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MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

FISHERIES DIVISON

JOB PROGRESS REPORT

State:	Montana	Title:	Southwestern Montana Fisheries Study
Project No.:	F-9-R-31/F-9-R-32	Title:	Investigation of the Influence of Clark Canyon Reservoir on the Stream Fishery of the Beaverhead River
Job No.:	II-a		

Project Period: July 1, 1982 through June 30, 1984

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ABSTRACT

Brown trout populations in the Hildreth section have remained relatively stable at high densities since 1980. Rainbow trout experienced good recruitment of Age I fish from a successful spawn in 1982 following several years of poor recruitment. Numbers of large rainbow trout attained their highest observed abundance following 1982-1983 winter flows that greatly exceeded minimum criteria for winter trout survival.

Gas bubble disease was observed for the first time in trout in the Beaverhead River. Data show 8.8 percent of the brown trout and 3 percent of the rainbow trout handled in the Hildreth section in fall 1983 exhibited gas bubble disease symptoms, primarily emphysema in the eyes. Saturometer readings below Clark Canyon Dam often approached or exceeded 120 percent.

While brown trout in the Pipe Organ section maintained high densities, most of the fish population was composed of Age II fish. Numbers of larger (Age IV+) brown trout have declined markedly despite good recruitment.

BACKGROUND

Effects of flow releases from Clark Canyon Reservoir on trout populations in the Beaverhead River have been monitored by the Montana Department of Fish, Wildlife and Parks since 1966. These studies show the Beaverhead supports excellent populations of trophy (over 5 lbs) rainbow and brown trout in its upper tailwater reaches. Nelson (1978) demonstrated non-irrigation season (October

16th to April 15th) flows of less than 250 cfs adversly affected numbers of trophy trout. The study further demonstrated extreme flow fluctuations during brown and rainbow trout spawning seasons severely restricted recruitment into the populations of both species.

Trout populations in the Hildreth section of the Beaverhead River were depressed prior to 1974. Changes in the operation of Clark Canyon Dam, resulting in more favorable winter and spawning period flow regimes, resulted in dramatic increases in rainbow trout abundance between 1974 and 1977, and brown trout numbers between 1975 and 1977 (Wells 1981). Brown trout populations remained relatively stable at high levels between 1977 and 1980, while rainbow trout populations have fluctuated with poor recruitment over the same period (McMullin 1982). Growth rates of both species and numbers of trophy trout have declined with increased numbers since 1974; however, total trout biomass has increased markedly (Wells 179). The Hildreth section was not sampled in 1981 and 1982 due to landowner conflicts. Sampling was resumed in 1983.

Trout populations in the Pipe Organ section (5.7 miles below Clark Canyon Dam) were monitored between 1967 and 1976. Sampling was resumed in the Pipe Organ section in the spring of 1981. Trout populations in the Pipe Organ section have exhibited a response to critical flow management similar to populations in the Hildreth section (McMullin 1982). While recent data indicate marked increases in both brown and rainbow trout lnumbers over pre-1974 levels, numbers of larger fish (Age IV+), especially brown trout, have declined. The Beaverhead River downstream from the beginning of the Pipe Organ section is open to year-round angling, while the reaches upstream from Pipe Organ bridge are closed to fishing from December 1st to mid-May.

OBJECTIVES AND DEGREE OF ATTAINMENT

1. To determine trout populations in two study sections of the Beaverhead River. Data are presented.

2. To evaluate the effect of flow releases from Clark Canyon Dam on trout populations. Data are presented.

3. To evaluate the effects of population density on trout growth. This objective was not met because of time constraints involved with age analysis. Data will be presented in the next report.

PROCEDURES

Trout populations were sampled by using boat-mounted mobile anode electrofishing equipment. Standing crop, number by length group and age group estimates were calculated using methods described by Vincent (1971 and 1974) and adapted for computer analysis (Holton, et al 1981). Fish were aged using the scale method. Discharges were measured at the USGS gage near Grant, MT. Gas saturations were measured using a Weiss saturometer.

