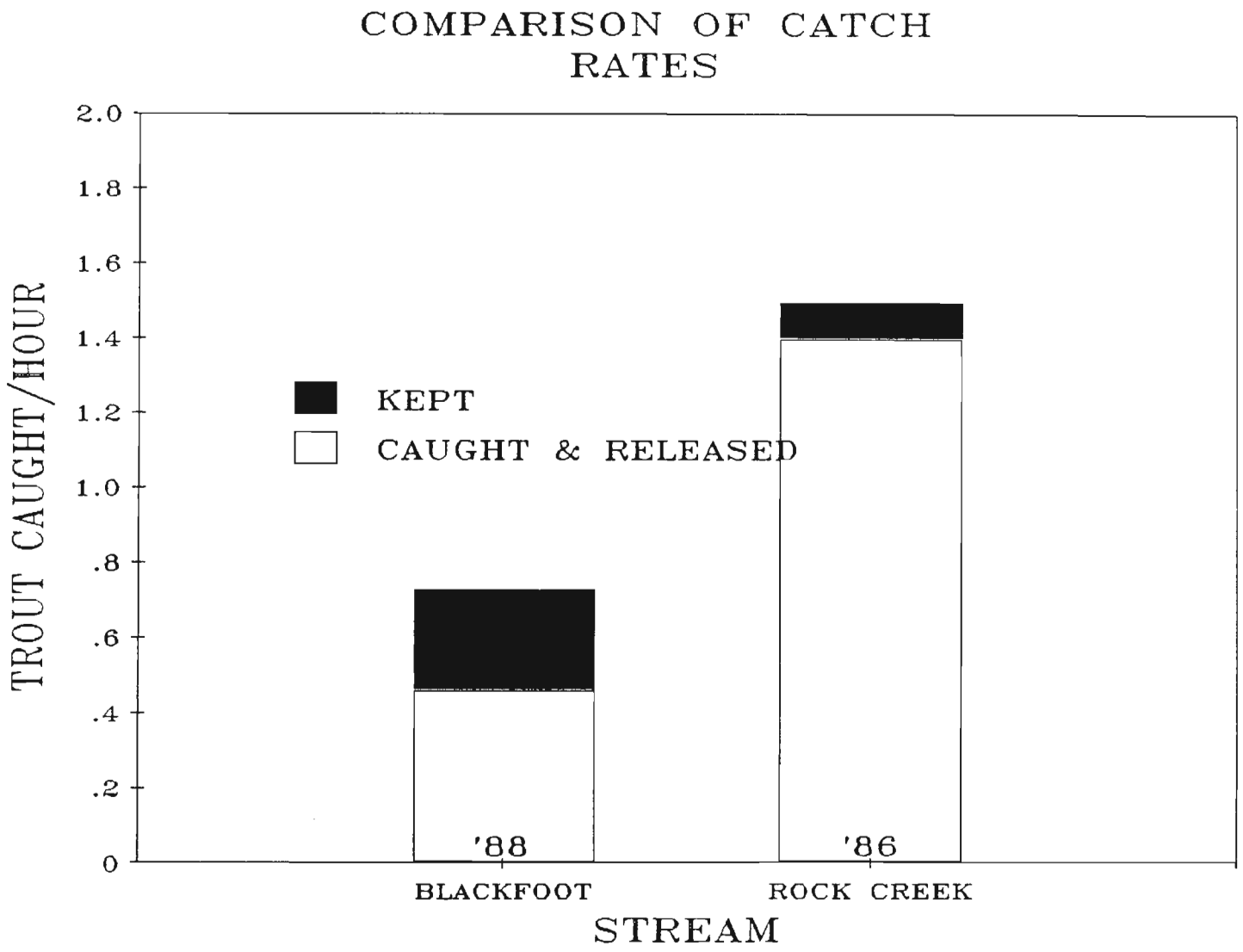


Figure 16. Comparison of angler catch rates of trout in Rock Creek and the lower Blackfoot River.

