MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
FISHERIES DIVISION
JOB PROGRESS REPORT

State: Montana
Project No.: F-5-R-36
Job No.: II

Title: Northcentral Montana Fisheries Study
Title: Inventory and Survey of Cold Water Fish Populations in Rivers and Streams

Period Covered: July 1, 1986 through June 30, 1987

ABSTRACT

Trout populations in 13 streams in the upper Sun, Marias, and Teton River drainages were sampled for species composition and abundance. Results of Smith River electrofishing surveys for 1985 and 1986 are summarized and compared to previous years' findings to evaluate the effectiveness of a restrictive slot limit imposed in May, 1985. Results are inconclusive but suggest that the special regulation may have resulted in the improvement of the fishery. It is recommended that the regulation be extended with modifications concerning bait fishing and upper size limit. Response to a voluntary creel survey of anglers fishing the Smith River during 1986 was poor (less than 10%) but indicated that harvest of rainbow and brown trout was very low, substantially less than 10% of existing populations. Larger sized rainbow trout were somewhat less numerous than normal in the Tresch section of Big Spring Creek but far more abundant than usual in the Burleigh section during fall 1986. Brown trout populations in Big Spring Creek were similar to past years. A fishing pressure and harvest survey was conducted in two sections of the Missouri River immediately downstream from Holter Dam from May 1 through October 15, 1986. Fishing pressure was 3,895 and 908 angler days per mile in the Holter and Craig sections respectively, which was high in comparison to other Montana rivers. Catch rates for trout (.46 per hour in Holter section, 0.61 per hour in Craig section) and average size of trout harvested (14.2 and 15.0 inches for rainbows, 15.2 inches for browns) were very good in comparison to other Montana rivers. An estimated 9,182 rainbows eight inches and longer were harvested in the Holter section. This represented more than 150% of the fall population and it is likely that much of this harvest was comprised of hatchery fish emigrating from Holter Reservoir. The estimated harvest of 2,253 rainbows 10 inches and longer in the Craig section represented approximately 15% of the fall 1986 population. Harvest for Craig section rainbows in size groups between 12 and 18 inches in length was acceptable and ranged between 17 and 21% of the standing stock, but harvest of rainbows 18 inches and longer was considered high (38% of population).

Totals of 218 and 368 brown trout 10 inches and longer were harvested in the Holter and Craig sections respectively, representing 71% and 29% of the spring 1986 populations. Harvest of age II+ and age IV+ and older browns in the Craig section was 36% and 29% of the spring population. Fall 1986 rainbow trout density was 4,255 fish six inches and longer per mile in the Craig section. This was midway between 1984 and 1985 estimates but substantially higher than 1982. Rainbows 18 inches and longer were more numerous in the Craig section in 1985 and 1986 than in previous years, perhaps due to changes in fishing regulations. Fall 1986 rainbow numbers in the Cascade section were very similar to results for 1981 and 1982, but numbers of larger rainbow appeared higher than in the past. Spring 1986 brown trout densities in the Craig section were similar to other sections surveyed in past years. Springtime trapping on Sheep Creek showed it to be a very heavily used spawning tributary for Missouri River rainbow trout. Mark-recapture estimates indicated at least 4,400 and 3,600 spawners nine inches and longer used Sheep Creek in 1986 and 1987 respectively with most spawners between 15 and 18 inches long. Tag return data from post-spawners indicates that most Sheep Creek spawners reside in the Missouri River from four miles above to 15 miles below the mouth of Sheep Creek. Several tag returns were obtained from rainbows in the Missouri River in or near the city of Great Falls, 50-60 river-miles downstream from Sheep Creek.

OBJECTIVES AND DEGREE OF ATTAINMENT

1. To evaluate effects of reduced creel limits on rainbow and brown trout populations in the Smith River for management recommendation. This work was done and is included in this report.

2. To monitor rainbow and brown trout populations in Big Spring Creek to evaluate the present management program. This work was done and is included in this report.

3. To estimate rainbow and brown trout populations in three sections of the Missouri River between Holter Dam and Cascade for management purposes. This work was done and is included in this report.

4. To obtain fishing pressure and harvest estimates for gamefish in the Missouri River from Holter Dam to Craig Bridge to evaluate present management program. This work was done and is included in this report.

5. To monitor trout spawning movements into tributaries of the Missouri River from Holter Dam to Cascade to develop management direction. Spring trapping for rainbow trout in Sheep Creek was done and is included in this report.

6. To inventory trout populations in 5 streams to update management files. This work was done for 13 streams and is included in this report.

PROCEDURES

Trout population estimates were obtained by employing electrofishing mark and recapture techniques described by Vincent (1971) or using a two-pass method (Leathe, 1983). Mark-recapture data was analyzed on Montana State University's CP6 computer or on MDFW&P IBM-compatible microcomputers. Small stream electrofishing was accomplished with bank shocking gear. Big Spring Creek and the Smith River were sampled using boat-mounted gear and a mobile anode. The Missouri River was electrofished at night with a jet boat and/or motorized drift boat equipped with fixed-boom gear. Fish were measured to the nearest 0.1 inch and weighed to the nearest .01 pound. Scale samples were collected and mounted on acetate slides and examined on a microfiche reader for age analysis.

Fishing pressure estimates in two sections of the Missouri River between Holter Dam and Craig Bridge were obtained by total angler counts made three times each census day from selected shoreline vantage points. During each count, all boat and shore anglers observed were tallied. Only anglers who were actually fishing or preparing to fish were counted, people rowing boats were not counted as boat anglers. Counts were made on half the weekdays and half the weekend days and holidays in each month from May 1 through October 15, 1986. The time of the first count on each census day was randomly selected hourly from 6:30 A to 2:30 P (or less in periods with shorter days) using a random numbers table. Subsequent counts on each sample day were made at three hour intervals. Weekday starting times were selected without replacement for two week periods while weekend and holiday starting times were selected without replacement on a monthly basis. Counts were considered instantaneous since a count on each section typically required less than 45 minutes to complete (Neuhold and Lu 1957). Catch rates, catch composition, fishing techniques, and angler and trip characteristics were determined by direct angler interviews. Pressure and harvest estimates were derived using the MDFW&P creel census program run on the Department's IBM-compatible micro-computers. This program uses procedures and formulae from Neuhold and Lu (1957).

Upstream and downstream portable fish traps consisting of block fences and trap boxes were installed in Sheep Creek, a tributary to the Missouri River near Cascade, in spring 1986 and 1987. In 1986, the block fences were made of standard chicken wire secured secured to the stream bottom with steel fenceposts and rocks. The Missouri River Flyfishers Club of Great Falls constructed and donated new block fences for the 1987 trap. These fences consisted of eight-foot long rectangular frames made of angle-iron with pre-drilled holes spaced 5/8-inch apart. Five-

foot lengths of 3/4-inch conduit were inserted through the holes in the angle-iron frame and driven approximately six inches into the stream bottom. Each panel was secured to an upstream fencepost using steel cable. During both years, fish migrating upstream were marked with a fin punch and fish returning downstream were examined for marks to allow calculation of a population estimate. A subsample of downstream migrants were marked with Floy tags to monitor harvest rates and movement by angler returns. Fish were measured to the nearest 0.1-inch and weighed to the nearest 0.01-pound.

FINDINGS

SMALL STREAMS

Thirteen streams were inventoried to update management files and to obtain preliminary information relative to instream flow determinations. Population estimates were made using the two-pass method described by Leathe (1983) and data collected are presented in Table 1. Conductivity of waters along the Rocky Mountain East Front is very low making shocking difficult and resulting in low numbers of fish sampled. Streams selected for instream flows will be presented in a future report. The South Fork of the Sun River above Hoadley Creek was sampled by hook and line to determine fish presence. Sampling on August 7, 1986, revealed a fishery composed of 70 percent brook trout and the remaining 30 percent made up of cutthroat trout, rainbow trout, and rainbow/cutthroat hybrids. Previous sampling in 1960 and 1975 indicated the stream was barren above a barrier located above the mouth of Hoadley Creek.

SMITH RIVER

Trout population levels were determined by electrofishing two sections of the Smith River during fall 1985 and three sections during the fall of 1986. This work was done to evaluate the effects of restrictive fishing regulations on the 52-mile section of river from the confluence with Rock Creek to Eden Bridge (Figure 1). Due to public concern for the fishery in the scenic semi-wilderness Smith River Canyon, a special trout limit of 3 fish per day under 13 inches and one fish per day over 22 inches caught by artificial lures only was imposed on March 1, 1985. This replaced the former trout limit of five fish, including only one over 18 inches.

Eagle Creek Section

The Eagle Creek electrofishing section is 2.04 miles long, (Figure 1) and was formerly known as the Zeig section. It is located approximately five miles upstream from Rock Creek, where the special regulation waters begin. Hence it can be viewed as a "control" section for comparative purposes although rainbow trout

Table 1. Miscellaneous Streams Surveyed, 1986.

Stream (Date)	Length Shocked	Species*	No.	Length Range	Weight Range	Pop. Estimate Per 1000 Ft
Spring Cr. (7-15-86)	310'	Rb	9	4.5- 8.3	0.06-0.32	
		Eb	11	4.6- 7.5	0.09-0.18	
Deep Creek (7-16-86)	650'	LL	2	7.0-18.0	-	-
Willow Creek (7-16-86	300'	No Fish				
McDonald Cr. (7-23-86)	306'	Eb	129	3.5- 9.1	0.02-0.31	467
Barr Creek (7-25-86)	600'	Eb	1			
N.Fk. Dupuyer Cr. (7-29-86)	200'	Ct	2	5.0- 5.3	0.05-0.06	--
		Eb	11	3.9- 8.4	0.05-0.29	--
S.Fk. Dupuyer Cr. (7-29-86)	300'	Ct	2			
Sheep Creek (7-29-86)	Didn't shock - flow too low					
Scoffin Creek (7-29-86)	Didn't shock - flow too low					
Dupuyer Creek (7-30-86)	650'	Eb	2			--
Elk Creek (8-6-86)	308'	Rb	12	5.0- 8.6	0.05-0.22	
		LL	9	5.9-13.6	0.09-1.10	
Ford Creek (8-6-86)	340'	Eb	5	5.3- 8.0	0.09-0.26	--
		Ct	2	3.6-11.0	0.02-0.78	--
		Rb	1	4.6	0.09	--

* Species Abbreviation: Rb-rainbow trout; Eb-brook trout; LL-brown trout; Ct-cutthroat trout.