FINDINGS

Hildreth Section

Brown Trout

Estimated numbers, standing crops and mean length and weight are given for age groups of brown trout in the Hildreth section, spring and fall of 1983, in Table 1. Spring brown trout numbers have remained stable at high levels of abundance in the interim between 1980 and 1983. Difficulty in gaining a reliable spring estimate of Age I brown trout due to their small size requires comparisons of Age II and older fish on a year-to-year basis. Comparing the 1983 spring estimate with past estimates (Table 2) indicates the stability of the brown trout population of the Hildreth section since 1977. A slight (3%) difference in total Age II+ numbers of brown trout between 1980 and 1983 is probably reflective of stable peak spawning period (Oct. 15th-Nov. 15th) flows in 1980 and 1981. Wells (1980) demonstrated stable flows during the peak spawning period were critical for good brown trout recruitment. Spawning period flows in 1980 were relatively high (237 to 420 cfs) and gradually increased through the period, while flows in 1981 were lower (116 to 146 cfs) but very stable (USGS data). A 28 percent decline in the number of Age IV+ brown trout between 1980 and 1983 was unexpected because of the large population of Age II brown trout present in 1980. The decline in numbers of these larger trout may be due to furunculosis mortality (Wells 1980) and low winter flows during the 1981-1982 non-irrigation season (Nelson 1978) in addition to fishing harvest.

Fall brown trout estimates are generally not reliable due to spawning movements. The fall 1983 estimate for Age I brown trout, however, is probably reliable because populations of these immature fish tend to remain stable during spawning. The estimate of 707 Age I brown trout in 1983 is indicative of good recruitment from the 1981 spawn and may result in continued high brown trout populations in succeeding years.

Rainbow Trout

Rainbow trout populations fluctuated with poor recruitment between 1977 and 1980. The fall 1980 sample was dominated by Age III rainbow trout from the 1977 spawn, while 1978 and 1979 were marked by poor reproductive success. Estimated numbers and standing crops of rainbow trout are given for spring and fall of 1983 in Table 3.

As opposed to 1980, when rainbow trout biomass was dominated by Age III fish from the 1977 spawn, the fall 1983 standing crop was dominated by Age IV+ fish. The Age IV and older group probably still contains fish (Age VI) from this good reproductive year. Numbers of Age I rainbow trout were relatively high in 1983 and would place about midway between the high reproductive year of 1977 and low reproductive years of 1978 and 1979 (Table 4). Very low numbers of Age II fish present in fall 1983 may be indicative of poor reproduction again in 1981.

Flow fluctuations during the peak rainbow trout spawning period (March 1st through March 31st) have been identified as a major factor in limiting rainbow trout reproduction in the Beaverhead River prior to 1974. The relatively good reproductive year of 1982 was marked by stable flows (191 to 216 cfs) during the peak rainbow trout spawning period; however, 1978 (152 to 157 cfs), 1979 (185 to 192 cfs), and 1981 (171 to 202 cfs) also experienced very stable flows during the period. It is probable some other factor(s)--such as competition with large numbers of brown trout or flow regime while rainbow trout eggs or fry are in the gravels--has been limiting rainbow trout reproduction in recent years.

The fishery of the Beaverhead River has been considered a trophy fishery because of the good opportunity to catch trout in excess of five pounds. Wells (1980) demonstrated this opportunity has diminished due to reduced growth rates of brown trout associated with increassed density, and winter mortality of large rainbow trout resulting from low winter flow releases. Table 5 presents data on the numbers of rainbow trout in excess of five pounds captured per electrofishing sample trip in the Hildreth section between 1966 and 1983.

