FISHERMAN USE AND FISH HARVEST ON THE WEST GALLATIN RIVER, MONTANA

by

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of

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VITA

The author, Richard Seth Lyden Jr., was born April 8, 1948 in Glasgow, Montana to Richard Sr. and Margaret Lyden. He graduated from Glasgow High School in June, 1966 and entered Eastern Montana College at Billings the following autumn. In September, 1969 he transferred to Montana State University at Bozeman from which he graduated with a Bachelor of Science degree in Fish and Wildlife Management in the spring of 1971. Richard began graduate studies at Montana State University in July, 1971. In September, 1972 he married Rebecca Crenshaw. They have one child, a son, Kelly Michael.

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ABSTRACT

Estimates of fishing intensity and yield of game fish were made on the canyon portion of the West Gallatin River, Montana during the summer fishing seasons of 1971 and 1972. Two sections each about 11 miles long were selected for intensive study. These sections were the most accessible and most heavily fished portions of the river. An estimated 57 percent in 1971 and 36 percent in 1972 of all fisherman were interviewed. During 1971, total fisherman days per stream mile were estimated to be 181 and 224 for the upper and lower sections, respectively while during 1972 these values were 196 and 274, respectively. An increase in fishing pressure of 35 percent in the lower section was attributed to a shorter high and turbid water period in 1972. The catch varied from 5,318 fish caught in 3,305 fisherman days in section B during 1972 to 3,618 fish caught in 2,616 fisherman days in section B during 1971. The average number of fish caught per fisherman day ranged from 1.38 to 2.02. Catch rates for wild rainbow trout ranged from 0.15 to 0.35 and for hatchery trout ranged from 0.05 to 0.30. Wild and hatchery rainbow trout combined, contributed 67.2 to 93.4 percent of the total game fish catch for both sections both years. An increase in the take of hatchery trout from 1971 to 1972 appeared to be due to more selective planting in 1972. The upper section, late summer, and weekdays were characterized as tourist fisheries while the lower section, early summer, and weekends-holidays were characterized as local fisheries. Tourists caught more trout than did locals but a greater percentage of the tourist catch was comprised of hatchery fish.

INTRODUCTION

The upper 41 miles of the West Gallatin River in Montana is one of eight streams in the state that is classified as having national as well as statewide fishery value. It represents 10 percent of the top quality stream miles in the state (Brown *et al.*, 1959). In the past several years this part of the river and the surrounding canyon area have been increasingly used for recreation.

In the late 1800's and early 1900's the Gallatin Canyon was used primarily for ranching and lumbering operations. During the period 1905 to 1914 the area was placed in the Gallatin National Forest, a road was built to West Yellowstone, and dude ranching began. This period signified the real opening of the canyon area and since then tourism has steadily risen in importance. With the growth of recreational activities, the rise in federal regulatory powers, and the increased activities of large corporations like Burlington Northern and Chrysler Realty, increased development of the Gallatin Canyon is occurring.

Construction of a large recreational development, the Big Sky of Montana complex, was initiated in the spring of 1971. This complex is located on the West Fork drainage of the Gallatin River and is expected to have a considerable impact on the area. In light of these expectations a study was made to evaluate the environmental, economic, and recreational features of the area prior to full development of the

complex. As a part of this larger study a fishing survey was conducted on the upper West Gallatin River in the canyon during the summer fishing seasons of 1971 and 1972. The primary objective of the study was to obtain baseline information on fisherman use and fish harvest.

DESCRIPTION OF THE STUDY AREA

The West Gallatin River originates on the east slope of the continental divide in Yellowstone National Park. It flows approximately 100 miles north to near Manhattan, Montana where it joins the East Gallatin River to form the Gallatin River.