The number of trout caught per hour averaged 0.73 during the entire sampled period (Figure 16). Of the total catch per hour, 0.46 trout were caught and released and 0.27 trout were kept. This catch rate was somewhat lower than catch rates in Rock Creek where 1.55 trout were caught per hour in 1986 during the regular fishing season; 1.46 caught and released and 0.09 kept.

The number of fish caught per angler per trip declined during each successive month of our survey (Figure 17). The number of caught and released fish within the total fish caught accounted for the decline as the number of kept fish per angler remained nearly constant at about 0.75 fish per angler per trip. Anglers released fewer fish as the season progressed.

Fisherman sampled were more likely to release a 6 to 8 inch trout than one 9 to 12 inches (Figure 18). All fish larger than 12 inches were kept. Of the total fish caught, 78% were less than 11.0 inches, 21% between 11.0 and 13.9 inches, and only 1% larger than 14.0 inches.

**BULL TROUT REDD COUNTS**

Bull trout redd counts were conducted in Monture Creek and the North Fork of the Blackfoot River. These two streams have previously been identified as important spawning tributaries of the Blackfoot River.

During October 1988, eleven bull trout redds were counted in Monture Creek in a 3-mile reach where redd counts were previously made. In 1985, 27 redds were observed in this reach. Decreased spawning activity in this area may be related to low streamflows observed during 1988. Most redds were located below beaver dams which appeared to reduce spawner access to areas used for spawning in previous years.

A redd count was also conducted in the North Fork of the Blackfoot River during 1988. This effort was facilitated by an angler familiar with important bull trout spawning areas in this river. Although previous observations of bull trout spawning were not quantified, the eleven redds counted during 1988 appeared to be significantly lower than normal. Preferred spawning areas during typical flow conditions were vacant in 1988, apparently due to low streamflows which reduced water depths by as much as two to three feet below normal. In addition, the Canyon Creek fire burned through this area during the period spawning normally occurs.