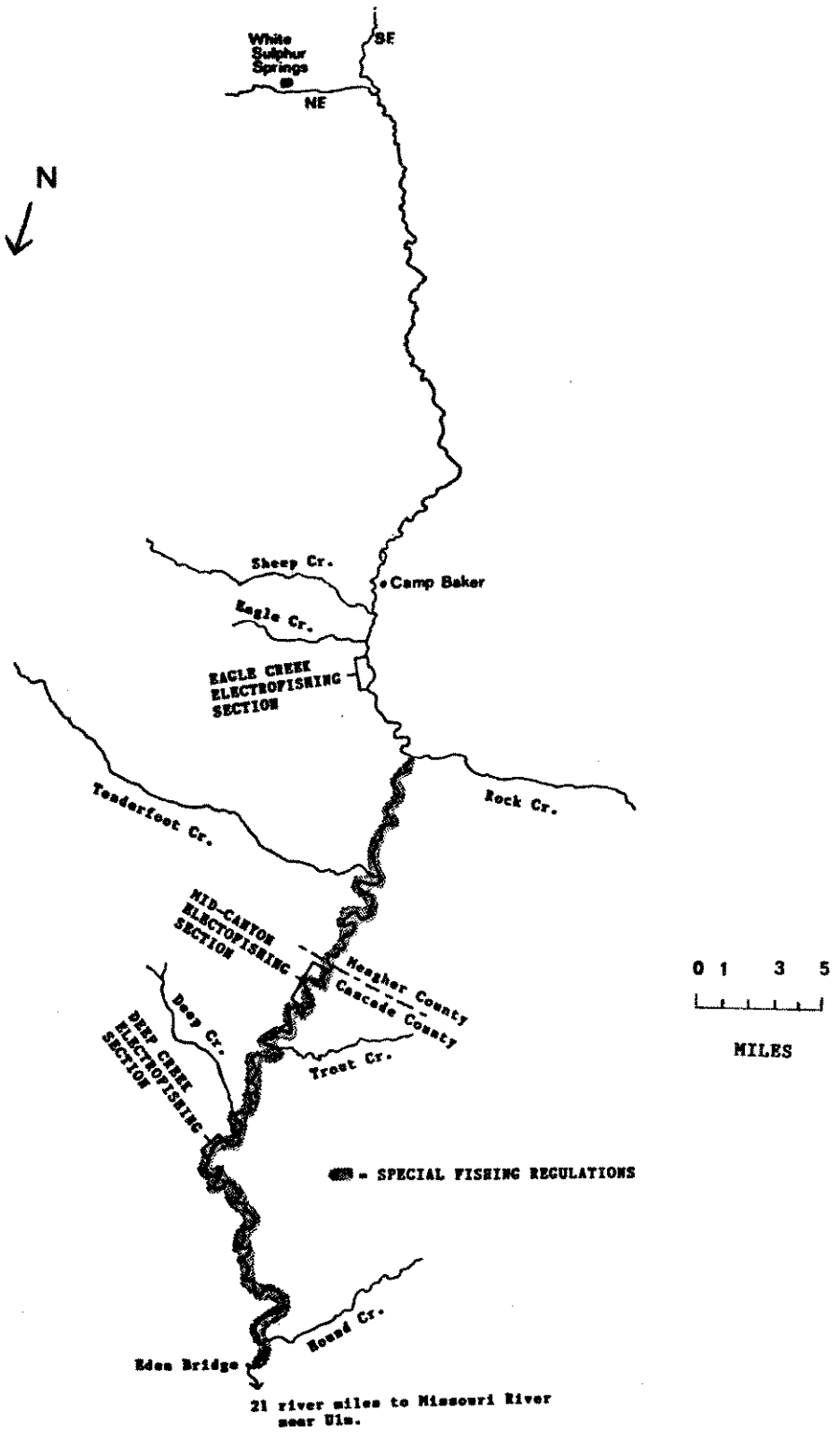

Figure 1. Map of the upper Smith River, Montana.

densities are markedly higher and growth rates are lower than in other sections. Fish population estimates have been conducted in this section annually since 1975 except for 1982 and 1983.

Results of electrofishing surveys indicate that populations of rainbow and brown trout have steadily increased during the past three years (Figure 2). In fact, populations of both species in fall 1986 were the highest on record for the Eagle Creek section. The 1986 rainbow population was significantly higher (at the 80% level) than those of 1975, 1976 and 1978 while confidence limits overlapped in other years. Data presented in Figure 3 indicate that the elevated rainbow trout population levels of 1985 and 1986 in the Eagle Creek Section are largely due to increases in numbers of age III+ and older fish. Recruitment of yearlings to the population and numbers of age II+ fish during 1984-1986 are comparable to past years, hence survival of older aged fish has apparently improved in recent years.

Recent increases in rainbow trout populations are somewhat surprising since environmental conditions in 1985 were very unfavorable due to drought-induced low water levels and probable high water temperatures. Also, it should be reiterated that this section was not afforded the protection of the special fishing regulation imposed in March, 1985. The reasons for recent improvement in the rainbow population are presently unclear but may relate to change of ownership and angler use patterns on the private land that surrounds the Eagle Creek section. In early 1985 the surrounding ranchland (Zeig Ranch) was sold and developed as a guest ranch. Fishing privileges for non-floaters are now afforded almost exclusively to guests, and catch-and-release fishing is strongly encouraged by the operators of the new guest ranch.

Brown trout trends in the Eagle Creek section are more difficult to interpret because of their relatively small population size (Figure 2). However, in spite of the wide confidence intervals, it is clear that the brown trout population has increased significantly since 1980. The 1981 through 1986 estimates were all significantly higher than corresponding figures for 1975 through 1978 except for 1976 (Figure 2). Due to small sample sizes it is difficult to evaluate changes in age structure but gross examination of data indicates that the population increase has occurred in all age groups. The cause(s) of these increases are unclear.

Length and age data collected during September electrofishing over the past 10 years indicate that brown trout growth rates are substantially greater than those for rainbow trout in all sections of the Smith River (Table 2). Brown trout growth rates appear similar in all sections while age III+ rainbow are 0.9 to 1.4 inches smaller in the Eagle Creek section than in downstream areas.

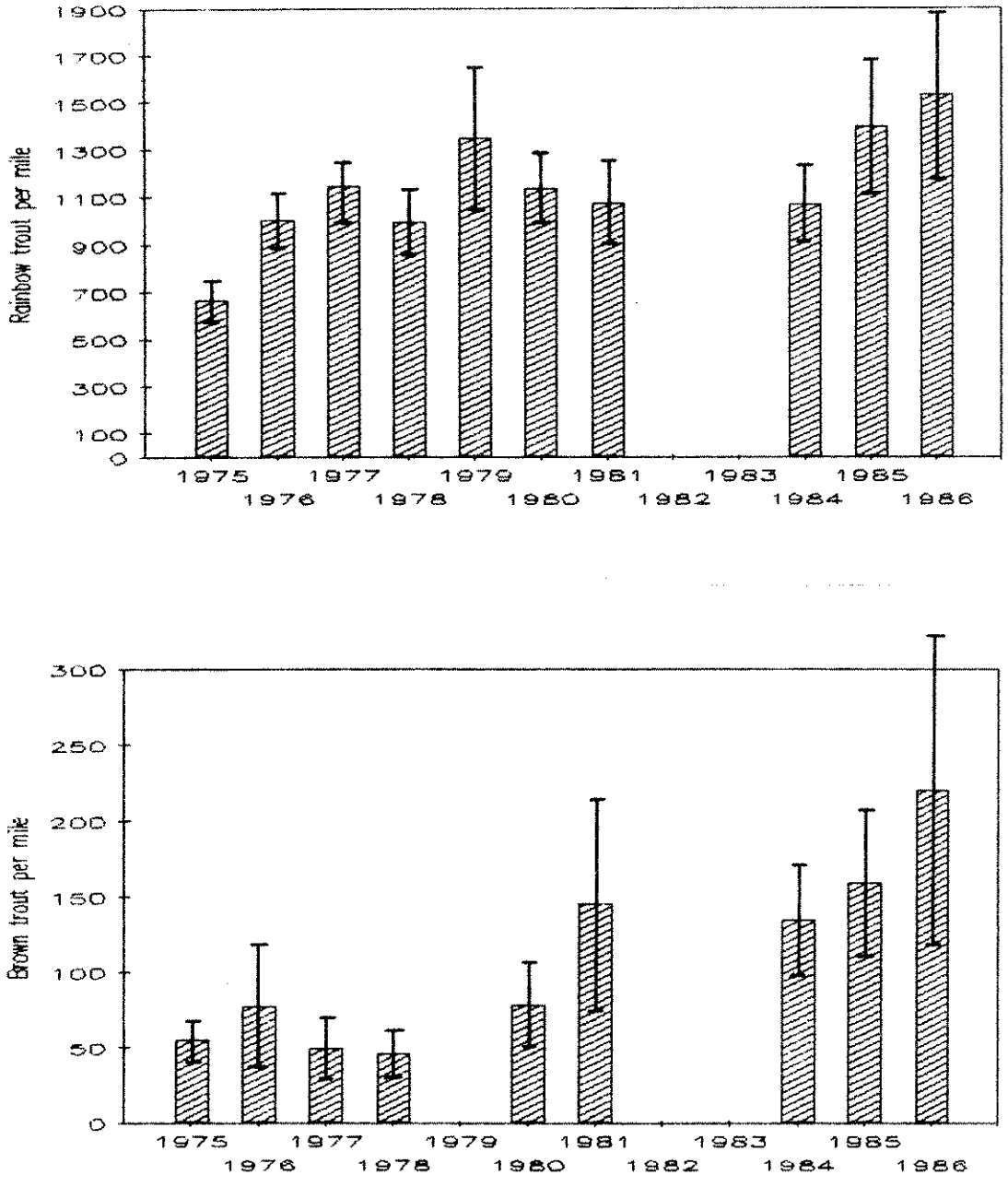

Figure 2. Density (fish per mile) of age I+ and older rainbow trout (upper graph) and brown trout (lower graph) in the Eagle Creek electrofishing section on the Smith River, 1975 - 1986. Eighty percent confidence intervals represented by vertical lines with bars.