From it's origin the West Gallatin River flows through high mountainous valleys until it reaches the Yellowstone National Park boundary. From the Park boundary the river flows through the Gallatin Canyon for a distance of about 41 miles after which it crosses the broad Gallatin Valley to it's confluence with the East Gallatin River. The West Gallatin River drains an area of 1,100 square miles all above 4,000 feet elevation. Of this drainage area 825 square miles are located above the mouth of the Gallatin Canyon.

The primary study area was the Gallatin Canyon and included the river from the Yellowstone National Park boundary downstream 41 miles. Fishing access sites are numerous along this portion of the river as the river flows through a preponderance of publicly owned land and is closely paralleled by a highway (Fig. 1).

In the canyon the West Gallatin River has a gradient of approximately 38 feet per mile and average width of about 60 feet. Pools and riffles occur in close succession and vary in length from a few to over 200 feet. A few of the pools are over 12 feet in depth. The

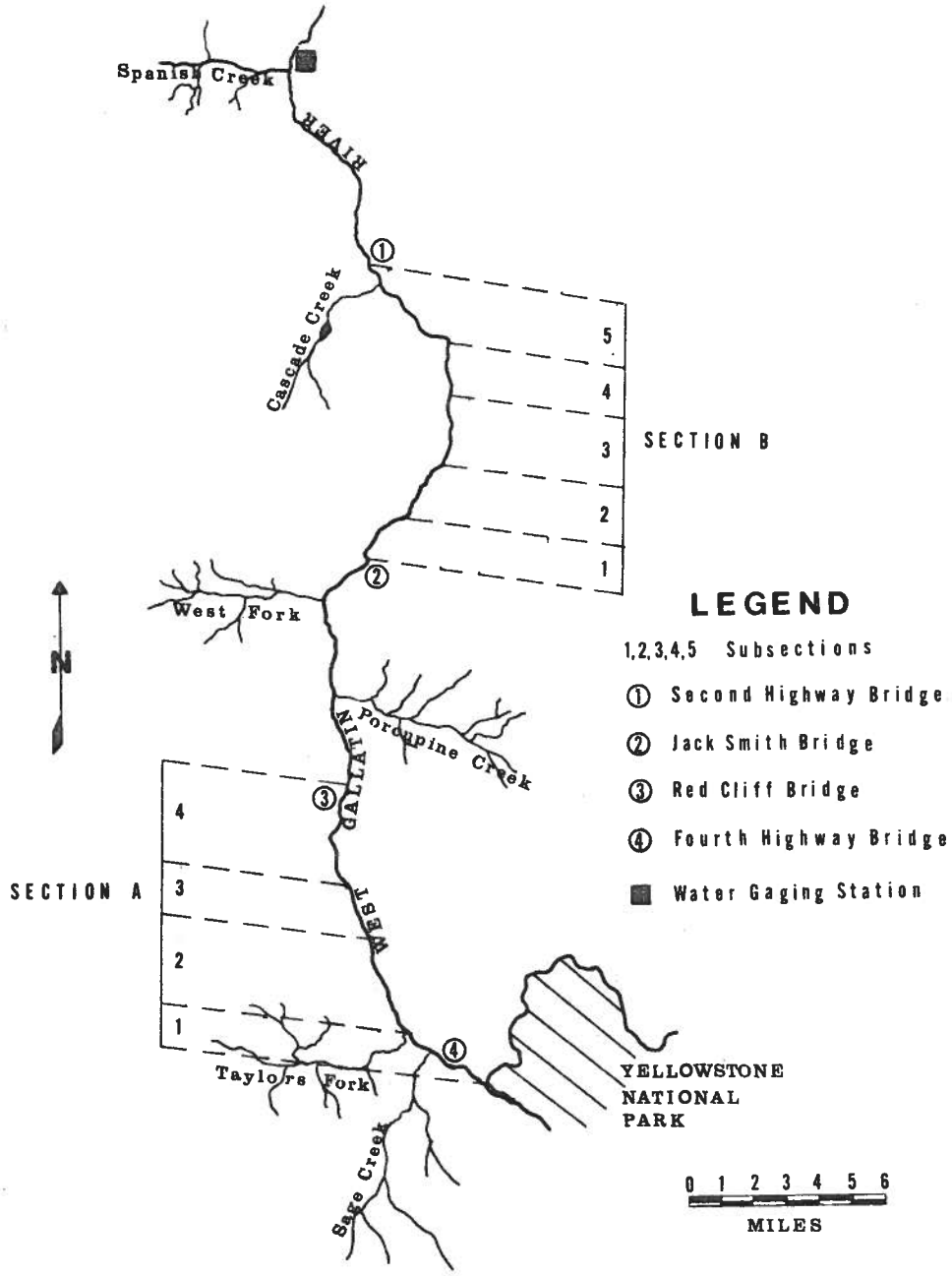

Figure 1. Study area, showing location of study sections A and B on the West Gallatin River.

stream bed is composed largely of loose boulders, rubble, gravel, and sand (Missouri River Basin Studies, 1951).

Surface discharge data for the period 1930 to 1969, and 1972, obtained from a U.S. Geological Survey gage station located on the river near Spanish Creek, show that the high water period normally occurs from late May to late June with peak flows occurring in early June and ranging up to 6,500 cfs. In 1972 high water extended from late May until late June with a peak flow of 5,540 cfs occurring on June 7. Discharge data taken from the Gallatin River near Logan, Montana suggested flow trends for the West Gallatin River (Fig. 2). These data showed that the high water period of 1971 lasted two weeks longer and that discharges were higher than those of 1972.

Rainbow trout (*Salmo gairdneri*) were the most important game fish in the canyon. Other game fish present include brown trout (*Salmo trutta*), cutthroat trout (*Salmo clarki*), rainbow-cutthroat hybrid trout, brook trout (*Salvelinus fontinalis*), and mountain whitefish (*Prosopium williamsoni*). Non-game fish present include mottled sculpin (*Cottus bairdi*), longnose sucker (*Catostomus catostomus*), white sucker (*Catostomus commersoni*), and longnose dace (*Rhinichthys cataractae*).