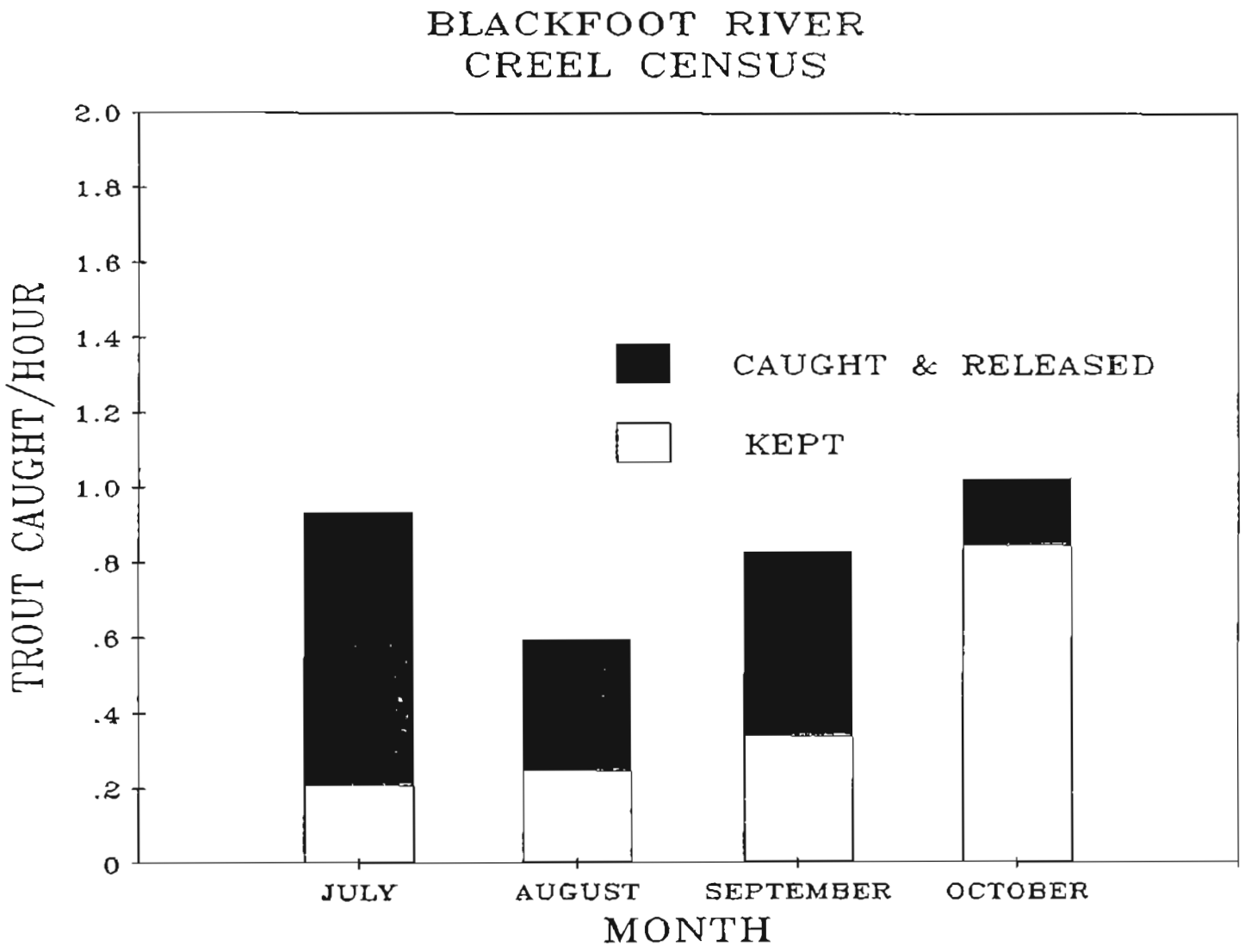


Figure 17. Monthly average catch of trout per angler in the lower Blackfoot River, 1988.