The data suggest there were more five pound and larger rainbow trout in the Hildreth section in fall of 1983 than in any year of record, except 1973, prior to the high fish densities of recent years. Nelson (1978) suggested non-irrigation season (October 16th - April 15th) flows of less than 250 cfs had adverse effects on the survival of Age IV+ rainbow trout in the Beaverhead River. Wells (1980) found average daily flows in excess of 300 cfs during the non-irrigation period resulted in minimal mortality of these larger rainbow trout. Average daily flow (ADF) during the non-irrigation period and number of days when flow was less than 250 cfs are presented for the 1980-1983 period in Table 6. The non-irrigation season of 1980-1981 was marked by good flows averaging in excess of 250 cfs through January, but the February to April period averaged below 250 cfs and had 69 days of flows less than 250 cfs. The 1981-1982 non-irrigation season was marked by flows of less than 250 cfs on every day of the period. Unfortunately, the Hildreth section was not electrofished in 1981 or 1982 to determine the effects on Age IV+ rainbow trout survival. The winter of 1982-1983 was marked by excellent flows for rainbow trout survival. ADF was in excess of 300 cfs in every month of the period while flow dropped below 250 cfs on only 10 days of the 181-day period. These high winter flows were followed by the highest fall numbers of Age IV+ rainbow trout ever recorded in the Hildreth section and the most five pound and larger rainbow trout captured since 1973. The ADF for the 1982-1983 non-irrigation period of 386 cfs was the highest winter ADF since the 1971-1972 period (Wells 1980).

Gas Supersaturation

During fall, 1983 electrofishing sample in the Hildreth section, gas bubble disease symptoms were observed in both brown and rainbow trout. These symptoms had not been observed in any prior sample (1966-1980) and were unexpected due to the fact that Clark Canyon Reservoir is discharged into the Beaverhead River via bottom-draw tunnels. Gas supersaturation generally occurs through gas entrapment over spillways or through extreme photosynthetic activity during dense algal blooms in euphotic zones (USEPA 1976). Disease symptoms in the Beaverhead River were most prevalantly manifest as emphysema (external gas bubbles) in the eyes and, to a lesser extent, on the opercles and fins. No acute mortality due to capillary emboli was observed; however, some unobserved mortality may have occurred.

Gas bubble disease symptoms were most frequently observed in the more abundant brown trout (8.8% affected) while symptoms were observed less frequently in rainbow trout (3% affected). Gas bubble disease symptoms were most prevalent in larger (13 in.+) brown trout, particularly the 13- through 16-inch fish (Table 7).

After gas bubble disease symptoms were observed in Beaverhead River fish, a series of total dissolved gas measurements were undertaken at sites in the upper river at different flow releases from the dam (Table 8). Gas saturations below Clark Canyon Dam remained at or above 110% on all but one of the sample dates. Samples in the fall and winter indicated flows of 700 cfs produced saturations of 119%, while lower flows (350-475 cfs) resulted in saturations of 110-112%. Samples from early spring 1984, however, revealed flows ranging between 675 and 1500 cfs resulted in saturations near 110% below the dam. The period between June 6 and July 14, 1984 was marked by flow releases over the dam spillway, the first time in the 20-year history of Clark Canyon Dam that spillway flow occurred. Saturations during this period were always in excess of 120%.

Gas saturation generally dissipated as flow moved downstream. Saturation levels generally dropped 1 to 4% by the Hildreth section (1.8 miles downstream), 1 to 10% at Pipe Organ Bridge (5.7 miles downstream). No gas bubble disease symptoms were observed in the Pipe Organ section. Elevations in gas saturation at the Hildreth section over levels recorded at the dam occurred while Clark Canyon Creek, which enters the river at the sample site, was at floodstage on May 7, 16 and 22, and discharging heavy sediment loads into the river. Gas saturations at or above 120% at the dam resulted in saturations of 115-121% at the Hildreth section.

More information is apparently required on lethal and chronic effects of gas supersaturation on salmonids. While gas saturations of 120% (Dawley and Ebel 1975) and as low as 115% (Bouck et al 1975) have been found to be acutely lethal to salmonids, no acute fish kills were observed on the Beaverhead River. Saturations of 110% have produced emphysema in most species of salmonids (Bouck et al 1975). Gas saturation levels have been found to decrease about 10% for each meter of depth increase. It is possible avoidance of high saturations in deep water by Beaverhead River trout has served to mitigate effects of gas supersaturation.