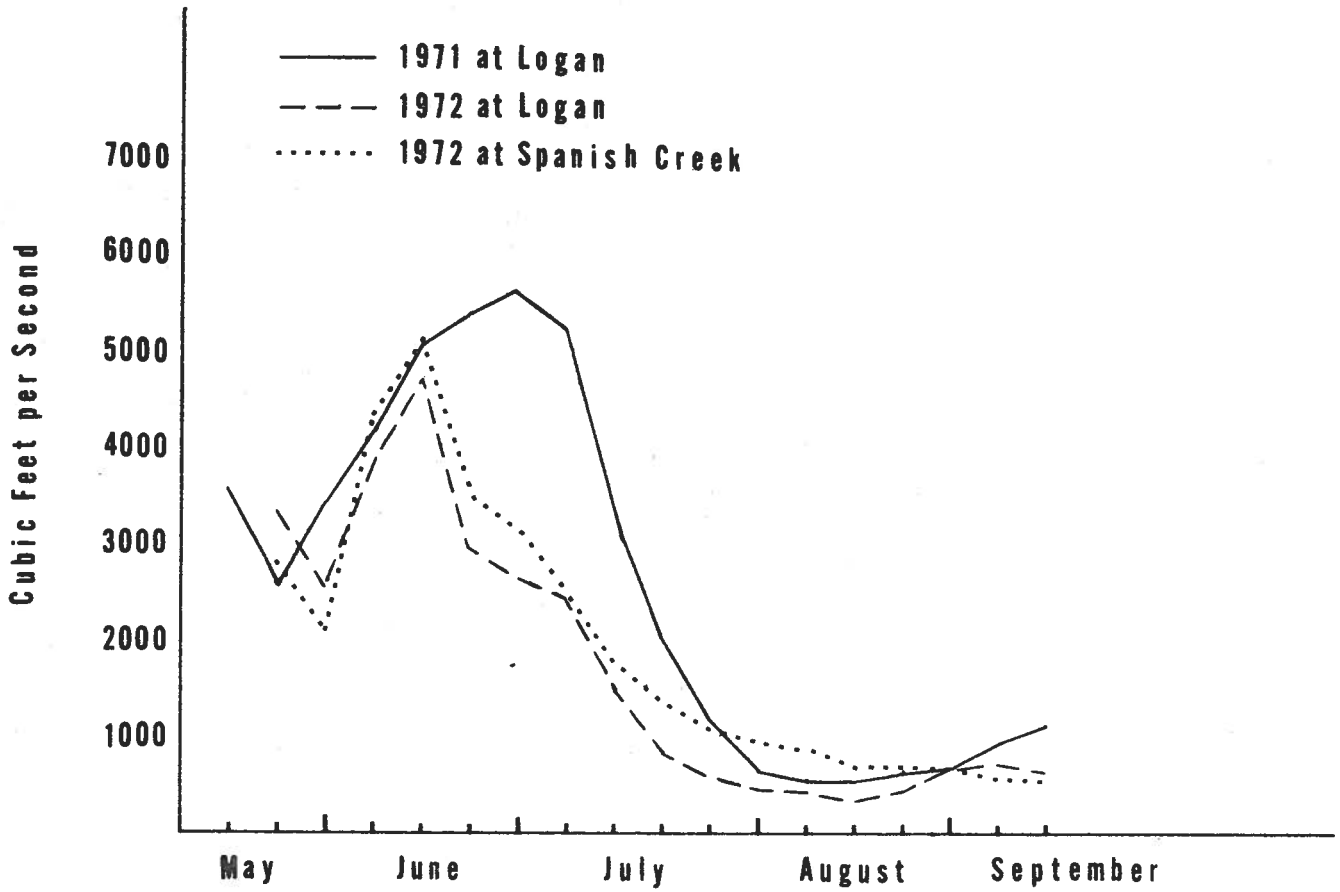

Figure 2. Discharge for the Gallatin River at Logan and for the West Gallatin River at Spanish Creek.

METHODS

Two sections of the West Gallatin River in the canyon were selected for intensive study. These sections contained the most accessible and observable portions of the river. A preliminary study conducted during 1970 along the entire 41 miles of the river in the canyon showed that 75 percent of the fisherman counted were in these two sections (Graham, personal correspondence). Study section A began at the Yellowstone National Park boundary and continued downstream 11.1 highway miles to a point 0.7 of a mile below the Red Cliff bridge (Fig.1). This section was further divided into four subsections ranging in length from 2.2 to 3.6 miles. Study section B began at the Jack Smith bridge located two miles below the West Fork tributary and continued downstream 11.8 miles to the second highway bridge located just below Cascade Creek. This section was further divided into five subsections ranging in length from 1.8 to 3.6 miles.

Beginning on the opening day of fishing season in each census year (May 16, 1971 and May 21, 1972) and continuing for four weeks in 1971 and three weeks in 1972, fisherman were censused on weekends and holidays. For the remainder of the summer up until September 12, 1971 and September 10, 1972, fisherman were censused a minimum of four days a week with the stipulation that all weekends and holidays be included. The weekdays censused were chosen at random with the

stipulation that no weekday was missed for more than three consecutive weeks. This partial census method was a modification of a method suggested by Best and Boles (1956).

To determine fishing intensities fisherman were counted in each section at 8, 10, and 12 a.m. and at 2, 4, 6, and 8 p.m. on each census day. Counts were made as rapidly as possible from an automobile. Only people actually fishing or those walking to the river with rod in hand were counted. The amount of river visible from the highway was estimated to be 90 percent in section A and 85 percent in section B.

Nine aerial counts of fisherman were made during the 1972 census. These counts were made on weekend days during peak fishing periods and included the entire river in the canyon.

