MONTANA DEPARTMENT OF FISH AND GAME

FISHERIES DIVISION

JOB PROGRESS REPORT

State: Montana

Project No.: F-9-R-22 Title: Southwestern Montana Fisheries Study

Job No.: I-b Title: Inventory of Waters of the Project Area

Project Period: July 1, 1973-June 30, 1974

Report Period: January 1, 1973-January 31, 1974

ABSTRACT

Brown and rainbow trout populations in the Reichle Section of the Big Hole River were investigated. Comparisons of this section's brown trout populations before and after the 1972 flood (31 year frequency) were made.

A mountain whitefish population estimate for one mile of the Fishtrap Section, Big Hole River, was made.

The magnitudes of man-made streambank and channel alterations were determined for sections of the Big Hole, Jefferson and Ruby Rivers.

Trout populations were investigated in three adjacent sections of the Ruby River. The sections included a mostly bulldozed section, a mostly natural section and a mostly blanket rock riprapped section. Population decreases in the two altered sections were related to degrees and/or types of natural habitat destruction.

Staff gage measurements were recorded and flows measured in Poindexter Slough.

The populations of 15 high mountain lakes in the Big Hole Drainage were investigated with gill nets. Additional data on water quality, depth, surface-bottom temperatures, and spawning conditions of each lake were collected.

BACKGROUND

With annually increasing fishing pressures and increasing destruction of game fish habitat, the importance of comprehensive fisheries management is paramount. Comprehensive fisheries management can only result from decisions based on data collected in a scientific manner. Comprehensive inventories of the project area is the best way to furnish data to the fisheries manager for aid in his management decisions. In addition, inventories provide needed information for more properly placing values upon our fisheries and outdoor recreation resources.

OBJECTIVES

The purpose of this project was to determine basic parameters in the project

area to aid management decisions and furnish baseline information on resource values for aid in more adequately dealing with land and water development projects.

PROCEDURES

Electrofishing gear with an output of 0-500 volts variable D.C. was utilized in censusing stream populations. The gear was fished from a fiberglas boat with a mobile positive electrode and a stationary negative electrode attached to the bottom of the boat. The captured fish were anesthetized, measured, marked and released near their capture site.

Population estimates were computed using five computer programs and calculations were made using modifications of River Electrofishing and Fish Population Estimates (Vincent, 1971).

A 2-man survey team floated the 78.1 miles of study sections on the Big Hole, Jefferson and Ruby Rivers to determine length, type and other related information of streambank and channel alterations. Data were recorded on survey forms and boundaries of each alteration were marked on enlarged (1" = 250') 1973 aerial photos during field investigations. Length of each alteration was determined with a map measure from 1973 photos in the field office.

Current velocities were calculated with a Gurley current meter at 0.4 of the observed depth at one foot intervals along a cross-sectional transect.

Experimental gill nets 125 feet long with graduated mesh sizes were used to sample lake populations. Lake depths were recorded with a Fathometer Depth Sounder-Recorder, Raytheon Marine Products, Model DE-725 C. Temperatures were measured with a hydrographic thermometer.

FINDINGS

Big Hole River

Reichle Section - The Reichle Section was established in 1971, to obtain base-line information of trout populations immediately downstream from the site of the proposed Reichle Dam. The section begins one and one-half miles downstream from the Reichle site and is four and one-half miles in length.

The estimated number of brown trout during the period samples, March 27-April 6, was 113.2 per 1,000 feet (Table 1). The estimated total pounds of brown trout per 1,000 feet was 126.0 (Table 1).

Figure 1 shows the comparison of brown trout numbers and pounds per 1,000 feet during spring and fall sampling 1971-1973. At the 80 percent confidence level, the numbers and pounds of brown trout do not appear to vary significantly before and after the 1972 flood. The mean condition factors of the brown trout population, during comparative seasons, were higher after than before the 1972 flood in this section.

The peak flows during the flood, as measured at the U.S. Geological Survey gaging station at Melrose, was 14,300 c.f.s. The frequency of this peak was calculated to be 31 years.

TABLE 1. Wild brown and rainbow trout population estimates per 1,000 feet and condition factors for the Reichle Section (4½ miles) of the Big Hole River, March-April, 1973. (80% confidence intervals in parentheses).