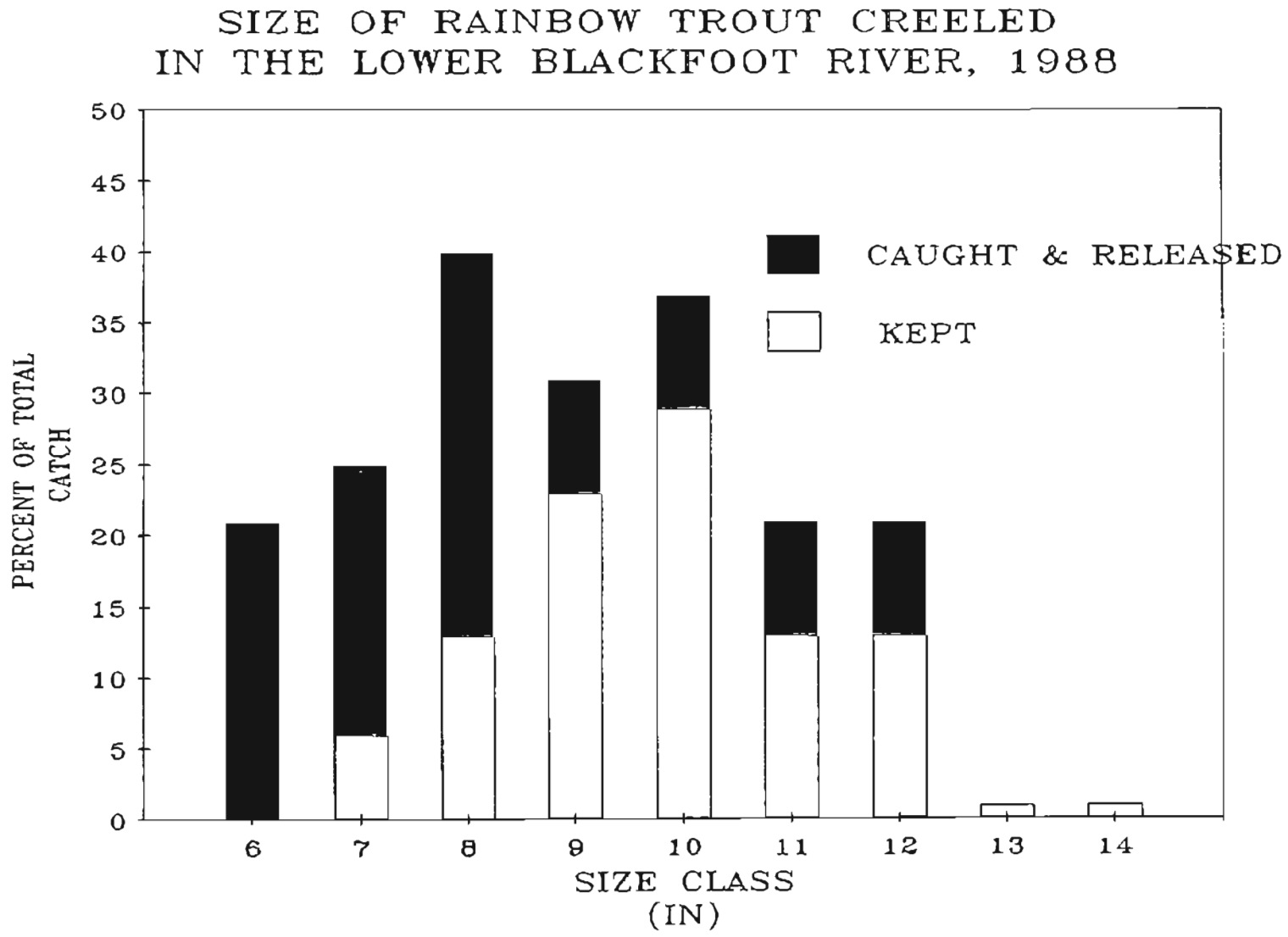


Figure 18. Size distribution of rainbow trout caught by anglers in the lower Blackfoot River, 1988.

## DISCUSSION

The Blackfoot River is one of the most scenic and heavily used river systems in western Montana. Users of this resource have recently expressed concern that the river's fishery was depressed and appeared to be declining further. Angler concerns were substantiated after this first field season of fisheries inventory - the Blackfoot River fishery indeed appears to be at a level well below its potential.

The potential problems, however, are complex and appear to vary from one reach of the river to the next. Fine sediment accumulation, low streamflows due to drought, metals toxicity from previous mining activity, inadequate recruitment, overharvest, and harsh winter conditions are among the many problems that a given reach of the Blackfoot River encounters. Five reaches were identified based on habitat characteristics and attributes of the trout population within each river segment.

### Reach 1: Headwaters to Lincoln

The Blackfoot River is relatively small stream in this reach with base flows typically less than 20 cfs. Cutthroat and brook trout are the dominate trout species present, comprising 53% and 46% of the trout population, respectively.

Cutthroat trout densities have declined significantly in two of the three electrofishing sections located in this reach compared to surveys conducted during the early 1970's. In 1975 the tailings pond at the Mike Horse Mine breached sending metals ladened sediments and water downstream into this reach. Fish population sampling immediately after the dam failure in the Flesher Section indicated a near total loss of YOY cutthroat, and a significant loss of age I and older fish. In 1988, densities of cutthroat in the Flesher Section remain below those observed after the fish kill of 1975. Reductions in cutthroat density were of a similar magnitude in the Below Pop's Place Section.

Trends in brook trout densities were more difficult to interpret. Differences between surveys during the early 1970's and the 1988 survey were not significant in Below Pop's Place Section, but densities were dramatically reduced in 1988 at the Flesher Section. These two sections are only about two miles apart. Changes in physical habitat, particularly resulting from beaver activity, is a possible explanation for the unpredictable trends in the brook trout population.