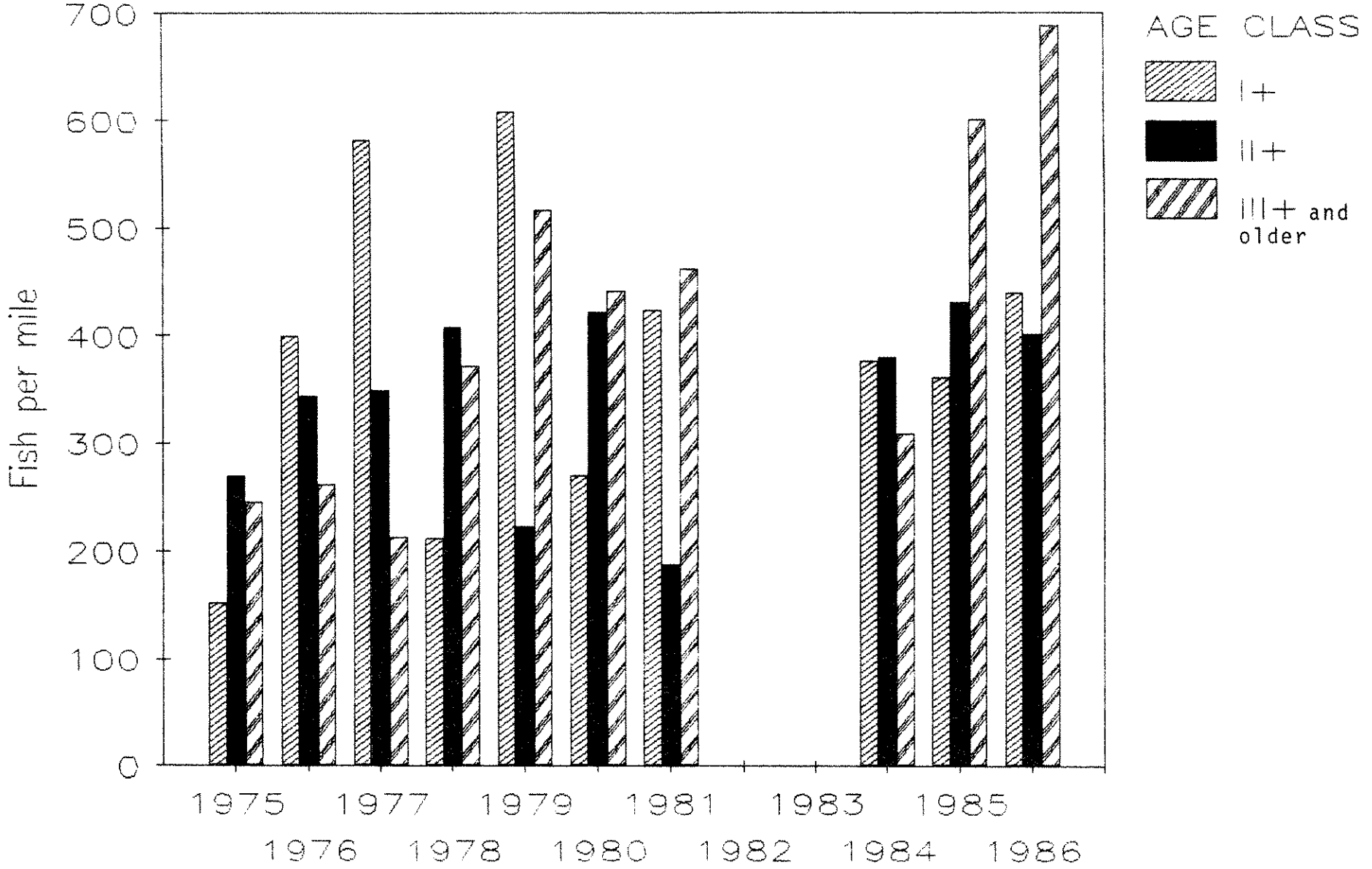

Figure 3. Rainbow trout density (fish per mile) by age group in the Eagle Creek electrofishing section of the Smith River, 1975-1986.

Table 2. Average length (inches) of rainbow and brown trout of various ages in three sections of the Smith River. Data were gathered during September in the years 1970-1986.

Species	Section	Age I+	Age II+	Age III+
Rainbow trout	Eagle Creek	7.1	9.3	11.1
Rainbow Trout	Mid-canyon	7.6	9.8	12.0
Rainbow trout	Deep Creek	8.3	10.9	12.5
Brown trout	Eagle Creek	8.6	12.7	15.6
Brown trout	Mid-canyon	8.8	12.3	15.8
Brown trout	Deep Creek	9.4	13.4	16.0

Table 3. Summary of fall trout population estimates (fish per mile) made in the Mid-canyon electrofishing section on the Smith River in 1984 and 1985. Average length in parenthesis and 80% confidence intervals in brackets.

Year	I+	II+	III+	IV+ & Older	Total	[± 80%CI]
			Rainbow Trout			
1984	129(7.6)	163(9.8)	76(11.9)	55(13.9)	423	[± 77]
1985	107(7.5)	225(9.9)	292(12.0)	87(14.0)	711	[± 182]
			Brown Trout			
1984	309(8.7)	78(12.2)	26(16.3)	19(18.0)	432	[± 123]
1985	64(8.8)	183(12.4)	69(15.3)	39(18.0)	355	[± 91]

Mid-canyon Section

The Mid-canyon electrofishing section is 3.56 miles long (Figure 1) and was established in fall 1984 to evaluate the special fishing regulation that became effective in March, 1985. Electrofishing results for 1984 and 1985 revealed that this section contained fewer rainbow and more brown trout per mile than the Eagle Creek section (Table 3, Figure 2). Populations of II+ and older rainbow and brown trout were all substantially greater in 1985 than in 1984, suggesting that the new slot limit was having a beneficial effect on the fishery. Unfortunately, it was not possible to collect and mark enough fish of either species to obtain a reliable population estimate during fall 1986. Three electrofishing runs were made through the section in 1986 but average catch per run was only 57 rainbow and 40 brown trout. These catches were only one third or less of average catches made in 1984 and 1985. Rough population estimates made using the scanty 1986 data suggest that rainbow and brown trout populations in 1986 decreased 60% and 54% from 1985 levels.

High stream flows and faulty or inefficient electrofishing gear were ruled out as possible causes for low 1986 catches in the Mid-canyon section since good results were obtained during fall 1986 in the Eagle and Deep Creek sections with the same gear at similar flows. Trout mortality associated with massive ice jams that occurred in this reach during late February 1986 may have been high enough to cause observed population reductions. Rapid warming following a prolonged cold spell caused streamflow at Camp Baker to increase from normal levels of around 90-110 cfs to more than 700 cfs over a three-day period in late February, according to USGS records. A local resident of the Smith River canyon reported massive ice jams and substantial flooding in the Mid-canyon section. He also reported finding the remains of numerous trout and whitefish that had apparently been stranded above the high water mark as ice jams broke and the water level rapidly receded. This type of mortality is not atypical in unregulated mountain streams subject to harsh winter conditions (Maciolek and Needham, 1952, Needham and Jones 1959).

Deep Creek Section

Due to the inability to obtain reliable fish population information in the Mid-canyon section during 1986 it was decided to conduct an estimate in the Deep Creek section, located about 12 miles downstream (Figure 1). The Deep Creek section was formerly known as the Fraunhofer section and is 2.52 miles long. Total numbers of rainbow trout were less in 1986 than in previous years but numbers of older rainbow (III+ and IV+ and older) were higher than previously observed (Table 4). Increased numbers of larger rainbow may be in response to recently instituted special fishing regulations. However, more information will be required to make that determination since the population level is relatively low and recent data is scanty.

Brown trout densities in the Deep Creek section were significantly higher in 1986 than in 1977 or 1970 (Table 5). This was especially noticeable in larger fish (age II+ and III+ and older). This may be related to special fishing regulations or it may reflect a general population response to unknown environmental factors such as water levels, shifts in populations of other fish species, or changes in food supply. Similar improvements in the brown trout population have been noted in the Eagle Creek section (Figure 2), suggesting that environmental factors are most likely responsible for the population shifts.

Angler Survey and Harvest

A voluntary creel census of anglers floating the 61-mile section of the Smith River between Camp Baker and Eden Bridge was conducted during 1986. The creel survey forms were printed on 5 1/2 by 8 1/2-inch cards and were available by June 1 at two locations with appropriate signing at the Camp Baker access where nearly all recreational Smith River floats begin. A total of 94 survey cards were returned with usable information. This amounted to less then a 10% response rate since a Parks Division survey indicated at least 1,098 anglers floated during June through August of 1986 (Baxter 1986). The majority of the survey cards were returned in June (55 cards) with fewer numbers in July (16). Only two cards were returned in August, reflecting a response rate of only 2% for that month. Angler responses on survey cards provided information for 371 days of fishing. Creel survey cards were simplified in 1987 in an attempt to increase angler participation in the program.