As many fisherman as practicable were interviewed between the hours of 8 a.m. and 8 p.m. to obtain information on party size and residence of individuals in the party; number, gender, and age (15 or older or under 15) of individuals fishing; time fished and fish caught. A return addressed card was given to those parties that indicated they would continue fishing after the interview was made. This card requested only information on party fishing time, total number of trout caught and kept and caught and released, and total number of other fish caught and kept and caught and released by the party on the day censused. Scale samples were taken from wild trout for use in determining the age composition and growth rates of fish comprising

the catch.

Approximately 10,500 "catchable" size hatchery rainbow trout were stocked in the canyon portion of the river during each census year. Plantings were made as soon as possible after the high water period. To identify the hatchery trout in the catch they were marked by removal of the adipose fin. In 1971, the fish were planted at numerous access points along the entire river in the canyon but the number stocked in each study section was not known. In 1972, the fish were stocked in areas of high fishing intensity with 4,500 planted in section A, 5,000 in B, and 1,000 in sections not censused.

On each census day turbidity samples were collected from the river at both ends of each study section. Turbidity was determined with a Hach 2100 Turbidimeter and expressed in Jackson Turbidity Units.

Fisherman census data were analyzed with the help of a computer.

RESULTS

Fishing Pressure

Fishing intensity data were divided into weekdays and weekends-holidays. Data were further grouped into one of four strata to compare seasonal distribution patterns and to facilitate estimates. Stratum one included opening day and the following four weeks of 1971 and opening day and the following three week of 1972. Strata two and three included consecutive four week periods following stratum one while stratum five contained the final five weeks each year. Fishing intensity data for weekdays of stratum one, where no field observations were made, were approximated using data from stratum one weekends-holidays and stratum two weekends-holidays and weekdays.

Angling intensity in hours was estimated by summing the daily distributions of fisherman in each period and constructing fishing intensity curves (Figs. 3 and 4). Total fishing pressure for any period thus became the total fisherman hours under that periods curve. Total fisherman hours was computed as the sum of the number of fisherman under the curve at each hour. The left side of each curve was closed through extrapolation from early morning starting times recorded on interview forms while the right side was closed by extrapolation from the finishing times recorded on census cards using only data from fisherman finishing after 8 p.m.