Species of Trout	Length Interval (Inches)	Estimated Numbers/ 1000 feet	Estimated Pounds/ 1000 feet	Condition Factor
Brown	6.7-12.2	38.4 (±17.8)	14.6 (±6.8)	34.97 (±5.11)
	12.3-15.1	28.4 (±8.2)	28.8 (±8.3	36.38 (±3.96)
	15.2-18.4	39.7 (±12.3)	65.5 (±20.3)	34.92 (±3.63)
	18.5-24.0	6.7 (±2.4)	17.1 (±6.1)	33.58 (±3.03)
Totals or Average		113.2 (±23.3)	126.0 (±23.7)	35.24 (±4.20)
Rainbow	7.9-17.2	16.7 (±9.0)	11.2 (±6.0)	36.04 (±4.58)

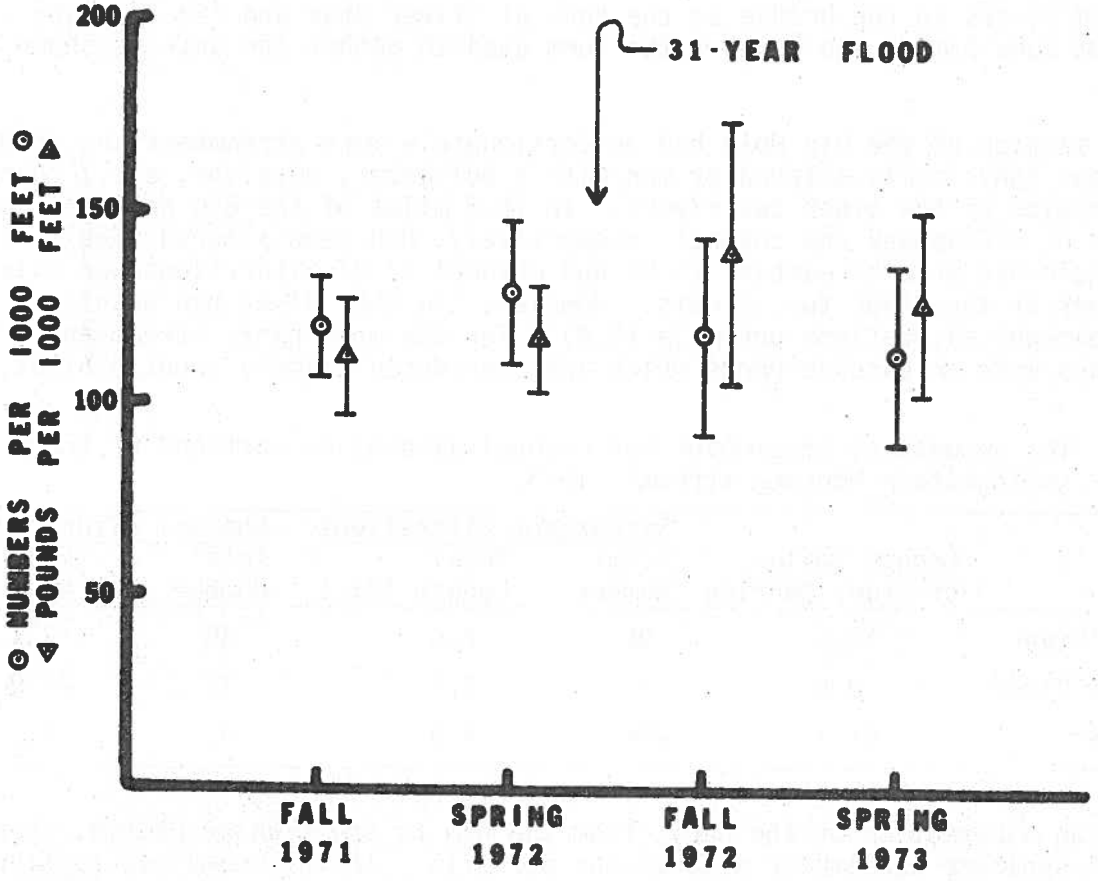

FIGURE 1. Brown trout point estimates and 80% confidence intervals per 1000 feet in the Reichle Section of the Big Hole River, Fall, 1971-Spring, 1973.

Brown trout length group intervals (Table 1) were based on length frequency distribution analyses. Numerous "check marks" made accurate age determinations from trout scales difficult to impossible.

A total of 520 trout were tagged in March-April, 1973, in the Reichle Section. Fishermen harvest and trout movement analyses based on tag return information will be presented in a future report.