Respondents reported overall catch rates of 1.75 rainbow and 0.56 brown trout per hour during 1986. Twenty-three percent of the rainbow and 49% of the brown trout caught were judged by anglers to be longer than 13 inches. Rainbow trout catch rates were highest in the upper 1/3 of the float while brown trout catch rates were relatively consistent throughout (Table 6). Interestingly, catch rates for guided anglers were reported to be less than those for non-guided anglers. Data for 72 angler-days by guided anglers revealed catch rates of 1.5 rainbow and 0.4 brown trout per hour compared to 1.8 rainbow and 0.6 brown trout

Table 4. Historical summary of fall rainbow trout age class densities (fish per mile) and average length (in parenthesis) in the Deep Creek electrofishing section on the Smith River. Eighty percent confidence interval for total estimate in brackets.

Sampling Year	Number of Rainbow Trout per Mile					
	I+	II+	III+	IV+ & older	Total	[±80% CI]
1986	51(8.5)	80(10.6)	44(12.7)	34(14.6)	209	[±47]
1977	232(8.6)	27(11.6)	27(13.7)*		286	[±45]
1976	114(8.4)	7(11.3)	28(12.2)	29(13.9)	178	[±31]
1970	412(7.7)	34(10.2)	33(13.0)*		479	[±132]

* Includes all fish three years and older

Table 5. Historical summary of fall brown trout age class densities (fish per mile) and average length (in parenthesis) in the Deep Creek electrofishing section on the Smith River. Eighty percent confidence interval for total estimate in brackets.

Sampling Year	Number of brown trout per mile				
	I+	II+	III+ & Older	Total	[±80% CI]
1986	67(8.9)	83(13.5)	91(16.8)	241	[±48]
1977	52(10.3)	33(14.1)	23(17.2)	108	[±28]
1976	No estimate - population too low				
1970	21(8.8)	48(13.0)	21(16.8)	90	[±34]

per hour for 322 angler days by non-guided anglers. Fly fishermen caught more rainbow per hour (2.02 fish per hour; 249 angler-days) than lure anglers (0.75 per hour; 32 angler-days) but brown trout catch rates were similar (0.59 vs. 0.50 per hour). Eighty-four percent of the respondents used flies only or flies and lures. Of the 84 anglers who revealed their age, two were less than 12 years old, six were 13-20 years and the majority (48 people) were age 21 - 40 with the remainder aged over 40 years.

Table 6. Rainbow and brown trout catch rates (fish per hour) in five sections of the Smith River as reported by anglers on voluntary creel survey cards for summer 1986.

Section	River Miles*	Angler-days Effort	Fish caught per hour Rainbow Trout	Brown Trout
Camp Baker to Rock Cr.	0 - 9	81	2.61	0.57
Rock Creek to Cow Coulee	9 - 24	82	2.18	0.49
Cow Coulee to Fraunhofer	24 - 37	13	1.48	0.41
Fraunhofer to Ridgetop	37 - 47	7	1.83	0.58
Ridgetop to Eden Bridge	47 - 61	28	0.62	0.39

* River miles are from MDFWP's Smith River floaters guide map.

Anglers fished an average of 3.7 hours per day and fished 3.9 days per trip during 1986. These figures are probably higher than for the average angler, hence they must be used with caution. For example, a 1985 Parks Division survey (Cheek 1985) showed that anglers fished an average of 1.9 days per float which appears more representative for the average angler. Using this latter figure and the 1986 Parks Division estimate of 1,384 anglers during the April through August float season (Baxter 1986), fishing pressure would be 2,630 angler-days. This is an under-estimate of total fishing pressure since it does not take into account shore anglers nor the few floaters who start at the few intermediate access points. A reasonable guess is that total fishing pressure is approximately 25-30% higher than the above estimate.

Respondents during 1986 reported keeping only 7% of rainbows and 4% of brown trout caught. These estimates are nearly identical to those observed in 1985 (8% and 5% respectively) in a Parks Division survey of all anglers (Cheek 1985). The 1986

survey showed harvest rates of 0.51 rainbow and 0.10 brown trout per angler-day. Multiplying these by estimated fishing pressure of 2,630 angler-days indicates harvest of 1,341 rainbow and 263 brown trout by floaters during the peak use period of May through August 1986. In 1985, floaters reported harvesting 383 rainbow and 148 brown trout (Cheek 1985).

Evaluation of Slot Limit

Based on the results of 1984 through 1986 electrofishing it is difficult to gauge the effectiveness of the special slot limit established in March 1985 for the canyon section of the Smith River. A major confounding factor was that densities of both brown and rainbow trout increased noticeably in the Eagle Creek section even though this section was not afforded the protection of the special regulations. It is possible that the population increases were due to: 1) reduced harvest by floaters who were unaware that special regulations did not begin until the confluence with Rock Creek, or, 2) reduced harvest by shore anglers who were guests at a newly established guest ranch that surrounds the survey section, or 3) natural fish population responses to changing environmental variables. Rainbow trout increases were most likely due to one or both of the first two reasons since the most noticeable changes were in the older rainbow age groups (recruitment has not increased) and environmental factors have not been particularly favorable in the past three years. Brown trout increases are more difficult to interpret because they appeared to begin in 1981, before the land ownership change occurred. The similar increases in brown trout in the Eagle and Deep Creek sections since the 1970's suggests that environmental conditions (such as mild winters, changes in food supply etc.) may be responsible for a general population expansion.

Results for the Mid-canyon section in 1985 and the Deep Creek section in 1986 showed improvements in populations of older rainbow and brown trout that might be attributed to fishing regulation changes. However, the precipitous decline of both species in the Mid-canyon section in 1986 makes definite conclusions impossible. This decline may have been due to a catastrophic winter freshet with associated ice jams, however, a landowner along the Deep Creek section reported similar conditions but with no apparent effect on fish populations.

Trout harvest by floaters during 1986 was quite low. Expansion of recent trout population estimates and comparison with harvest estimates indicates that only five to six percent of the populations of rainbow and brown trout in the 6-13 inch size range between Camp Baker and Eden Bridge were harvested by floaters during 1986. Even if these figures are in error by a factor of two, exploitation rates would still be low. In spite of some data deficiencies, there is enough positive evidence to warrant extension of the special fishing regulation for at least two more

years. However, some modifications should be considered. Allowing only children less than 12 years of age to fish with bait should be considered. This would close an existing "loophole" that allows all anglers to fish with bait if they claim to be fishing for species other than trout. It would also foster better relations with landowners along the river, most of whom favor such a regulation. Good relations and cooperation with private landowners is essential to the success of the Department's ongoing Smith River recreation management program. It is unlikely that allowing children's bait fishing would appreciably affect trout populations, since recent trout population increases in the Eagle Creek section occurred despite the fact that all floaters were allowed to fish with bait in this section.

Finally, lowering the upper end of the slot limit from 22" should be considered. During the years 1970 through 1986 Department electrofishing crews have handled 2,343 rainbow and 1,272 brown trout in the Mid-canyon and Deep Creek electrofishing sections. Only two brown trout larger than 22 inches have been handled during this time (one in 1976, one in 1984) and no rainbow larger than 22 inches have been handled. In fact, only one rainbow longer than 18 inches (an 18.9 inch fish taken in 1986) has ever been collected in these sections by our crews.

BIG SPRING CREEK

Electrofishing surveys were conducted during fall 1986 on the two long-term fish population monitoring sections of Big Spring Creek. The Tresch section is 0.83 miles long, is located immediately downstream from the City of Lewistown, and corresponds to section D of Marcoux (1969). The Burleigh section is 1.11 miles long, is located about four miles upstream from the City of Lewistown, and corresponds to section B of Marcoux (1969). Scale collections made during 1986 were not read in time for this report, hence only length group comparisons will be presented. Age class analysis will be presented in a future report.

In the Tresch section, 1986 densities of small rainbow (5-10 inch fish) were similar to past years while densities of medium-sized (10-15 inches) and large rainbow (longer than 15 inches) were somewhat lower than in past years (Table 7). Total density of 5-inch and longer rainbow in the Tresch section during 1986 was in excess of 3,000 fish per mile, which exceeds all previous estimates except 1983 and 1984, indicating a healthy population. Rainbow densities in the Burleigh section in 1986 were the highest on record (1,425 fish per mile exceeding 10 inches; Table 7) due primarily to unusually high numbers of 10-15 inch fish. Small sample sizes for 5 to 10 inch rainbow trout in the Burleigh section preclude the calculation of valid population estimates. Brown trout numbers in all size groups in both sections were similar to previous years (Table 8).

Table 7. Number of rainbow trout per mile by size group in the Tresch and Burleigh electrofishing sections on Big Spring Creek, 1979 - 1986.

Sample Year	Rainbow Trout per Mile				
	5-10 inches	10-15 inches		15 inches & longer	
	Tresch	Tresch	Burleigh	Tresch	Burleigh
1986	1530	1547	1404	87	21
1985	--	--	--	--	--
1984	1136	1918	692	234	34
1983	1487	2114	389	137	0
1982	--	--	428	--	30
1981	1666	867	330	245	23
1980	811	849	428	236	19
1979	506	549	172	22	4

Table 8. Number of brown trout per mile by size group in the Tresch and Burleigh electrofishing sections on Big Spring Creek, 1979 - 1986.

Sample Year	Brown trout per mile			
	10-15 inches		15 inches and longer	
	Tresch	Burleigh	Tresch	Burleigh
1986	275	20	71	61
1985	--	--	--	--
1984	288	20	125	39
1983	222	7	113	28
1982	--	7	--	60
1981	312	5	111	60
1980	339	5	121	79
1979	175	5	34	40

MISSOURI RIVER

CREEL CENSUS

A fishing pressure and harvest survey was conducted on two sections of the Missouri River during the period 1 May - 15 October, 1986. The upper section, referred to as the "Holter" section, was comprised of the 2.5-mile river segment beginning immediately below Holter Dam and ending at the first downstream bridge (Wolf Creek Bridge). The Craig section was 5.6 miles long, beginning at Wolf Creek bridge and ending at the next downstream bridge (Craig Bridge).