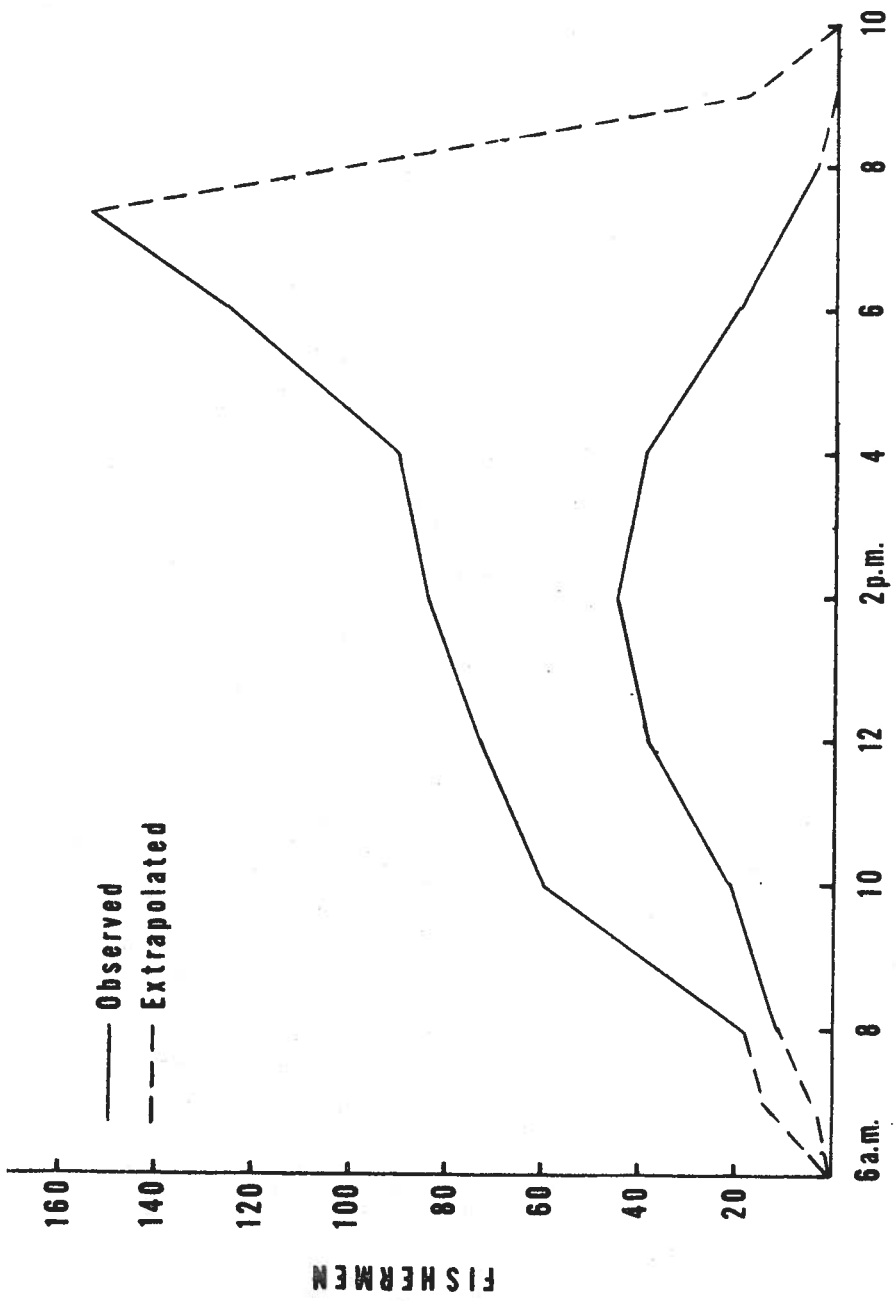

Figure 3. Fishing intensity curves for the weekends-holidays of stratum one (smaller curve) and weekdays of stratum three (larger curve).