The Hogum Section, also located in this reach, provided little information concerning population changes for cutthroat or brook trout. Trout densities were low in the early 1970's, and remained low during the current survey. Available habitat in

this section is poor due to a near absence of hiding cover. Other influences on the fishery are difficult to detect because poor habitat probably limits the fishery in this section.

The general decline in trout populations, particularly for cutthroat trout, in this reach may be related to metals toxicity. Tailings released during the 1975 dam failure were suspected to have been deposited in beaver pond areas of this reach. In addition, evidence of downstream movement of tailings below the beaver dams has been collected in 1988 (J. Moore, pers.comm.).

Low summer streamflows, accompanied by accumulated fine sediments in the absence of flushing flows, may also contribute to the decreased densities of trout observed during 1988. Effects of low streamflows are particularly noticeable in the lower portion of this reach where the permeable alluvium lowers the groundwater table (Coffin and Wilke 1971).

**Reach 2: Lincoln to Nevada Creek**

Water lost to the subsurface in the upper river reappears in Reach 2 in the form of groundwater seepage and spring creeks. This additional water has a significant influence on the fishery of Reach 2. In addition, the gradient decreases and structural cover (particularly log jams) becomes more abundant. The predominant trout species in this reach is brown trout. The presence of brown trout in this reach probably results from a combination of the groundwater influence, which is a preferred component in brown trout spawning habitat, and the abundance of structural cover.

Trout population estimates were conducted in the Poorman-Dalton and Canyon Sections during the early 1970's, and repeated during 1988. During both surveys, brown trout densities were significantly higher in the Poorman-Dalton Section than in the Canyon Section, located about 13 miles downstream. Higher densities in the Poorman-Dalton Section are probably, in part, due to its proximity to the preferred brown trout spawning area where extensive groundwater recharge occurs. Surveys of brown trout YOY are highest in this area, and progressively decrease in density downstream from this area. Spawning in this area appears to be the primary source of brown trout recruitment for Reach 2.

Mature brown trout (age II and older) densities have not significantly changed between the two sampling periods. Yearling brown trout densities, however, have decreased significantly in both sections since the early 1970's. This decline in numbers of juvenile fish may be related to drought conditions and below normal streamflows. A similar observation was made in the Bitterroot River where low streamflows resulted in decreased numbers of juvenile brown trout, but did not significantly effect numbers of adults (Spoon 1987). Increased juvenile mortality

was attributed to losses of preferred shoreline habitat during low flow periods. Although the effects of a weak year class on the adult population may not be detected immediately, there is likely to be a gradual decline in adult numbers.

Fisheries in this reach may also be adversely affected by accumulation of fine sediments. Large amounts of sediment are deposited in this reach due to its low gradient. Accumulation of this sediment has probably increased because of the lack of flushing flows that normally occur in the spring. Springtime streamflows in the Blackfoot River have been below the 50% exceedance level during each of the past five years, and visible increases in streambed sediments is apparent.

Metals contamination may also adversely effect the fishery in this reach. Elevated levels of metals were observed in streambed sediments of reach 2 in 1988, indicating that there has been additional downstream penetration of contaminated sediments that originated from previous mining activity in the headwaters (J.Moore pers.comm.). In addition, elevated levels of cadmium in the livers of large brown trout provide further evidence of potential metals impacts in this stream segment.

Although brown trout presently dominate the trout fishery in this reach, brook trout were common in the Poorman-Dalton Section during the early 1970's. In 1972, there were an estimated 53 brook trout per 1,000 ft, but only a total of eight were captured in 1988. It is not known whether this decline was a result of changes in physical habitat, water quantity, water quality, or a combination of these or other factors.