Pipe Organ Section

Brown Trout

Estimated numbers, standing crop and mean lengths and weights by age group are presented for brown trout in the Pipe Organ section in the spring of 1983 in Table 9. Brown trout numbers suffered an overall 18% decline from 1982 levels but remained substantially higher than numbers observed during the 1970s (Table 10). While recent (1981-1983) brown trout abundance has been high in the Pipe Organ section, numbers of larger brown trout, especially Age IV+ have declined dramatically. Most of the numerical gains can be accounted for by Age II fish. While strong classes of Age II brown trout appeared in 1981 and 1982, no concommittent increase in numbers of Age III and Age IV+ fish were observed in 1983.

Brown trout standing crop has also shifted toward younger fish (Age II) in recent years in the Pipe Organ section (Table 11). During the 1970s, biomass of age II brown trout accounted for 6 to 33 percent of the total brown trout biomass. Since 1981, Age II brown trout have accounted for about 50 percent of the total, while Age IV+ brown trout have declined to 5 to 17 percent from a 1972 high of 51 percent of the brown trout standing crop. The decrease in the numbers of larger brown trout may be related to fisherman harvest associated with regulations allowing year-round angling downstream from Pipe Organ Bridge.

Rainbow Trout

Rainbow trout populations in the Pipe Organ section have folowed a trend similar to that of the brown trout--expanding to levels of abundance much higher than those of the 1970s. Estimated fall numbers and standing crops of rainbow trout in the Pipe Organ section are given in Table 12 for 1982 and 1983.

Numbers of rainbow trout in 1982 were quite similar to the estimated 1015 observed in 1981 (McMullin 1982). Stronger year classes of Age II and III rainbow trout in 1982 were offset by a 59 percent decline in numbers of Age IV+ rainbows from 1981 levels. The 1983 rainbow estimate was of questionable reliability due to an inability to complete enough recapture samples as a result of high flows in the river. The 1983 estimate, however, reflects a strong class of Age I rainbow trout resulting from a successful reproductive year in 1982. This same trend was observed in the Hildreth section upstream.

DISCUSSION

Brown trout numbers in the Hildreth section remained quite stable at high population levels between 1980 and 1983. Numbers of Age IV+ brown trout have declined over the same period. This decline may be a result of several factors including mortality associated with low (<250 cfs) overwinter flows in 1981-1982, furunculosis infections (Wells 1980), fisherman harvest, and mortality resulting from high gas supersaturations.

Rainbow trout populations in the Hildreth section supported the highest numbers of Age IV+ fish for the period of study (1966-1983) and produced the most "trophy" sized fish (≥5.0 lbs) handled during sampling runs since 1973. This abundance of large rainbow trout is reflective of excellent recruitment from the 1977 spawn and follows the 1982-1983 winter flow regime in which average daily flow exceeded 300 cfs for the first season since 1972-1973. Wells (1980) found winter flows in excess of 300 cfs resulted in minimum mortality of large rainbow trout. The 1982 rainbow trout spawning season appeared to be relatively successful resulting in an abundance of Age I fish in 1983. Rainbow trout recruitment has suffered poor years since 1977 (McMullin 1982).

Gas bubble disease, primarily manifest as eye emphysema in brown trout, was discovered for the first time in fall, 1983 in the Hildreth section. While saturations in excess of 120% have been measured, no acute mortality has been observed. It is possible fish in the Beaverhead River avoid lethal effects by moving to depths great enough to lessen the percent saturation (USEPA 1976). Reasons for the gas supersaturation problem are not fully understood at this time because Clark Canyon Reservoir has a bottom-draw outlet. Fall releases of 700 cfs produced saturations of 119% which dropped as flow release dropped. Similar release regimes in spring did not produce such high saturations. Spillway overflow resulted in saturations which exceded 120%; however, air entrapment over the spillway can explain this occurrence. Continued monitoring of symptoms in fish and gas saturations should result in more information on which to base an explanation.