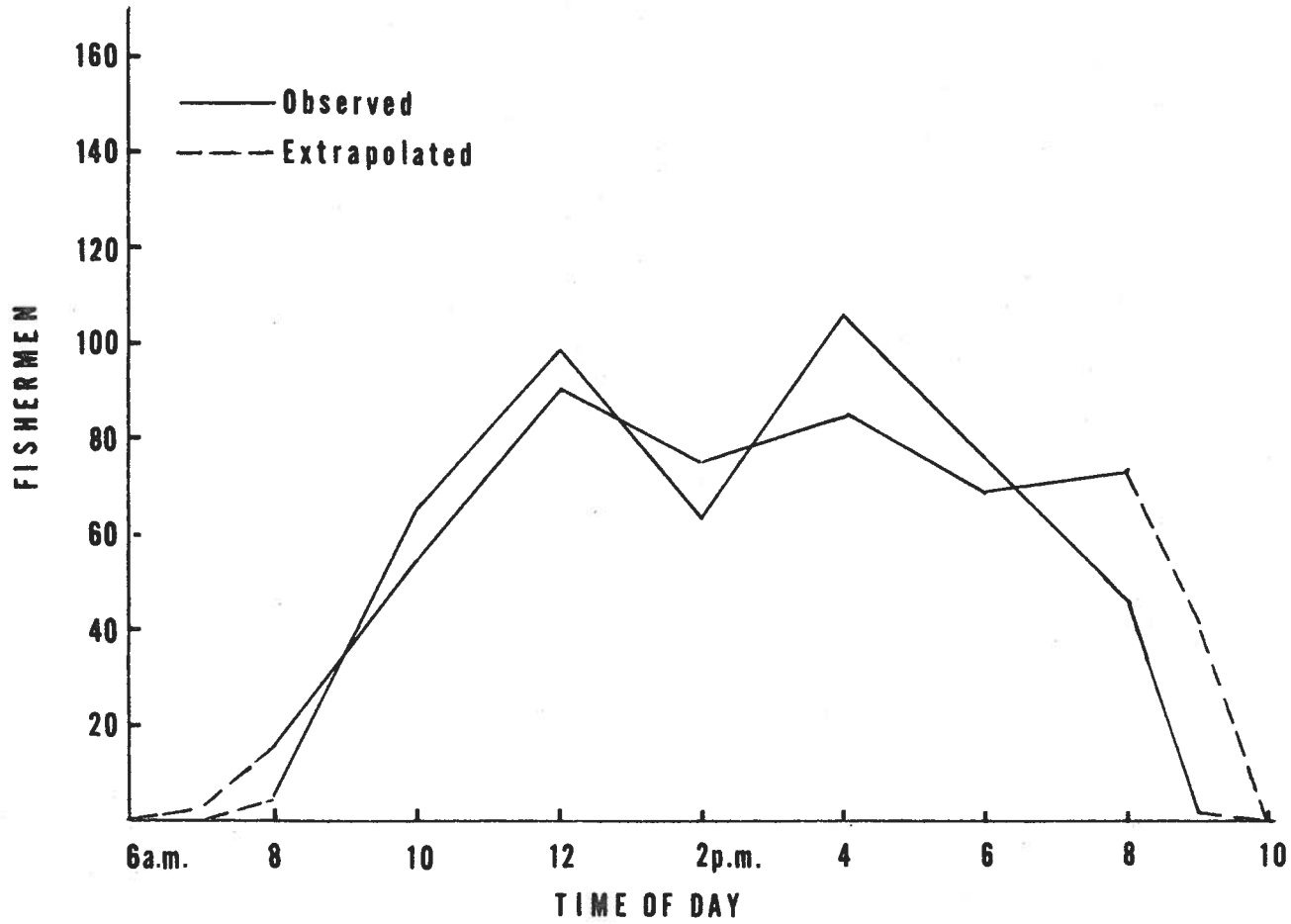

Figure 4. Fishing intensity curves for the weekends-holidays of stratum four (bimodal curve) and weekends-holidays of stratum three (trimodal curve).

The number of parties interviewed was 1,213 in 1971 and 886 in 1972. These represented 57 percent of the total estimated fisherman in 1971 and 36 percent in 1972. A slightly greater number of fishermen were interviewed in study section B than in A during both years but the percentage of the total fishermen interviewed in each section was the same. Of all fishing cards given out 55 percent were returned during 1971 and 48 percent during 1972. A slightly greater percentage of the cards were returned from section A than from B.

The distribution of fishing intensity was of two general types. Bell shaped distributions were characteristic of periods of relatively low fishing pressure such as weekends-holidays of stratum one and weekdays of most strata (Fig. 3). Peterson (1970) noted a similar distribution for late summer, low fishing pressure periods on Big Spring Creek, Montana. Vincent (1969) also described a bell shaped distribution for the Madison River of Montana. Variations of the bell shaped distribution, in which a single mode was characteristic, did occur. In most instances this mode was relatively small and occurred in the early afternoon. However, in section B during weekdays of stratum three during both years this single mode was highly pronounced and occurred at 8 p.m. (Fig. 3). Peterson (1970) also noted a high evening mode on weekdays during the mid to late summer portion of the fishing season. This high evening mode suggests that the fishing pressure on weekdays in section B during stratum

three was primarily local. Bimodal distributions were characteristic of periods of high fishing pressure. This distribution occurred on weekends-holidays of strata 2, 3, and 4, and on weekdays of a few late summer strata (Fig. 4). The first mode generally occurred between 12 and 2 p.m. with the second between 4 and 6 p.m. Similar bimodal distributions have been noted by other authors and the distribution is characteristic of "resort" situations (Peterson, 1970 and Cope, 1955). A single trimodal curve occurred during 1971 in section A during stratum three on weekends-holidays with the third mode occurring at 8 p.m. (Fig. 4).