Fishtrap Section - A 4.4 mile section of the Big Hole River, beginning at the confluence of Fishtrap Creek, was electrofished on April 30 and May 9, 1973. During the marking run, 12 wild and 13 hatchery rainbow trout, 17 brook trout and 20 Arctic grayling were captured. Low numbers of these species negated attempts to estimate their respective populations. However, the population of mountain whitefish was estimated for the first mile of the section. The point estimate of mountain whitefish in that sub-section was 15,853 with an 80 confidence interval of ±8,992.

Big Hole, Jefferson and Ruby Rivers - Streambank and Channel Alteration Study

During the summer of 1973, the magnitude of streambank and channel alterations by man were investigated on portions of three streams. The portions studied were: (1) the Big Hole River from the site of the proposed Reichle Dam to the mouth, (2) the Jefferson River from the confluence of the Big Hole and Beaverhead Rivers to the bridge at the town of Silver Star and (3) the Ruby River from Ruby Dam to the mouth. The form used to gather the data is shown in Figure 2.

The section of the Big Hole had proportionately more streambank and channel alterations (physically altered by man with a bulldozer, dragline, etc.) than in either section of the other two rivers. In 16.5 miles of the Big Hole, 7.0 and 2.4 miles of streambank and channel, respectively, had been altered (Table 2). The Big Hole had more streambank (5.8) and channel (1.8) alterations per mile than either of the other two streams. However, the Ruby River had nearly as many streambank alterations per mile (5.4). For the most part, streambank alterations were on outside bends which are considered primary trout habitat.

TABLE 2. The amounts of streambank and channel altered in portions of three southwestern Montana streams, 1973.

Stream	Length (miles) of Study Section	Streambank Alterations		Channel Alterations	
		Total Number	Total Length (Mi.)	Total Number	Total Length (Mi.)
Big Hole River	16.5	96	7.0	30	2.4
Jefferson River	9.9	41	2.0	13	1.0
Ruby River	51.7	280	8.9	53	4.3

In the sub-section of the Ruby, from the dam to the town of Laurin, there were 10.4 separate streambank alterations per mile. In this same sub-section was found the highest concentration of irrigation diversions per mile (0.90) compared to other sections or sub-sections studied (Table 3). Cause and effect relationships between number of irrigation diversions and number of streambank alterations per mile is not within the scope of this study; however, there does appear to be a correlation between number of irrigation diversions and number of streambank alterations.

ap o.	ID No.	CHANNEL ALTERATIONS Realignment before	after	Other	For irrigation	Not For irrigation	BANK ALTERATIONS Blanket Rock	Rock Jetties	Car Bodies	River Gravel	Others-designate	WHO (agr., etc.)	No. irri. take-offs	REMARKS (functional, non-functional, etc.)

TOTALS

FIGURE 2. Channel and streambank alteration form used in Alterations Study, 1973

TABLE 3. Number of irrigation diversions in the study sections of the Big Hole, Jefferson and Ruby Rivers, 1973. (No./mile in parentheses).

Big Hole	Jefferson	Ruby			Total
		Dam-Laurin	Laurin-Sheridan	Sheridan-Mouth	
14 (85)	6 (0.61)	12 (0.90)	10 (0.47)	6 (0.35)	28 (0.54)

Construction activities associated with irrigation diversions accounted for a large portion of channel alterations. Approximately 50, 45 and 12 percent of all channel alterations on the Big Hole, Jefferson and Ruby Rivers, respectively, were related to irrigation diversion construction.

Blanket rock riprap far exceeded any other method of streambank alteration (Table 4) and represented 75, 79 and 68 percent of all streambank alterations on the Big Hole, Jefferson and Ruby Rivers, respectively. River gravel, pushed up from the adjacent streambed, was the next most used method of streambank alteration (Table 4).

TABLE 4. Type and amount of streambank alterations in the study sections of the Big Hole, Jefferson and Ruby Rivers, 1973. Amount in feet with miles in parentheses.

Type 1/	Big Hole River	Jefferson River	Ruby River
Blanket rock	27,731 (5.25)	8,378 (1.59)	32,135 (6.09)
Rock jetties	540 (0.10)	356 (0.07)	243 (0.05)
Car bodies	0 (-)	0 (-)	143 (0.03)
River gravel	8,357 (1.58)	1,316 (0.25)	8,501 (1.61)
Other (logs, debris, brush, etc)	237 (0.04)	572 (0.11)	6,145 (1.16)
Totals	36,865 (6.98)	10,622 (2.01)	47,167 (8.93)

1/ Dikes were not included.