Trout populations in the Pipe Organ section have increased dramatically over levels present in the 1970s. While brown trout numbers increased markedly, numbers of large fish (Age IV+) have declined. Since large numbers of Age II brown trout were present in 1981, 1982 and 1983, recruitment does not appear to be a problem. Fishing regulations, which allow year-round angling in the Pipe Organ section, may be responsible for the depressed numbers of larger fish through selective harvest. Further study in a comparable section closed to winter angling could provide more information on the problem.

Rainbow trout populations in the Pipe Organ section appeared to have good spawning success in 1982. As was observed in the Hildreth section, good spawning flows were available in 1982 but good spawning flows were also available in other recent years which exhibited poor spawning success. Further study may reveal other factors limiting rainbow trout spawning success in the Beaverhead River.

RECOMMENDATIONS

This project should continue. Further investigations into brown and rainbow trout population dynamics, rainbow trout recruitment, effects of flows on trout mortality and recruitment and effects of gas supersaturation should be studied in the Hildreth section. Brown trout population dynamics and age structure and rainbow trout recruitment should be studied in the Pipe Organ section. A third section, comparable to the Pipe Organ section but upstream in the rach closed to winter fishing, should be added to assess effects of year-round angling on larger brown and rainbow trout.

LITERATURE CITED

Bouck, G.R. et al. 1975. Mortality, salt water adaptation and reproduction of fish exposed to gas supersaturated water. USEPA, Western Fish Tox. Sta., Corvallis, Oregon.

Dawley, E.M. and W.J. Ebel. 1975. Effects of various concentrations of dissolved atmospheric gas on juvenile chinook salmon, Oncorhyncus tshawytscha, and steelhead trout. Fish Bull.

Holton, G.D., R. Vincent, R.C. McFarland and B. Gooch. 1981. A computer system to compile fish population statistics. Montana Dept. of Fish, Wildlife and Parks, Helena, MT. 20 pp.

McMullin, S.L. 1982. Investigation of the influence of Clark Canyon Reservoir on the stream fishery of the Beaverhead River. Montana Dept. of Fish, Wildlife and Parks, Job progress report, Project No. F-9-R-30, Job No. II-a. 10 pp.

Nelson, F.A. 1978. Beaverhead River and Clark Canyon Reservoir fishery study. Montana Dept. of Fish and Game, Contr. No. 14-06-600-8790.

United States Environmental Protection Agency. 1976. Quality criteria for water. Washington D.C., EPA 440/9-76-023. 501 pp.

Vincent, E.R. 1971. River electrofishing and fish population estimates. Prog. Fish. Cult. 33:163-169.

____________. 1974. Addendum to river electrofishing and fish population estimates. Prog. Fish Cult. 36:182.

Wells, J.D. 1979. Investigation of the influence of Clark Canyon Reservoir on the stream fishery of the Beaverhead River. Montana Dept. of Fish and Game. Job prog. report, Proj. No. F-9-R-27, Job I-d.

__________. 1981. Investigation of the influence of Clark Canyon Reservoir on the stream fishery of the Beaverhead River. Montana Dept. of Fish and Game, Job prog. report, Proj. No. F-9-R-28, Job No. II-a. 10 pp.

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TABLES

Table 1. Estimated number, standing crop and mean length and weight of brown trout by age group in the Hildreth section (6250 ft) of the Beaverhead River in 1983 (standard deviations [80% confidence interval] are in parentheses).

Age Group	Mean Length (in.)	Mean Weight (lbs)	Number	Number Mile	Biomass (lbs)	Bio.(lbs) Per Mile
			April 1983			
I	6.8	0.14	36	31	5	4
II	12.5	0.78	668	566	524	444
III	16.5	1.70	528	447	899	762
IV+	19.7	2.82	361	306	1016	861
			1592 (±281)	1350	2444 (±261)	2071
			October 1983			
I	10.8	0.54	707	599	380	322
II	16.2	1.73	680	576	1174	995
III	18.9	2.78	534	453	1484	1258
IV+	21.1	3.63	183	155	663	562
			2104 (±244)	1783	3701 (±397)	3137

Table 2. Estimated spring number and biomass of Age II and older brown trout in the Hildreth section of the Beaverhead River, 1974-1983.