Angler Characteristics

Totals of 731 and 549 anglers were interviewed in the Holter and Craig sections, respectively. The majority of anglers in each section were Montana residents (Table 9). The Craig section received more use from nonresidents and residents of Lewis and Clark County (Helena area) while residents of Cascade County (Great Falls area) dominated users in the Holter section. The Craig section received substantially more use by commercially guided anglers than the Holter section. About 12% of anglers in the Craig section were guided, compared to less than 1% in the Holter section. Eighty-one percent of the guided anglers were nonresidents. Method of fishing varied substantially between sections (Table 10). In the Holter section, 61% fished with bait and 29% used artificials while in the Craig section 16% used bait and 79% used artificials. Ninety-six percent of anglers in the Craig section fished specifically for trout compared to 87% in the Holter section. Very few anglers (less than 1% fished specifically for whitefish, and 1% of anglers fished specifically for walleye in the Holter section. None of the anglers in the Craig section reported fishing specifically for whitefish or walleye. The percentage of walleye anglers using the Holter section was likely under-estimated since most walleye fishing occurred at night. The census was conducted only between dawn and dusk.

Fishing Pressure

Total fishing pressure measured in angler-hours in the Holter section was approximately 28% higher than in the Craig section (Table 11). Shore angling was predominant in the Holter section while the amount of angling in the Craig Section was almost equal for shore and boat anglers. Total fishing pressure was highest in the months of June through August in the Holter section and in July and August in the Craig section (Table 11). The number of hours per completed fishing trip was substantially higher for both shore and boat anglers in the Craig section as compared to the Holter section (Table 12). Conversion of angler-hours to angler-days using data from Tables 11 and 12 revealed that 9,738 angler-days were expended in the Holter section compared to 5,086 angler-days in the Craig section. This equates

Table 9. Origin of anglers (by percent) fishing two sections of the Missouri River 1 May - 15 October, 1986.

Origin	Holter Section	Craig Section
Cascade Co.	47%	20%
Lewis & Clark Co.	11%	27%
Other Montana	15%	19%
Non-resident	26%	32%
Foreign	1%	1%

Table 10. Fishing methods (by percent) employed by anglers on two sections of the Missouri River 1 May-15 October, 1986.

Bait Type	Holter Section	Craig Section
Lures	9%	12%
Flies	20%	67%
Bait	61%	16%
Combination	10%	5%

Table 11. Monthly summary of fishing pressure estimates (angler-hours) for two sections of the Missouri River between May 1 and Oct. 15, 1986. Eighty percent confidence intervals in parenthesis.

Month	Holter section (2.5 miles)			Craig Section (5.6 miles)		
	Shore	Boat	Total	Shore	Boat	Total
May	3476	320	3796	1289	942	2232
June	5195	987	6182	1043	1449	2492
July	7173	1518	8691	2230	3022	5252
Aug.	3962	1358	5320	2457	3537	5994
Sept.	2184	538	2722	1386	1394	2780
Oct 1-15	883	171	1055	675	589	1264
Totals	22874	4892	27765	9079	10934	20012
(±80% CI)	(±1224)	(±504)	(±1323)	(±658)	(±796)	(±1033)

Table 12. Number of hours per completed fishing trip for two sections of the Missouri River between May 1 and October 15, 1986. Number of completed trip interviews (n) in parenthesis.

	Holter Section	Craig Section
Shore anglers	2.707 (n=69)	3.068 (n=50)
Boat anglers	3.798 (n=41)	5.141 (n=271)

to 3,895 and 908 angler-days per mile respectively in these two sections. The largest number of anglers tallied in a single count in the Holter section was 39 (23 shore anglers, 16 boat anglers) observed in a count made on 28 July. In the Craig section, the maximum was 30 anglers (26 shore anglers, 4 boat anglers) in a count made on 7 August. The highest number of fishing boats observed on the Craig section was 12 in a count made on July 27.

Total fishing pressure for the Missouri River from Holter Dam to Craig Bridge (8.1 miles) was estimated to be 47,800 angler-hours for this study conducted between May 1 and October 15, 1986. Manipulation of data presented by Fredenberg (1985) revealed similar fishing pressure (approximately 50,000 angler-hours) on a 12.0 mile section of the Bighorn River for a comparable time period in 1982-1983. Total fishing pressure for a one-year period (October 1982 through September 1983) on the upper 12.0 miles of the Bighorn River was estimated at 987 angler-days per mile. This was substantially higher than a previous study conducted on the Bighorn River (631 angler-days per mile) and studies on the Madison, Bighole, Yellowstone, West Gallatin and Flathead rivers (250-650 angler-days per mile) summarized by Fredenberg (1985). Consequently, fishing pressure on the Missouri River determined by this study (3,895 days per mile in Holter section, 908 days per mile in Craig section) was very heavy in comparison to other waters. This conclusion is borne out by results of the statewide mail survey to determine fishing pressure in the 1984 and 1985 fishing seasons (Table 13).

Catch Rates and Harvest

Rainbow trout catch rates averaged .44 per hour in the Holter section and .51 per hour in the Craig section (Table 14). Catch rates for rainbow were slightly higher for boat anglers in each section. Rainbow catch rates peaked at .63 fish per hour in the Craig section during September while peak catch rates of .55 fish per hour were recorded in June and September in the Holter section (Table 14). Brown trout catch rates were much lower, averaging 0.02 and .10 fish per hour in the Holter and Craig sections respectively (Table 15). Low brown trout catch rates are consistent with relatively low population levels (approximately 100-300 fish per mile) determined in electrofishing surveys as will be discussed later. The total trout catch rate for the Craig section (.61 fish per hour) is higher than was observed during studies conducted during similar periods on the Bighorn, Yellowstone and West Gallatin rivers but lower than in two sections of the Madison River, where rates were 0.80 and 0.95 trout per hour (Fredenberg 1985).

Anglers who used flies generally enjoyed the highest catch rates for both rainbow and brown trout in both sections (Tables 16 and 17) Bait anglers generally kept the highest percentage (about 80%) of their catch in both sections. Interestingly, fly anglers kept a much higher percentage of their catch in the Holter section (44% of rainbows, 33% of browns, Table 16) than in the Craig

Table 13. Montana's 10 most heavily used trout rivers. Based on average of angler-days of use reported by anglers on statewide mail surveys conducted for the 1984 and 1985 fishing seasons.

Rank	River	Section	Section Length (miles)	Ave. angler Days
1	Madison	Hebgen Dam to Mouth	88	102,000
2	Missouri	Holter Dam to Cascade	36	73,000
3	Gallatin	Headwaters to Mouth	83	57,000
4	Bitterroot	Headwaters to Mouth	81	56,000
5	Clark Fork	Headwaters to Paradise	227	55,000
6	Big Hole	Headwaters to Mouth	126	51,000
7	Yellowstone	Gardiner to Reedpoint	84	46,000
8	Stillwater	Headwaters to Mouth	42	32,000
9	Blackfoot	Headwaters to Mouth	105	30,000
10*	Bighorn	Ft. Smith to Little Bighorn River	42	30,000

* Recent information indicates use on Bighorn River may have doubled in 1986.

Table 14. Monthly summary of rainbow trout catch rates (catch/hour includes fish released) for two sections of the Missouri River from May 1 to October 15, 1986. Number of anglers interviewed is in parenthesis.

Month	Holter Section			Craig Section		
	Shore	Boat	Combined	Shore	Boat	Combined
May	.25(55)	.15(7)	.23(62)	.00(8)	.27(18)	.19(26)
June	.52(86)	.96(5)	.55(91)	.28(14)	.33(16)	.31(30)
July	.42(195)	.38(17)	.42(212)	.43(43)	.56(76)	.51(119)
Aug.	.35(147)	.42(31)	.36(178)	.44(60)	.53(144)	.51(204)
Sept.	.51(127)	.94(12)	.55(139)	.58(43)	.66(82)	.63(125)
Oct 1-15	.54(46)	.58(3)	.54(49)	.75(23)	.30(22)	.53(45)
Overall	.43(656)	.51(75)	.44(731)	.48(191)	.53(358)	.51(549)

Table 15. Monthly summary of brown trout catch rates (catch/hour includes fish released) for two sections of the Missouri River from May 1 to October 15, 1986. See Table 14 for sample sizes.

Month	Holter Section			Craig Section		
	Shore	Boat	Combined	Shore	Boat	Combined
May	.04	.04	.04	.00	.14	.10
June	.01	.00	.01	.06	.12	.09
July	.01	.00	.01	.05	.09	.08
Aug.	.01	.02	.01	.07	.08	.08
Sept.	.04	.00	.03	.21	.10	.14
Oct 1-15	.04	.00	.04	.26	.06	.16
Overall	.02	.01	.02	.12	.09	.10

Table 16. Catch and harvest information by fishing method for anglers in the Holter section of the Missouri River, 1 May - 15 October, 1986.

Fishing Method	No. of Interviews	Rainbow trout		Brown Trout	
		Caught/hr	Kept	Caught/hr	Kept
Lures	65	.36	54%	.02	33%
Flies	149	.56	44%	.03	33%
Bait	449	.44	80%	.01	78%
Combo	227	.51	49%	.03	38%

Table 17. Catch and harvest information by fishing method for anglers in the Craig section of the Missouri River, 1 May - 15 October, 1986.

Fishing Method	No. of Interviews	Rainbow Trout		Brown Trout	
		Caught/hr	Kept	Caught/hr	Kept
Lures	68	.41	58%	.06	82%
Flies	363	.60	9%	.12	7%
Bait	86	.35	78%	.05	46%
Combo	32	.35	47%	.03	0%

section, where these anglers kept very few fish (9% of rainbows, 7% of browns, Table 17). Anglers who fished with a combination of gear types (i.e., flies and lures, lures and bait, etc.) generally experienced intermediate catch and harvest rates. Overall, anglers kept 68% of the rainbows and 55% of brown trout caught in the Holter section compared to 19% and 13% respectively in the Craig section.