Dikes were not classified as a separate form of streambank alteration because most were in combination with blanket rock riprap and some were placed away from the streambank without altering it. However, there was a large amount of dikes. The largest concentration of dikes was found in the 16.5 miles of Big Hole studied where there was 21,004 feet. Of the 21,004 feet, 95 percent was added to blanket rock riprap.

Agriculture far exceeded state or county governments as that part of society most responsible for both streambank and channel alterations in the study sections (Table 5).

TABLE 5. Percentages of streambank and channel alterations done by and/or for agriculture (agr.) and state (st.) or county (co.) governments, 1973.

River	Streambank Alterations			Channel Alterations		
	Agr.	St.	Co.	Agr.	St.	Co.
Big Hole	98.6%	0.0%	1.4%	100.0%	0%	.0%
Jefferson	89.0%	2.0%	9.0%	71.1%	0%	28.9%
Ruby	94.2%	0.4%	5.4%	100.0%	0%	.0%

Ruby River Habitat Alteration and Trout Population Study

Trout populations (brown trout represented over 99 percent of the trout populations) were investigated in three adjacent sections of Ruby River near the town of Laurin.

Eighty-three percent of channel and 58 percent of streambank in section 1, the upstream section, were altered with a bulldozer (Figure 3). Bulldozer activity in section 1 consisted entirely of work within the existing channel and pushing streambed gravel to the sides. No channel straightening was involved. Section 1 was 5,100 feet in length.

Section 2, the middle section, had no channel alterations and only 3.6 percent of the streambank was riprapped with blanket rock. This section was used as a "control" section because of its mostly natural state (Figure 4). This section was 3,100 feet in length and began 285 feet from the end of section 1.

All outside bends of section 3, the downstream section, were lined with rock riprap (Figure 5). The streambed was not bulldozed or physically altered. This section was 2,100 feet in length and began 5,200 feet downstream from section 2.

Because of the relative proximity of the sections and because of similar water quality, water quantity and fishing pressure, it was assumed that differences in trout populations would be related to differences in habitat caused by man's activities.

The population estimates of brown trout per 1,000 feet were 80.8, 255.2 and 116.2 for section 1, 2 and 3, respectively (Table 6). Approximately 3 times as many brown trout were present in the natural section than in the bulldozed section and over 2 times as many were present in the natural section than in the riprapped section per 1,000 feet of stream (Table 6, Figure 6). No over-lapping occurred in confidence intervals of population point estimates between sections 1 and 2 or sections 3 and 2. I interpret these data to mean that a definite relationship exists between bulldozing the streambed and riprapping the streambanks and depressed brown trout population numbers in sections 1 and 3, respectively.

It appeared that all brown trout, age I and older, were adversely affected by the respective types of habitat alterations in both the bulldozed and riprapped sections and that the affect was felt, more or less, proportionately by the age groups estimated (Table 6, Figure 7).

Poindexter Slough

A "closed tile drainage system" was constructed in the headwaters area during 1971 through a contract funded by the Bureau of Reclamation (described in Peterson, 1973).

Forty-eight staff gage measurements were recorded from February 21 through December 31, 1973. Measurements ranged from 0.23 on April 12 to 2.00 on July 2. Current velocities were calculated at five different staff gage measurements for the purpose of calibrating staff gage measurements to flow measurements. All data are filed for inclusion in a future completion report.

I recommend that trout populations and flows continue to be monitored periodically to determine long-range effects of the closed tile drainage system upon these two parameters.

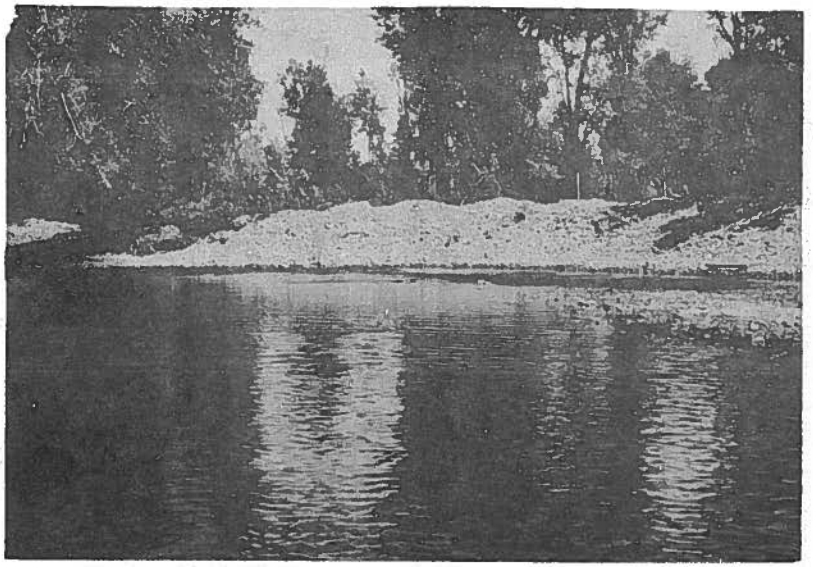

FIGURE 3. The bulldozed section, section 1.