Year	Age Group II	Age Group III	Age Group IV+	Total No.	Total Biomass (lbs)
1974	32	90	195	317	846
1975	467	61	142	670	1030
1976	624	420	139	1183	1681
1977	864	410	475	1752	2624
1978	565	791	338	1694	2536
1979	329	536	442	1307	2213
1980	733	370	504	1607	2531
1981	--	--	--	--	--
1982	--	--	--	--	--
1983	668	528	361	1557	2439

Table 3. Estimated numbers, standing crop and mean length and weight of rainbow trout by age group in the Hildreth section (6250 ft) of the Beaverhead River in 1983 (standard deviations [80% confidence interval] are in parentheses).

Age Group	Mean Length (in.)	Mean Weight (lbs)	Number	Number Per Mile	Biomass (lbs)	Bio.(lbs) Per Mile
			April 1983			
I	6.7	0.15	56	47	8	7
II	13.3	1.06	263	223	279	236
III	17.7	2.38	263	223	626	531
IV+	20.6	3.61	501	425	1809	1533
			1084 (±150)	918	2722 (±380)	2307
			October 1983			
I	10.8	0.60	560	475	336	285
II	16.1	1.94	98	83	191	162
III	18.7	2.90	124	105	359	304
IV+	21.3	4.39	150	127	658	558
			932 (±167)	790	1544 (± 250)	1309

Table 4. Estimated fall numbers and biomass of rainbow trout in the Hildreth section of the Beaverhead River by age group, 1974-1983.

Year	Age Group I	II	III	IV	Total Number	Total Biomass (lbs)
1974	997	143	55	15	1210	1857
1975	796	281	26	4	1107	1504
1976	--	--	--	--	--	--
1977	274	241	159	26	700	1477
1978	895	224	156	63	1338	1727
1979	290	462	74	39	865	1500
1980	301	204	429	117	1051	2665
1981	--	--	--	--	--	--
1982	--	--	--	--	--	--
1983	560	98	124	150	932	1544

Table 5. Numbers of rainbow trout $\geq$ 5.0 lbs captured per electrofishing trip in the Hildreth section of the Beaverhead River, 1966-1983 during fall sampling periods.

Year	No. Caught	No. Trips	No. Per Trip	Year	No. Caught	No. Trips	No. Per Trip
1966	3	2	1.5	1975	1	4	0.3
1967	2	2	1.0	1976	--	--	--
1968	11	3	3.7	1977	7	4	1.8
1969	5	3	1.7	1978	6	4	1.5
1970	8	4	2.0	1979	5	4	1.3
1971	11	4	2.8	1980	10	4	2.5
1972	9	4	2.3	1981	--	--	--
1973	16	3	5.3	1982	--	--	--
1974	13	3	4.3	1983	21	4	5.3

Table 6. Average daily flow (ADF) and number of days per month that flow was less than 250 cfs (parentheses) for the non-irrigation period (Oct. 16th-April 15th) 1980-1983 (measured at the USGS gage near Grant, Montana).

Time Period	Month						
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1980-81	289 (15)	384 (2)	312 (0)	262 (0)	211 (23)	188 (31)	183 (15)
1981-82	140 (15)	144 (30)	168 (31)	196 (31)	228 (28)	196 (31)	227 (15)
1982-83	402 (1)	334 (0)	344 (0)	359 (0)	373 (0)	446 (5)	446 (4)

Table 7. Numbers and percentages by inch group of brown trout exhibiting symptoms (primarily eye emphysema) of gas bubble disease in the Hildreth section of the Beaverhead River, October 13, 14, 26 and 27, 1983.