Guided boat anglers in the Craig section experienced higher catch rates but kept far fewer fish than did non-guided boat anglers. All guided anglers interviewed in the Craig section were associated with boats. Guided anglers (68 interviews) caught .72 rainbow per hour and kept only 3% of them compared to .49 per hour and 27% kept for non-guided boat anglers (290 interviews). For brown trout, guided anglers caught .11 fish per hour and released all of them compared to .08 per hour and 20% kept for non-guided boat anglers fishing the Craig section.

Monthly harvest information for rainbow trout is presented in Table 18. A total of 9,219 rainbow trout were harvested in the Holter section and shore anglers accounted for approximately two-thirds of the total. Anglers harvested only about one-fourth as many rainbow in the Craig section (2,253 fish) and boat anglers harvested more fish than shore anglers. Peak rainbow trout harvest occurred during June and July in the Holter section versus July and August in the Craig section. The average size of rainbows harvested in the Craig section (15.0 inches, n=143) was slightly larger than in the Holter section (14.2 inches, n=413). Length frequency diagrams (Figure 4) showed very few rainbow longer than 18 inches harvested in either section. In the Holter section, only 3 fish of 413 measured (0.6% of total) exceeded 18 inches compared to 8 of 143 measured (5.5% of total) in the Craig section. No rainbows longer than 20 inches were measured during the census. The average size of rainbow trout was similar to those from the Bighorn River where they averaged 15.5 inches and was large in comparison to other Montana rivers (Fredenberg 1985). Although scale samples were collected for age analysis, these data were not available for this report and will be presented in a future report.

Totals of 228 and 384 brown trout were estimated to be harvested in the Holter and Craig sections respectively (Table 19). Shore anglers accounted for most of the harvest in the Holter section whereas boat anglers harvested the majority of the brown trout in the Craig section. Because relatively few brown trout (47 fish) were measured in either section, data were pooled for length and age analysis. Brown trout averaged 15.2 inches long in this study compared to 15.7 inches on the Bighorn River, which was large in comparison to other Montana rivers (Fredenberg 1985). Approximately 15% of the brown trout harvested from the Missouri River exceeded 18 inches in length and 4% of the catch were longer than 20 inches (Figure 5).

Table 18. Monthly summary of rainbow trout harvest for two sections of the Missouri River between May 1 and October 15, 1986. Eighty percent confidence intervals in parenthesis.

Month	Holter section			Craig section		
	Shore	Boat	Total	Shore	Boat	Total
May	821	47	868	0	183	183
June	2073	952	3025	198	85	283
July	2293	575	2868	421	495	916
Aug.	954	442	1396	189	369	558
Sept.	513	205	718	77	79	155
Oct 1-15	282	62	344	79	78	157
Totals (+80% CI)	6936 (±746)	2283 (±571)	9219 (±939)	963 (±237)	1290 (±226)	2253 (±327)

Table 19. Monthly summary of brown trout harvest for two sections of the Missouri River between May 1 and October 15, 1986. Eighty percent confidence intervals in parenthesis.

Month	Holter section			Craig section		
	Shore	Boat	Total	Shore	Boat	Total
May	66	0	66	0	110	110
June	45	0	45	0	57	57
July	15	0	15	47	65	112
Aug.	0	15	15	47	21	68
Sept.	53	0	53	22	5	27
Oct 1-15	34	0	34	10	0	10
Totals (+80% CI)	213 (±87)	15 (±19)	228 (±89)	126 (±69)	258 (±109)	384 (±129)

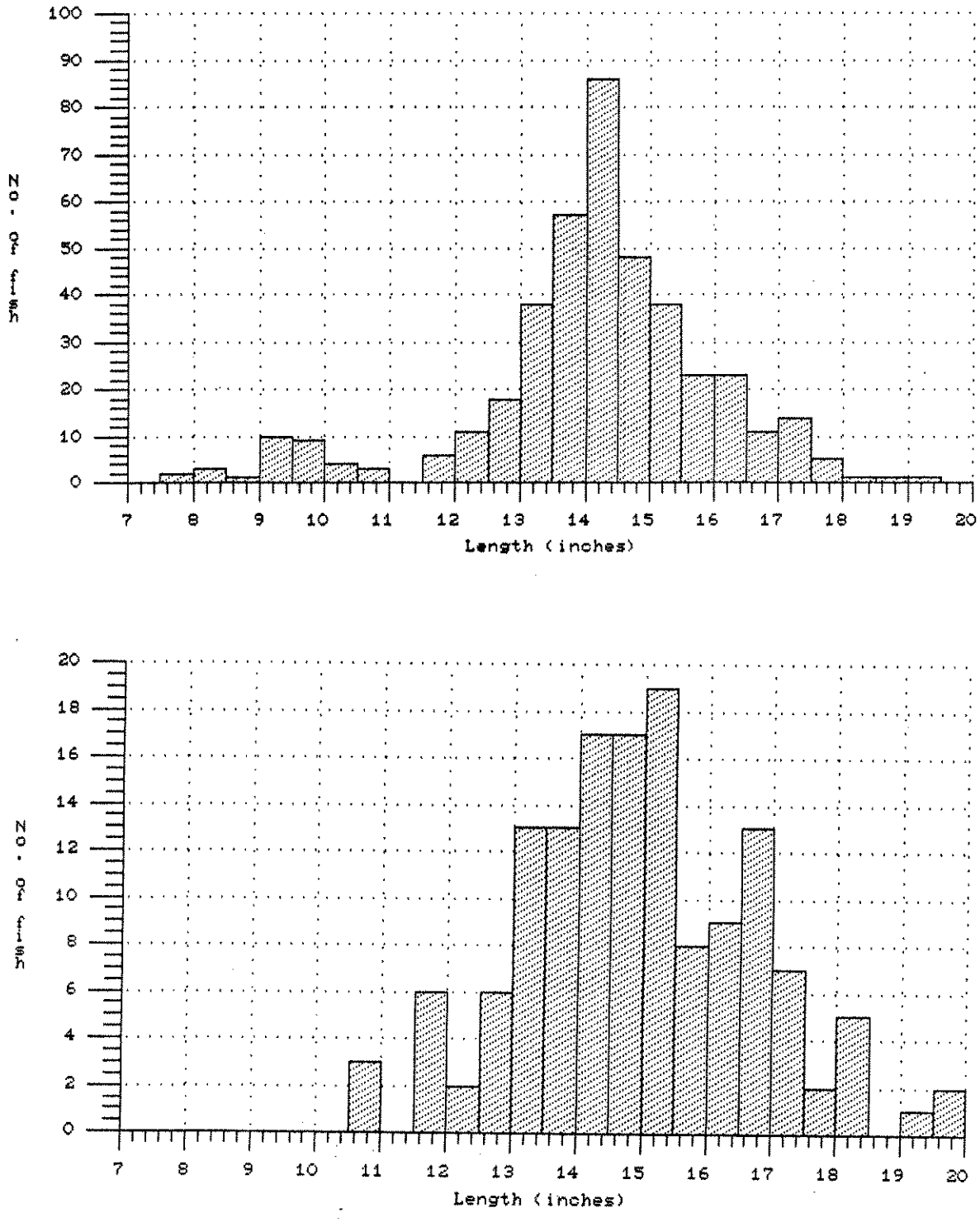

Figure 4. Length frequency diagrams for rainbow trout caught by anglers in the Holter (upper graph) and Craig (lower graph) sections of the Missouri River 1 May - 15 October, 1986.

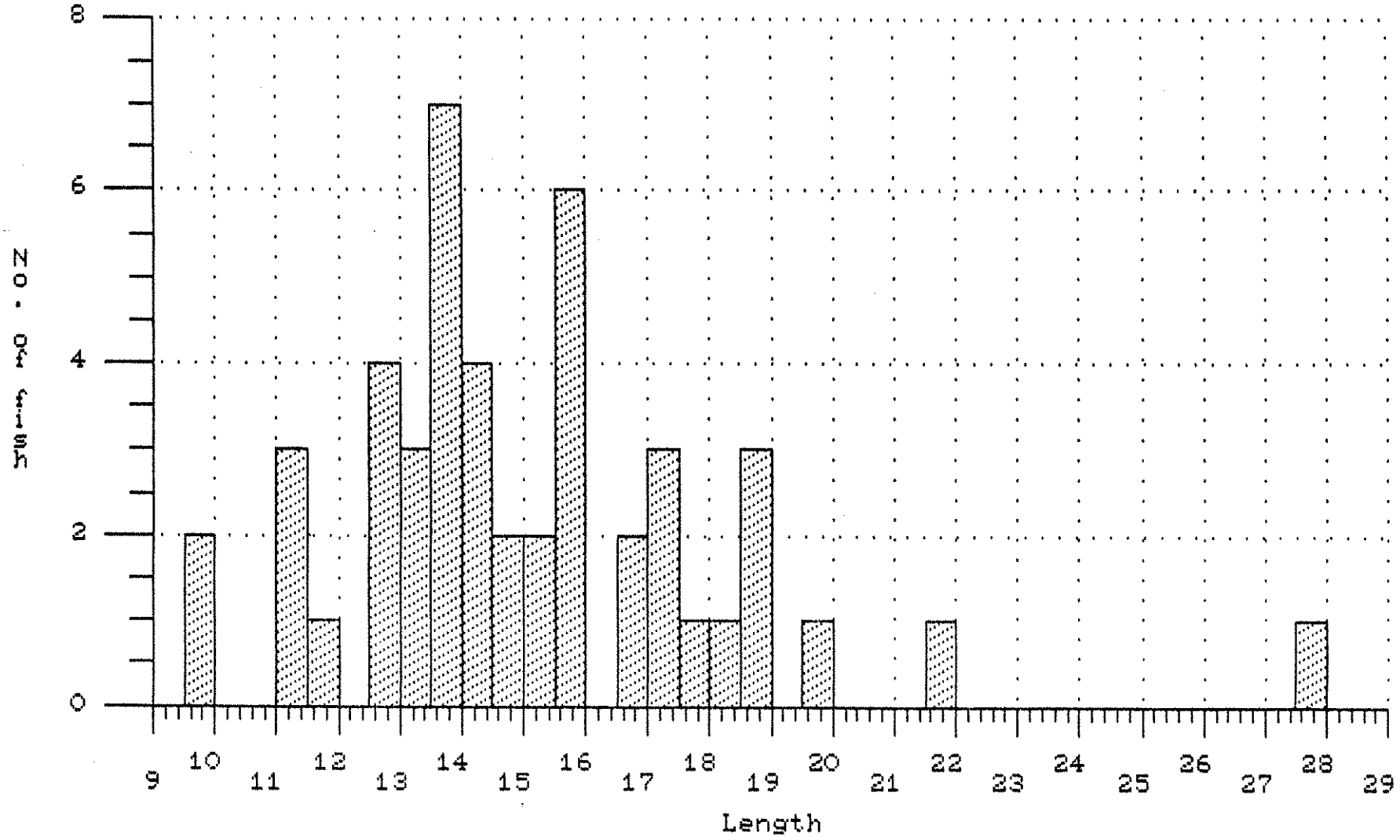

Figure 5. Length frequency diagram for brown trout caught by anglers on the Missouri River between Holter dam and Craig bridge, 1 May - 15 October, 1986.