**Reach 3: Nevada Creek to Monture Creek**

The gradient of the Blackfoot River increases below the mouth of Nevada Creek, and physical habitat characteristics change abruptly in this reach of the river. Woody debris jams are less common and meandering is less pronounced. Instream cover in the form of rocks and boulders replace the undercut banks and shoreline structural cover of reach 2. This is probably the most scenic and isolated reach of the Blackfoot River, but unfortunately, the lowest densities of trout reside in this river segment.

The trout population in this reach was surveyed in the Raymond Bridge Section, located about six miles upstream from the North Fork of the Blackfoot River. No fisheries surveys were conducted in this reach prior to 1988. Although electrofishing efficiency in this section was high, too few trout were captured to obtain an estimate of population density. Similar to reach 2, brown trout are the dominant trout species, but rainbow and cutthroat trout begin to appear in this area. comprising 20% and 9% of the raw catch, respectively.

Changes in the trout population probably relate to changes in physical habitat and recruitment sources. This type of habitat is typically occupied by rainbow/cutthroat trout fisheries in western Montana (e.g. Rock Creek and upper Bitterroot River). Their low abundance in the Raymond Bridge Section appears to be due to poor recruitment levels. The only rainbow or cutthroat YOY observed in this reach were found near the mouth of the North Fork where their numbers were limited. The North Fork is the only tributary entering this reach which has significant potential to be used for spawning. Brown trout, which tend be more successful spawners in the mainstems of western Montana rivers, probably dominate this reach because there is at least some source of recruitment available.

Despite the relatively high gradient in this reach, fine sediment accumulations were easily visible in 1988. These accumulations are probably a result of the low streamflows and the lack of flushing flows during each of the last five years. This buildup of sediment is accompanied by extensive growths of algae and rooted aquatic plants, which according to local residents, are not typically present in this river segment. Increased oxygen demands by this vegetation, in conjunction with low summer flows and elevated water temperatures, probably poses additional stresses on the trout fishery. Entrance of the cooler waters of the North Fork in the lower portion of this reach, however, improves water quality and reduces stress on the fishery.

This reach also appears to be an unusually harsh environment for trout during the winter. Formation of anchor ice on the stream bottom in the Raymond Bridge Section was extensive during late fall, 1988. Local residents have also commented that this area is particularly prone to anchor ice formation.

Trout adapt to winter conditions in streams by seeking refuge within open spaces of the stream bottom (provided that they are not filled with sediment) and moving to areas without anchor ice. Peters (1988) documented movement of cutthroat trout from summer habitat in the West Fork of Rock Creek as a probable response to anchor ice conditions in the fall. There appeared to be a similar pattern of trout movement out of the Raymond Bridge Section during successive runs of the fall population surveys, indicating a possible response to winter conditions.
Changes in seasonal abundance of cutthroat trout in the North Fork have also been observed by local fishermen.

If seasonal movements are indeed common in the Blackfoot River, there may be concentrations of trout in overwintering areas and summer population densities may be influenced by availability of these wintering areas. Future management strategies should, therefore, take into account the potential

migratory nature of the fishery. Continued tagging efforts to identify movement patterns will be important in directing management strategies.

Reach 4: Monture Creek to Belmont Creek

The physical characteristics of this reach of the Blackfoot River are similar to those in the lower segment of reach 3, below the mouth of the North Fork. Monture Creek was chosen as a reach break because the extensive rainbow trout recruitment from this tributary marks the upper boundary of the Blackfoot River fishery dominated by rainbow trout. Trout populations in this segment were sampled in the Scotty Brown Bridge Section. No fisheries information was collected in this reach prior to 1988.

Based on habitat comparisons with other western Montana rivers containing healthy rainbow/cutthroat trout fisheries, this reach of the Blackfoot River appears to have outstanding potential for supporting a fishery. The density of rainbow trout over 5.0 inches in length, however, was only 142/mile during sampling in fall, 1988. The majority of fish were concentrated in deep pools, while long stretches of river possessing favorable habitat were completely void of fish.