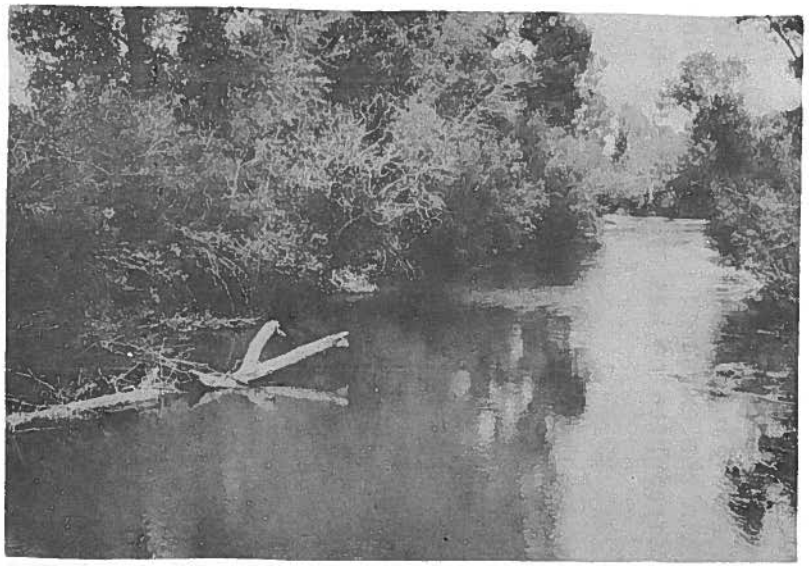

FIGURE 4. The natural section, section 2.

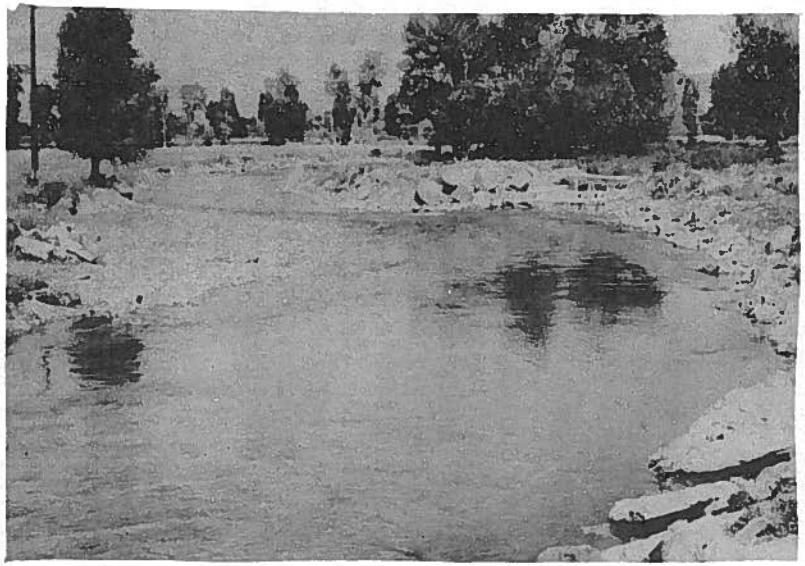

FIGURE 5. The riprapped section, section 3.