Effects of Harvest on Trout Populations

Rainbow Trout

Length measurements of rainbows harvested in the Holter section revealed that 99.6% of creeled fish exceeded 8.0 inches (Figure 4). Consequently, the harvest of rainbows longer than eight inches was estimated to be 9,182 fish. Preliminary population data indicates that approximately 5,900 rainbow longer than 8.0 inches were present in the Holter section during fall 1986. Further analysis showed that about 30% of the population was comprised of 8-11 inch hatchery rainbow that were planted in Holter Reservoir in July 1986 and subsequently washed over or through the dam. These fish were identified by examination for fluorescent pigment marks that were applied prior to planting in the reservoir. Comparison of the harvest estimate (9,102 fish) with the fall population estimate (5,900 fish) suggests that 156% of the standing rainbow trout population in the Holter section was harvested. While at first glance this appears absurd, it is likely to be accurate. Preliminary results of creel census work being conducted in 1987 indicate that about 90% of the 10-13 inch rainbow trout being harvested in the Holter section are hatchery fish that emigrated from Holter Reservoir. Thus it is likely that a very substantial portion of the rainbow trout harvest in the Holter section consists of hatchery fish that steadily trickled over or through the dam throughout the fishing season. This phenomenon is being closely monitored and will be evaluated in more detail in next year's report.

Length data for rainbow trout harvested from the Craig section (Figure 4) reveals that 100% of these fish exceeded 10 inches. The fall 1986 population estimate indicated 15,177 rainbows longer than 10 inches present in the 5.6 mile Craig section. Hence, the estimated harvest of 2,253 rainbows longer than 10 inches amounted to approximately 15% of the standing population. Examination of harvest broken down into length groups shows that harvest of small fish (10-12 inches) was only 2.9% of the population but harvest of fish longer than 18 inches was 37.6%, which could be considered high (Table 20). Fredenberg (1985) found that an average angler harvest rate of 26.9% for age II+ and III+ rainbow accounted for 72% of total mortality in the Bighorn River.

Brown Trout

Pooled length frequency data for the Holter and Craig sections indicated that 95.8% of the fish harvested exceeded 10 inches (Figure 5). Conversion of harvest data from Table 19 results in estimated harvest of 218 and 368 brown trout longer than 10 inches in the Holter and Craig sections, respectively. Preliminary population data for brown trout in the Holter section indicates a spring 1986 population of 306 brown trout longer than 10 inches. Comparison of harvest (218 fish) with standing crop

Table 20. Rainbow trout harvest during the period May 1 through October 15, 1986 compared to fall, 1986 population estimates in the Craig section of the Missouri River.

Length Group	Estimated Harvest	Estimated Population Size	% Harvested
10 - 12"	142	4,917	2.9%
12 - 14"	536	2,668	20.1%
14 - 16"	962	4,559	21.1%
16 - 18"	489	2,803	17.4%
> 18"	124	330	37.6%
Total	2,253	15,277	14.7%

Table 21. Brown trout harvest during the period May 1 through October 15, 1986 compared to spring 1986 population estimates in the Craig section of the Missouri River.

Age Class	Estimated Harvest	Estimated Population size	% Harvested
II+	219	613	35.7%
III+	77	462	16.6%
IV+ and older	66	228	28.9%
Total	362	1,303	27.8%

(306 fish) indicates an extremely high brown trout harvest of 71% in the Holter section. This may in part explain why spring 1986 brown trout density in the Holter section was 40% lower than in the Craig section (136 per mile versus 224 per mile brown trout longer than 10 inches).

The percentage of the brown trout harvested in the Craig section was much lower than in the Holter section. Anglers harvested an estimated 368 brown trout longer than 10 inches compared to an estimated spring 1986 population of 1,253 fish in the entire section. Consequently, harvest amounted to approximately 29% of the population. Age determinations from scales collected from harvested brown trout pooled for both sections indicated that 6% were age I=, 57% age II+, 20% were age III+ and 17% were age IV+ and older. Harvest rates were highest for age II+ (35.7%) and age IV+ and older brown trout (28.9%; Table 21). Anglers on the Bighorn River harvested an estimated 18% of age II+ and 11% of age III brown trout during the period December 1982 through September 1983 (Fredenberg 1985).

MISSOURI RIVER TROUT POPULATIONS

Trout population estimates were made on two sections of the Missouri River during the spring of 1986 and on three sections in fall 1986. Population estimates were conducted in the Holter and Craig sections in the spring and fall to correspond with the fishing pressure and harvest survey being conducted there. It was hoped that spring and fall trout estimates in these sections could be compared with creel census results to determine the influence of angler harvest on summer mortality rates. However, it appears this may not be possible due to biases in population estimates that may be related to spawning movements of rainbow trout in the spring and brown trout in the fall. These estimates were conducted cooperatively with the Mid-Missouri Reservoir Study (Lere, 1987) to also examine the influence of hatchery rainbow trout emigrating from Holter Reservoir on the tailwater trout fishery. The Holter section was 2.25 miles long, beginning approximately 200 yards below Holter Dam and extending to the first downstream bridge, the Wolf Creek bridge. The Craig section was 5.59 miles long and was located between the Wolf Creek and Craig bridges.

The Cascade electrofishing section was inventoried in fall 1986 to determine if changes in trout populations had occurred since 1982 when it was last surveyed (Berg, 1983). Local anglers had expressed concern that development of a new fishing access (Pelican Point) during the spring and summer of 1986 in this "lower river" area would have a negative influence on trout populations through increased angler harvest. The Cascade section is 4.1 miles long and begins about 0.2 miles downstream from Halfbreed Rapids, which are located approximately 10.5 river

miles upstream from the town of Cascade. The new Pelican Point Fishing Access lies approximately midway on the Cascade electrofishing section.

Age analysis of nearly all trout scales collected since 1984 has been completed but will be presented in a subsequent report. Scale collections made during other studies (Berg, 1983) will also be examined to allow better evaluation of long term trout trends in the Craig and Cascade sections.

Fall rainbow trout densities in the Craig and Cascade electrofishing sections are presented in Table 22. Total rainbow trout population in the Craig section in fall 1986 was 4,255 fish six-inches and longer per mile, which was higher than in 1985 but lower than in 1984. Population levels in 1984-1986 were substantially higher than reported by Berg (1983) for the Craig section in 1982 (2,290 rainbows seven inches or greater per mile). Numbers of rainbows 18 inches and longer have ranged from 40 to 60 fish per mile during the 1984-1986 period (Table 22). These densities are substantially higher than was found in 1982 (eight fish per mile longer than 18 inches; Berg 1983). Increased density of larger rainbows in recent years may be in response to a change in the general trout fishing regulation for central Montana that took effect on May 1, 1983. The former limit of 10 pounds and one fish (or 10 fish) was replaced with a more restrictive limit of five fish including only one fish longer than 18 inches.

In fall 1986 there were 1,389 rainbow trout longer than six inches estimated per mile in the Cascade section (Table 22). This was similar to data for 1981 and 1982 when Berg (1983) estimated 1,343 and 1,268 rainbows longer than seven inches per mile respectively. The density of large rainbow in 1986 (39 fish per mile longer than 18 inches) was higher than observed in 1981 and 1982 (20 per mile and 7 per mile respectively, Berg 1983).

Spring population estimates are being used to evaluate brown trout population trends in the Missouri River because known spawning movements in September caused inaccuracies in fall estimates of mature brown trout. The spring 1986 brown trout population in the entire Craig section was estimated to be 1,310 fish ($\pm$ 86 fish; 80% CI) seven inches and longer. This equates to 234 brown trout seven inches and longer per mile, which is a larger population than has been seen in the past in other river sections. No previous spring estimates are available for the Craig section but Berg (1983) estimated 125-130 seven-inch and longer brown trout per mile in the Hardy section in spring estimates conducted between 1980 and 1982. He also estimated 121 browns per mile in the Cascade section in spring 1980. The Hardy section is located approximately midway between the Craig and Cascade sections. The spring 1986 Craig section brown trout population included 18 fish per mile longer than 18 inches. Berg (1983) estimated from 21 to 26 browns longer than 18 inches per

Table 22. Fall rainbow trout density (fish per mile) by length group in the Craig and Cascade electrofishing sections on the Missouri River. Eighty percent confidence intervals around total population estimates are in parenthesis.

Length Group	Craig Section			Cascade Section
	1984	1985	1986	1986
6 - 10"	2,068	924	1,524	255
10 - 12"	603	386	879	564
12 - 14"	924	800	477	114
14 - 16"	974	900	815	230
16 - 18"	720	422	501	187
≥ 18"	40	60	59	39
Total > 6"	5,329 (± 739)	3,492 (± 412)	4,255 (± 112)	1,389 (± 151)
Total >14"	1,734	1,382	1,375	456

mile in the Hardy section during spring estimates for the years 1980-1982. He estimated 40 brown trout longer than 18 inches per mile in the Cascade section in spring 1980. Brown trout age class estimates are currently being analyzed and will be presented in the next annual progress report.