Low streamflows during 1988 may have influenced habitat use by trout and appeared to result in movement of fish from traditional habitats to the deep pools. Pool seeking behavior associated with low streamflows has previously been observed in the Bitterroot River (Spoon 1987). Angler concerns over a depressed fishery are warranted considering the low densities of trout observed in the Scotty Brown Bridge Section. Apparent trout movement from more typical habitats to pool areas would likely decrease angler success and add to the perception that trout numbers are very low. Relatively high water temperatures, in excess of 70 F, may have also contributed to poor fishing.

The reason(s) for low trout densities in this reach is not clear. Rainbow trout YOY surveys found some of the highest numbers of YOY in the Blackfoot River, indicating that recruitment is not limiting the fishery. Based on adult population surveys during the fall, it appeared that the large numbers of YOY does not translate into an abundance of the succeeding age class (yearlings). Since yearlings (approximately 3 to 6 inches in length) are not generally harvested by fishermen, natural mortality or movement of these juvenile fish appears to occur in this segment of river. The ultimate fate of rainbow trout YOY in this reach is in need of further study.

Effects of trout harvest by fishermen should also be evaluated in reach 4. Although low densities of trout in this reach are not likely a result of overharvest, increased fishing pressure in recent years has probably further depressed this

fishery which has a limited ability to withstand additional losses through angler harvest. Restrictive regulations, imposed throughout the Blackfoot River in 1988 due to the effects of the current drought, provide a unique opportunity to evaluate the potential of this management tool. Evaluating this regulation, which reduces the creel limit to two fish, none exceeding 14 inches, will help us determine whether the fishery can be enhanced by reducing mortality due to anglers.

Although brown trout comprised a significant portion of the catch (38%) in the Scotty Brown Bridge Section, the majority of the fish were observed staging near spawning tributaries and may not have been residents of this section. A springtime estimate will provide a more accurate assessment of resident brown trout abundance in this segment of the Blackfoot River.

**Reach 5: Mouth to Belmont Creek**
(RM 0 to 21.9)

Physical characteristics of reach 5 are similar to reach 4, except that the Blackfoot River grows in size due to the inputs of several major tributaries. The reach break at the mouth of Belmont Creek was chosen because of changes in characteristics of the fishery in this vicinity. During 1988, no population estimates were obtained in this reach due to poor sampling efficiencies during the fall. Survey runs of adult trout populations were made from River Bend FAS to Whitaker Bridge and in the Johnsrud Section. Population estimates were previously conducted six times between 1980 and 1985 in the Johnsrud Section. Sampling of the Johnsrud Section is scheduled for spring/summer 1989 since it was not accomplished during this inventory as planned.

The density of rainbow trout increases significantly in this segment of the Blackfoot River. Similar to reach 4, rainbow trout YOY were abundant in this reach, but unlike the upstream fishery, these large numbers of juveniles appear to carry over into very high densities of subsequent age classes. Estimated numbers of rainbow trout from 4.0 to 10.9 inches (over 500/1000 ft) in the Johnsrud Section are the higher than in any other western Montana rainbow trout fishery. This exceptionally high density of small fish not only indicates that recruitment is excellent, but that juvenile fish missing in the upstream reach may be moving to this segment of river.

The density of larger trout in the Johnsrud Section, however, is lower than in most of the larger rivers of western Montana. Trout growth is relatively slow in the lower Blackfoot River, but the low numbers of trout larger than 12.0 inches in this reach appear to be primarily due to extremely heavy fishing pressure. The 1984-85 statewide fishing pressure survey estimated 23,082 fisherman trips on the Blackfoot River between

the mouth and the Clearwater River (RM 34.7). Assuming similar catch rates to those observed during 1988, this fishing pressure would result in the harvest of 18,234 rainbow trout. Based on an expansion of population estimate data in this reach, there were roughly 28,556 rainbow trout available to the fishermen. Comparisons of these numbers indicate that harvest is a significant source of rainbow trout mortality.