Inch Group	Affected/Handled	Percent Affected
7.0 - 7.9	0/6	0
8.0 - 8.9	0/11	0
9.0 - 9.9	2/38	5
10.0 - 10.9	2/54	4
11.0 - 11.9	1/48	2
12.0 - 12.9	0/18	0
13.0 - 13.9	3/21	14
14.0 - 14.9	5/36	14
15.0 - 15.9	8/71	11
16.0 - 16.9	15/91	16
17.0 - 17.9	9/103	9
18.0 - 18.9	12/100	12
19.0 - 19.9	5/81	6
20.0+	9/99	10
Total	68/777	8.8%

Table 8. Total dissolved gas saturation readings at different flow releases at stations on the upper Beaverhead River, 1983-1984 (water temperature in °F in parentheses).

Date and Discharge (cfs)[1]		% Saturation Clark Canyon	% Saturation, Hildreth Section (1.8 mi.)	% Saturation at Henneberry Access (4.2 mi.)	% Saturation at Pipe Organ (5.7 mi.)
10/26/84	350 cfs	111% (45°)	--	--	--
11/16/83	700	119 (41°)	115% (42°)	109% (44°)	--
12/08/83	700	119 (40°)	115 (41°)	--	109% (43°)
01/03/84	425	110 (37°)	108 (36°)	--	--
01/09/84	475	112 (37°)	--	--	--
05/07/84	675	112 (44°)	116 (45°)	111 (45°)	--
05/16/84	725	110 (48°)	114 (45°)	109 (47°)	--
05/22/84	950	107 (49°)	118 (49°)	115 (50°)	--
06/04/84	1500	110 (53°)	110 (53°)	--	--
06/06/84	1500	120 (53°)	117 (53°)	--	--
06/07/84	1550	129 (51°)	--	--	--
06/12/84	1550	124 (53°)	121 (53°)	--	113 (56°)
06/15/84	1750	120 (56°)	119 (56°)	--	111 (56°)
06/19/84	1875	121 (59°)	119 (56°)	--	105 (57°)
07/19/84	2150	110 (56°)	--	--	--

1 Release at Clark Canyon Dam.

Table 9. Estimated numbers, standing crop and mean length and weight of brown trout by age group in the Pipe Organ section (13125 feet) of the Beaverhead River in April, 1983 (standard deviations [80% confidence interval] in parentheses).

Age Group	Mean Length (in.)	Mean Weight (lbs)	Number	Biomass (lbs)
II	12.6	0.78	1719	1394
III	15.9	1.40	829	1160
IV+	19.3	2.30	53	121
			2673 (±400)	2675 (±362)

Table 10. Estimated spring numbers per mile of Age II and older brown trout in the Pipe Organ section of the Beaverhead River, 1968-1983 (section length varied between 8513 and 14,162 feet).

Year	Age Group II	Age Group III	Age Group IV+	Total
1968	269	127	90	507
1970	338	285	21	644
1971	169	391	169	729
1972	380	227	269	876
1974	63	232	153	449
1976	491	459 (III+)	--	950
1981	792	306	90	1188
1982	824	422	63	1309
1983	719	333	21	1073

Table 11. Percentage of brown trout standing crop (biomass) accounted for by age group in the Pipe Organ section of the Beaverhead River, 1970-1983.

Year	Age II % Of Total Biomass	Age III % Of Total Biomass	Age IV+ % Of Total Biomass
1970	33	59	7
1971	14	54	32
1972	22	27	51
1974	6	47	46
1976	31	69 (III+)	--
1981	50	34	17
1982	45	43	11
1983	52	43	5

Table 12. Estimated numbers, standing crop and mean length and weight of rainbow trout by age group in the Pipe Organ section of the Beaverhead River in fall, 1982 and 1983 (standard deviation [80% confidence interval] in parentheses).

Age Group	Mean Length (in.)	Mean Weight (lbs)	Number	Biomass (lbs)
		October 1982		
I	11.8	0.71	256	181
II	16.0	1.75	482	844
III	18.4	2.62	174	454
IV+	20.6	3.51	37	130
			949 (±249)	1608 (±380)
		October 1983		
I	10.8	0.54	968	526
II	15.9	1.74	743	1291
III	18.2	2.55	264	674
IV+	18.9	2.91	90	261
			2065 (±1027)	2752 (±1396)