SHEEP CREEK

Upstream and downstream fish traps were operated near the mouth of Sheep Creek between April 11 and May 4, 1986 and from March 7 through May 8, 1987. Sheep Creek is a small tributary stream draining into the Missouri River approximately 11 river miles upstream from the town of Cascade. Traps designed to catch fish migrating upstream were much more effective than traps set to capture post-spawners emigrating downstream. Periodic electrofishing of post-spawners accumulating immediately upstream of the upper trap was necessary. Length frequency diagrams for both years showed the majority of rainbow trout spawners moving upstream were 15 to 18 inches long (Figure 6). More smaller and larger fish were captured in 1987 which may be due to better sampling of the entire spawning run. The majority of the 10-13 inch fish captured in both years were precocious males, often referred to as "jacks".

A total of 699 rainbow trout spawners nine inches and longer were marked as they passed through the lower trap in 1986. A population estimate of 4,400 spawners was estimated based on 55 recaptures of post-spawners passing down through the upper trap. This estimate is somewhat innacurate because the entire duration of the spawning run was not sampled. The maximum number of spawners moving upstream in a single night was 207 fish on April 21, 1986. More than 80 fish moved upstream to spawn on five dates between April 11 and April 23, 1986.

A total of 1,139 rainbow trout spawners nine inches and longer were marked as they passed upstream through the lower trap in 1987. Of the 1,341 spawners handled while returning downstream, 426 were marked, indicating a spawning population of 3,555 fish. This estimate does not include mortality which occurs during spawning. Based on field observations of carcasses, this could approach 10-20% of the population. Recapture information on fish returning downstream indicated the traps were much less efficient than expected. Numerous fish (about 70% of the run) were able to navigate around, over, or through the trapping area without being captured. Much of this movement likely occurred during several freshets that caused temporary breaches in the trap leads. Daily catch informaation is not yet summarized and will appear in a later report.

Yellow tags were placed on 304 spawners as they emigrated from Sheep Creek in the spring of 1986. Voluntary tag returns revealed 19 of these fish were caught by anglers during 1986 and four have been caught by anglers to date in 1987. Thus,

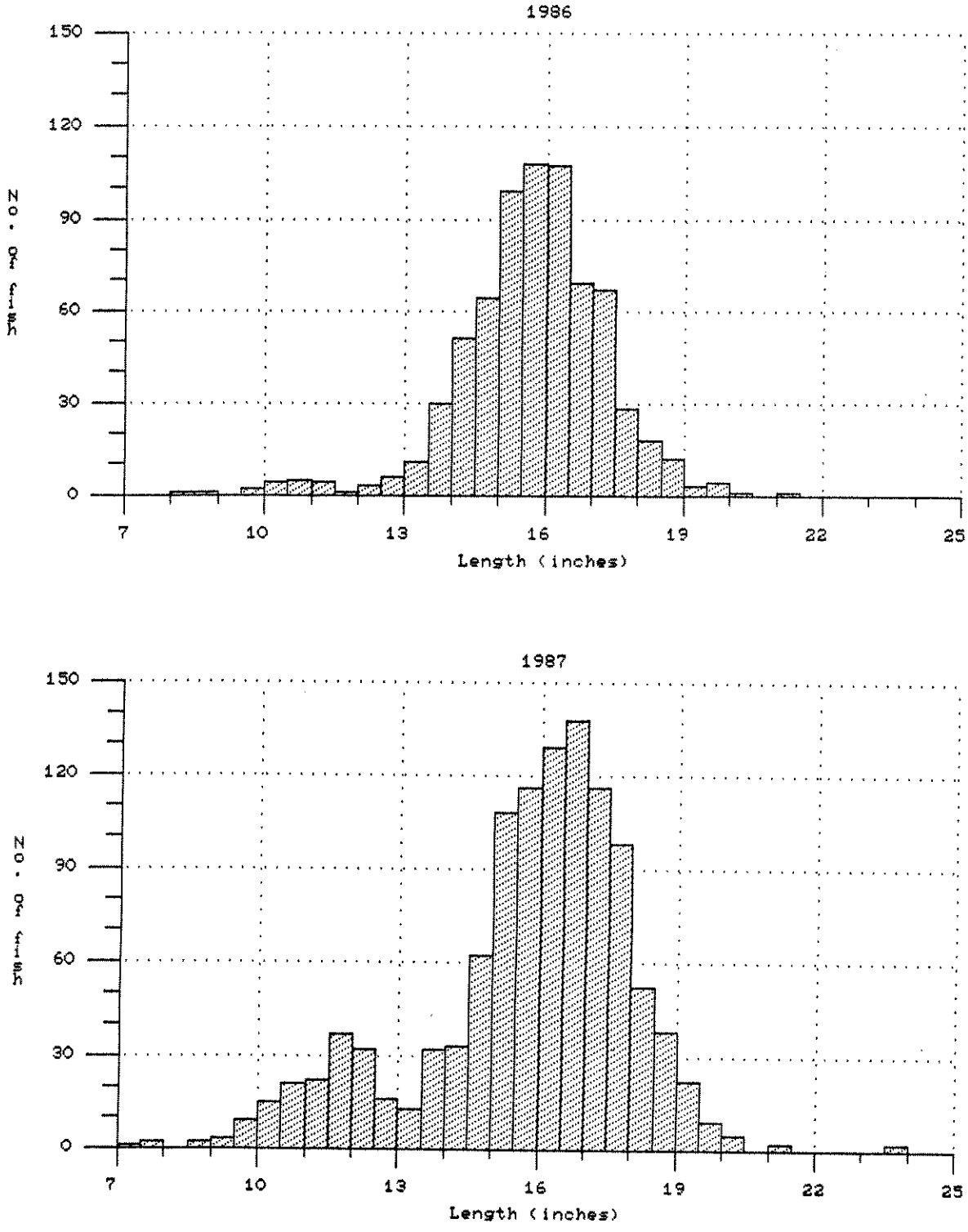

Figure 6. Length frequency of rainbow trout migrating upstream (caught in lower trap) on Sheep Creek during the spring of 1986 (upper graph) and 1987 (lower graph).

information to date indicates that at least 8% of the spawners have been harvested by anglers. Sixty-three of the spawners tagged in 1986 were recaptured in fish traps run in 1987, indicating that at least 21% of the annual spawning run is comprised of repeat spawners. Of the 23 angler tag returns from 1986 spawners, only three were caught in the Missouri River upstream from the mouth of Sheep Creek. All the remaining returns were from the river at the mouth of Sheep Creek (3 returns) or in the river downstream from the mouth of Sheep Creek (17 returns). Most of the returns (12 tags) from downstream areas were within 15 miles of Sheep Creek. However, three tagged fish were caught more than 50 miles downstream, in or near the city of Great Falls. The longest upstream movement of Sheep Creek spawners tagged in 1986 was only three miles.

A total of 374 rainbow post-spawners were tagged with green tags during spring 1987 as they emigrated from Sheep Creek to the Missouri River. To date, 17 of these (4.5%) have been returned by anglers during 1987. In contrast to 1986 results, nearly half of the returns from fish tagged in 1987 showed movements of from one to 11 miles upstream in the Missouri River from the mouth of Sheep Creek. Almost all of these fish were taken two to four miles upstream in the river from the mouth of Sheep Creek. Two green tags have been recovered from fish caught in or near Great Falls. The reasons behind the tendency towards upstream movement by 1987 fish are currently unclear.

RECOMMENDATIONS

1. Conduct field studies to identify and recommend minimum flow levels in selected streams that were surveyed during 1986 along the Rocky Mountain Front. Include these streams in the upcoming Missouri River Basin water reservation application to be filed by MDFWP.

2. Extend the special fishing regulation on the canyon section of the Smith River for two more years with modifications to allow children's bait fishing and reduce the upper size limit. Continue annual fall population estimates on three river sections to evaluate the effectiveness of the regulation.

3. Provide population estimates for 1986 by age group for Big Spring Creek and continue to monitor trout populations in two sections on a biennial basis to ensure that the quality fishery is maintained.

4. Attempt to implement a special fishing regulation in the Craig section of the Missouri River to reduce angler harvest of brown trout and consequently increase the brown trout population.

5. Conduct annual spring population estimates by electrofishing to monitor brown trout populations in two sections of the Missouri River and determine population response to any special fishing regulations.

6. Conduct annual fall population estimates by electrofishing on three sections of the Missouri River to monitor rainbow trout population levels and responses to special regulation, environmental conditions (primarily streamflows), and changes in fishing pressure. Use creel census and electrofishing to determine movements, influences on harvest, and influence on wild trout populations of hatchery rainbow trout emigrating from Holter Reservoir. Investigate the possibility of implementing special fishing regulations to control harvest of large (18 inches and longer) rainbow trout in the Craig section. Estimated harvest rates during 1986 of nearly 38% of the population were considered to be high.

7. Continue age analysis of current and past fish population data for Craig and Cascade sections of Missouri River to recognize population trends that may be occurring and identify causative agents.

8. Complete the analysis of 1986 and 1987 spring trapping data for rainbow trout spawning in Sheep Creek. Continue to monitor post-spawning movements via tag returns. Redirect spring trapping efforts to tributaries in the Dearborn River or Little Prickly Pear Creek drainages during 1988.

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Code Numbers of Waters Referred to in the Report Are:

14-1280	Deep Creek
14-1640	Dupuyer Creek
14-3360	McDonald Creek
14-3840	No. Fk. Dupuyer Creek
14-4920	Scoffin Creek
14-5000	Sheep Creek
14-5480	So. Fk. Dupuyer Creek
14-5760	Spring Creek
14-6720	Willow Creek
16-0310	Big Spring Creek, Sec. 02
17-4896	Missouri River, Sec. 09
17-6576	Sheep Creek
17-6832	Smith River, Sec. 02
20-0350	Barr Creek
20-2000	Elk Creek
20-2150	Ford Creek
20-5600	So. Fk. Sun River