This source of mortality is size selective, and may largely explain the low numbers of larger trout. During 1988, anglers tended to release rainbow trout smaller than 8.0 inches, but kept most fish larger than 9.0 inches in length. Angler preference for harvesting relatively large trout, and the tendency to use bait (over 60%) while fishing the Blackfoot River are two factors not generally compatible with the concept of restricting harvest via regulation changes. Public education concerning the current limitations and the future potential of this fishery will be necessary to use restrictive harvest regulations as a management tool to enhance this fishery. As discussed for reach 4, an evaluation of the restrictive regulation related to the drought will help determine whether numbers of fish, particularly in larger size classes, can be enhanced by reducing angler harvest.

## CONCLUSIONS AND RECOMMENDATIONS

This initial field season of data collection in the Blackfoot River improves our understanding of the basic characteristics and potential of the trout fishery. Since one year of data collection is not sufficient to answer all of the complex questions facing this fishery, the efforts of this first field season were designed to address general questions regarding current fishery concerns, and perhaps more importantly, to provide direction for continued work on the Blackfoot River fishery. The results of this work generated three general conclusions including:

1) Habitat and fisheries characteristics of the Blackfoot River are diverse and require that the drainage be broken into at least five distinct reaches for management purposes. Each reach appears to have its own problems and limiting factors that must be addressed individually.

2) Trout populations were below expected levels in virtually all reaches sampled. Depressed trout populations appear to result from a combination of natural limiting factors and human influences. Future enhancement efforts should be reach specific, and take into account natural environmental influences as well as those resulting from human activities such as land use and angler exploitation.

3) Populations of native trout species, cutthroat and bull trout, of the Blackfoot River appear to be particularly threatened. In order to maintain or enhance current population densities and ensure viable gene pools, there is a need for additional protective management of these species.

Based on our findings during the 1988 field season, and considering current aquatic resource studies being conducted by related agencies, the following fisheries work is recommended for the Blackfoot River:

1) Conduct annual spring population inventory on Poorman-Dalton, Canyon, Raymond, Scotty Brown, and Johnsrud Sections for the next five years to establish a baseline from which potential effects of mining and other land use activities can be evaluated. This information will also aid evaluation of restrictive regulations imposed during 1988 due to drought conditions.

2) Survey major tributaries of the Blackfoot River to identify current and potential spawning use of these streams, and assess condition of resident trout fisheries. Emphasis should be placed on evaluation and enhancement of native trout species (cutthroat and bull trout) that are resident to, or spawn in, these

tributaries. Efforts should be coordinated with the forest biologist currently active in the drainage.

3) Continue tagging studies, in conjunction with population inventories, to evaluate fish movement trends and determine seasonal use patterns which may influence future management strategies.

4) Continue and extend the scope of the voluntary creel census to include season-long evaluations of angler use throughout the drainage. This effort, complimented by a statewide fishing pressure survey planned for 1989, will help determine angler influences in the river. Fisherman contacts will also function to inform the public of the various fisheries concerns in the Blackfoot River.

5) Develop public consensus for future fisheries management by presenting results of this inventory and analysis to the interested public. Meetings and/or media exposure is recommended in the population centers of Lincoln, Ovando, Seeley Lake, Missoula, and Great Falls.

6) Develop a river management plan on the Blackfoot River to deal with public concerns and resource issues in the drainage.

**PREPARED BY:** DONALD PETERS AND DENNIS WORKMAN

**DATE:** AUGUST, 1989

| **WATERS REFERRED TO:** | **STATE WATER CODE;** |
|---|---|
| Blackfoot River Sec. 1 | 04 - 0600 |
| Blackfoot River Sec. 2 | 04 - 0630 |
| Blackfoot River Sec. 3 | 04 - 0660 |
| Alice Creek | 04 - 0030 |
| Copper Creek | 04 - 1440 |
| Landers Fork | 04 - 3120 |
| North Fork of the Blackfoot River | 04 - 3960 |
| Monture Creek | 04 - 3690 |

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