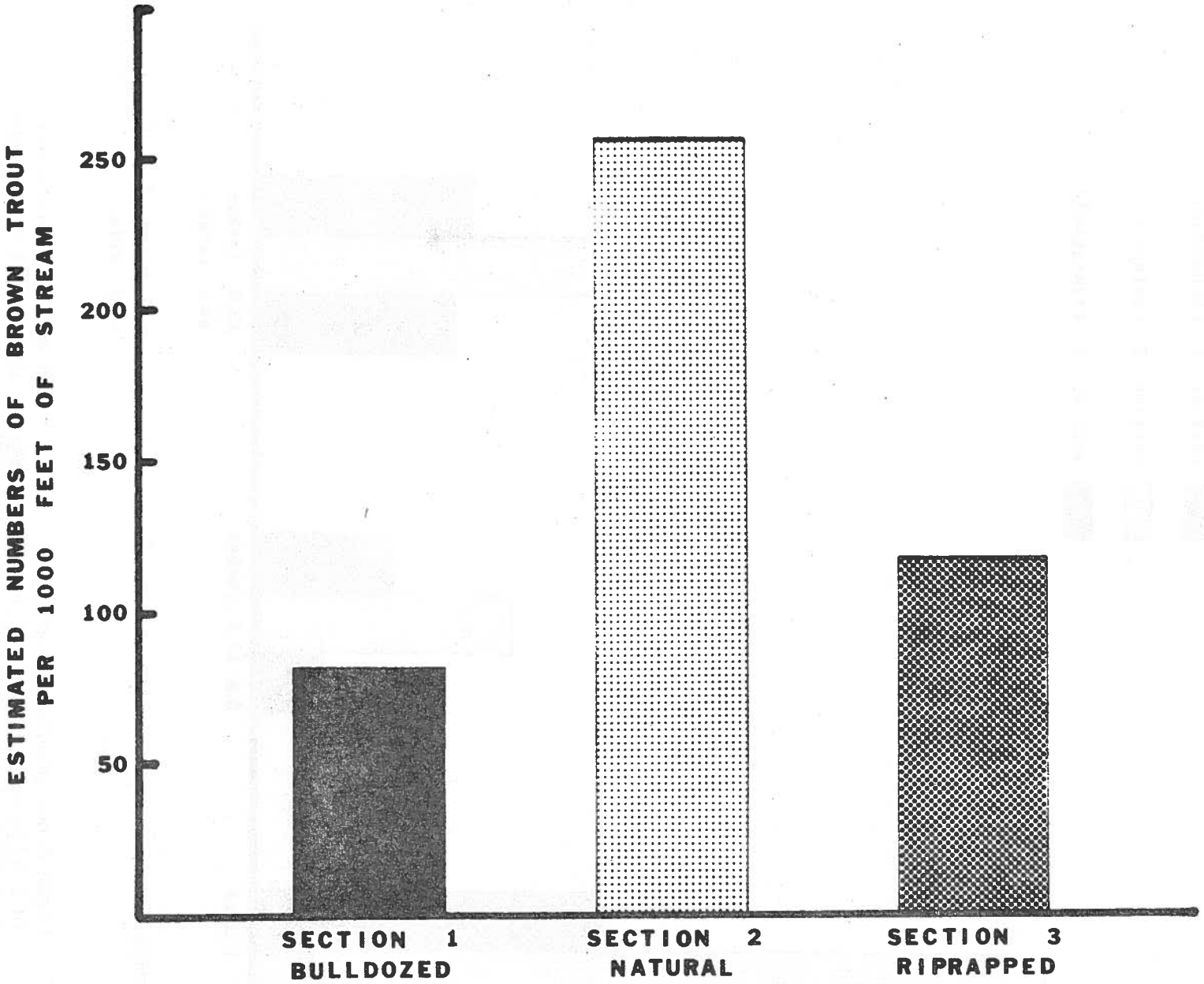

FIGURE 6. Total brown trout population estimates in 3 adjacent sections with varying degrees of channel and streambank alterations, Ruby River, July, 1973.

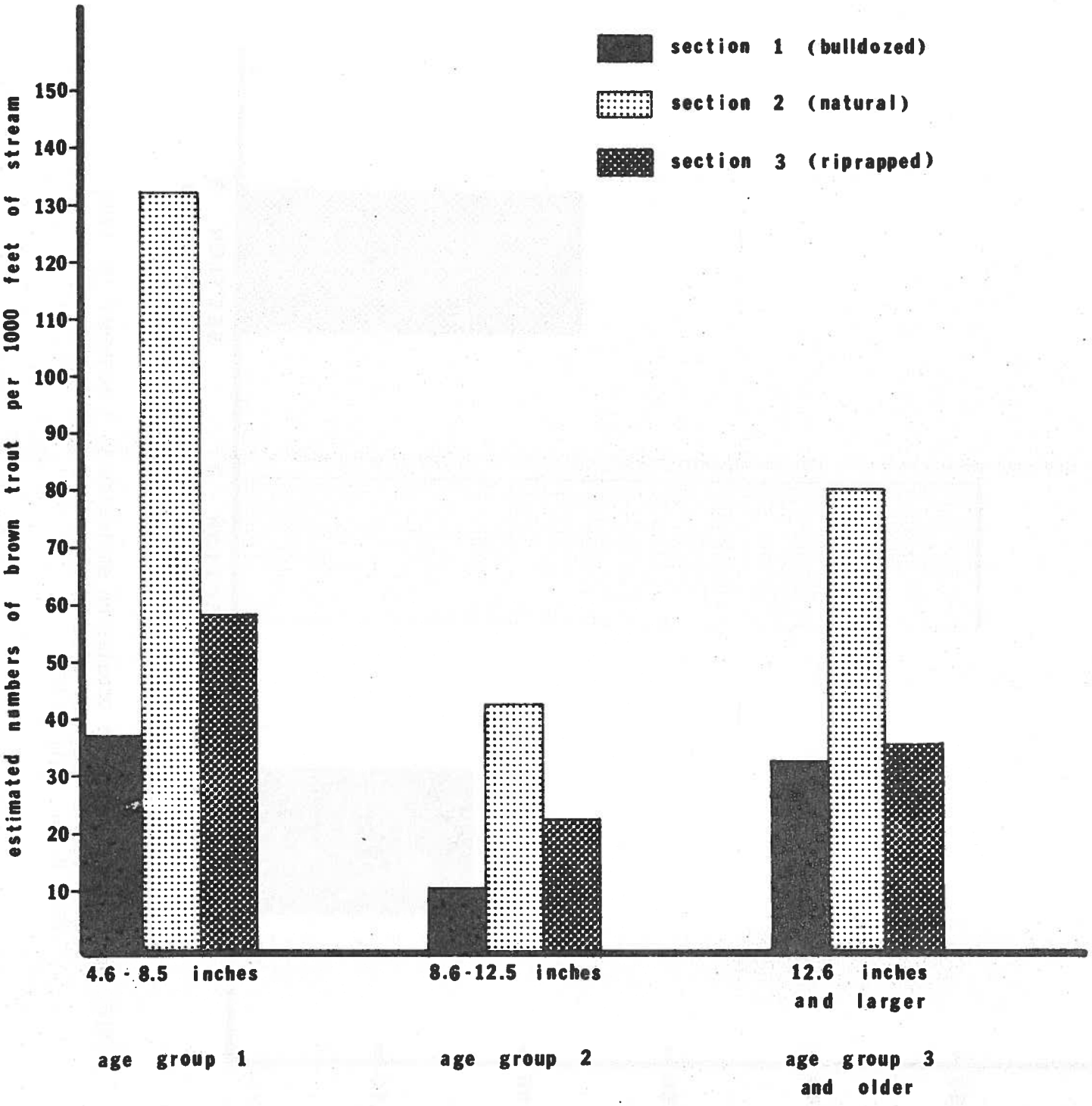

FIGURE 7. Brown trout population estimates, by size and age group intervals, in 3 adjacent sections with varying degrees of channel and stream-bank alterations, Ruby River, July, 1973.

TABLE 6. Brown trout population parameters in three adjacent sections with varying degrees of channel and streambank alterations, Ruby River, July, 1973. (80% confidence intervals in parentheses.)

Parameter	Length Interval (inches) 1/	Section 1 (Bulldozed)	Section 2 (Natural)	Section 3 (Riprapped)
Estimated number per 1,000 feet	4.6-8.5	36.9 (±9.4)	132.3 (±20.0)	58.1 (±17.6)
	8.6-12.5	11.2 (±2.7)	42.6 (±7.7)	22.4 (±7.6)
	12.6 & larger	32.7 (±3.5)	80.3 (±6.8)	35.7 (±5.2)
Total		80.8 (±10.4)	255.2 (±22.6)	116.2 (±19.5)
Estimated pounds per 1000 feet	4.6-8.5	4.5 (±1.2)	13.5 (±1.9)	9.0 (±2.9)
	8.6-12.5	5.9 (±1.4)	21.0 (±3.9)	11.9 (±3.8)
	12.6 & larger	44.3 (±4.7)	98.7 (±8.4)	45.7 (±6.7)
Total		54.7 (±5.1)	133.2 (±9.4)	66.6 (±8.1)
Condition Factors	4.6-8.5	39.54 (±6.09)	38.22 (±5.13)	43.13 (±4.34)
	8.6-12.5	40.68 (±3.72)	41.28 (±3.48)	40.95 (±4.30)
	12.6 & larger	39.04 (±2.93)	38.61 (±3.05)	39.00 (±3.14)
Mean		39.18 (±6.12)	38.62 (±6.10)	40.98 (±4.53

1/ Based on length frequency distribution analysis, length intervals 4.6-8.5, 8.6-12.5 and 12.6 & larger were assumed to be mostly Age Groups I, II and III & older, respectively.

Lakes

One experimental gill net 125 feet long with graduated mesh sizes was set for approximately 24 hours in each of 15 high mountain lakes during August of 1973. The lakes were located in the west side of the upper Big Hole River Drainage.

Data from these investigations are listed in Table 7. Additional data, including water quality analysis from the Water Quality Bureau, Montana Board of Health, are available in files for each lake listed.

No immediate changes in management of the lakes appear presently necessary.

RECOMMENDATIONS

Lake and stream inventories should be continued in order to furnish base-line data. These data are the basis for comprehensive sport fisheries management in Montana. They are also invaluable in determining resource values for aid in dealing with land and water development projects.

LITERATURE CITED

Peterson, N.W. 1973. Inventory of waters of the project area. Job Progress Report, Federal Aid in Fish and Wildlife Restoration Act. Mont. Proj. No. F-9-R-20, Job I-b, 11 pp.

Vincent, E.R. 1971. River electrofishing and fish population estimates. The Prog. Fish Culturist, 33 (3): 163-169.

TABLE 7. Gill net data from mountain lake surveys, August, 1973.

Lake (code number)	No. of Sets 1/	Species Caught 2/	No. Caught	Size Range, inches	Mean Length (inches)	Lake Elev. (feet)	Maximum Depth (feet)	Spawning 3/
Ajax (02-7150)	1	Rb	6	7.3-14.6	11.5	8522	93	Marginal
Berry (02-7300)	1	Ct	6	6.4-14.1	9.7	8700	32	Marginal
Geneva (02-7900)	1	Ct	3	9.5-11.9	10.3	8451	47	Fair
Hamby (02-8075)	1	Gr	3	11.2-15.2	13.5	8092	33	Fair-good
		RbxCt	2	12.3-13.1	12.7			
		Ct	3	8.8-12.1	10.8			
		Eb	17	6.6-13.4	9.8			
Janhke (02-8225)	1	Ct	9	8.5-12.9	10.6	8760	16	Fair-good
Lena (02-8300)	1	Rb	22	6.2-13.9	9.2	8345	29	Marginal
Little (02-8425	1	-	None	-	-	8750	29	Marginal-fair
Ridge (02-8900)	1	Ct	2	11.4-14.5	13.0	8449	32	Marginal-fair
Rock Island (02-8925)								
Lower	1	Rb	20	6.0-12.7	9.1	8325	19	Good
Upper	1	Rb	1	11.8	11.8	8360	8	Marginal
Slag-a-melt (02-9125)								
Lower	1	Eb	34	5.1-9.1	7.8	8316	17	Good
Upper	1	-	None	-	-	8740	75	Nil
Timberline (02-9325	1	-	None	-	-	9180	26	Nil
Upper Miner (02-9475)	1	Eb	11	6.4-15.5	11.5	8029	60	Marginal
Upper-Upper Miner (02-9475)	1	Rb	10	6.1-13.9	10.2	8749	99	Marginal

1/ 125 x 5 foot monofilament sinking gill nets with 3/4-2 inch graduated square mesh were set for approximately 24 hours in each lake.

2/ Species abbreviations: Ct= cutthroat trout; Eb=brook trout; Gr=Arctic grayling; Rb=rainbow trout; RbxCt=rainbow-cutthroat hybrids.

3/ Relative terms based on the judgment of the investigator.

Prepared by: Norman W. Peterson

Date: February 15, 1974

Waters referred to:

Big Hole River, Sec. 1	02-0425
Big Hole River, Sec. 2	02-0450
Jefferson River	10-3840
Poindexter Slough	01-9320
Ruby River	01-6360
Ajax Lake	02-7150
Berry Lake	02-7300
Geneva Lake	02-7900
Hamby Lake	02-8075
Janhke Lake	02-8225
Lena Lake	02-8300
Little Lake	02-8425
Miner Lakes (2)	02-9475
Ridge Lake	02-8900
Rock Island Lakes (2)	02-8925
Slag-a-melt Lakes (2)	02-9125
Timberline Lake	02-9325