The total number of fisherman hours for each study section and census year was estimated for each stratum and for weekends-holidays and weekdays (Table 1). Total hours were 6,536 for section A and 8,227 for B during 1971 while during 1972 these values were 6,344 and 11,108 for sections A and B, respectively. Fisherman hours during 1972 were 18 percent greater than during 1971. In section B the number of fisherman hours was 25 and 75 percent greater than in section A during 1971 and 1972, respectively. Total fisherman hours on weekdays were 24 percent greater during 1971 and 41 percent greater during 1972 than for weekends-holidays. However, weekends-holidays showed a 72.8 and 51.3 percent greater fishing intensity per day than weekdays during 1971 and 1972, respectively. The highest observed hours per day (209) was in section B during

TABLE 1. TOTAL NUMBER OF FISHERMAN HOURS AND NUMBER OF FISHERMAN HOURS PER DAY (IN PARENTHESES) FOR EACH STRATA AND SECTION DURING 1971 AND 1972.

	1971			1972		
Strata	A	B	Total	A	B	Total
I Weekends-Holidays	465(46.5)	705(70.5)	1170(61.6)	353(44.1)	615(76.9)	968(128.0)
I Weekdays	252(13.0)	590(31.1)	842(44.3)	444(31.7)	730(52.1)	1174(83.9)
II Weekends-Holidays	567(63.0)	829(92.1)	1396(155.1)	401(44.6)	1039(115.4)	1440(160.0)
II Weekdays	308(16.2)	694(36.5)	1002(52.7)	505(26.6)	1231(64.8)	1736(91.4)
III Weekends-Holidays	928(116.0)	1055(131.9)	1983(247.9)	890(111.3)	1668(209.0)	2558(319.8)
III Weekdays	1361(68.1)	1775(88.8)	3136(156.8)	1523(76.2)	2885(144.3)	4408(220.4)
IV Weekends-Holidays	895(81.4)	1123(102.1)	2018(183.5)	924(84.0)	1342(122.0)	2266(206.0)
IV Weekdays	1760(73.3)	1456(60.7)	3216(134.0)	1304(54.3)	1598(66.6)	2902(120.9)
Total Weekends-Holidays	2855(75.1)	3712(97.7)	6567(172.8)	2568(71.3)	4664(129.6)	7232(200.9)
Total Weekdays	3681(44.9)	4515(55.1)	8196(100.0)	3776(49.0)	6444(83.7)	10220(132.7)
Grand Total	6536	8227	14763	6344	11108	17452

weekends-holidays of stratum three, 1972 while the lowest (13) was the estimate for section A during weekdays of stratum one, 1971. The fisherman hours for stratum three, which had the highest fishing pressure, increased 36 percent from 1971 to 1972 while changes in the other strata ranged from a decrease of 1.2 percent to an increase of 32.4 percent.

Fisherman hours in section B increased by 35 percent from 1971 to 1972 and a large portion of this increase occurred during stratum three. This increase may be partially attributed to the influence of turbidity. Weekly averages of turbidity taken at the lower end of section B showed that trends in turbidity were similar to the trends in discharge, i.e. the concentration was greater and the duration two weeks longer in 1971 than in 1972 (Fig. 5). The river in subsection A-1, the 2.9 miles from the Park line to Taylors Fork, remained clear even during the high water period, thus fishing pressure in this area was high during all periods. The remainder of this section and all of section B had comparable amounts of turbidity at any given time.

The estimated fisherman hours at 7 a.m. or earlier was less than one percent and at 9 p.m. or later was less than four percent of the total fisherman hours during each census year. Studies by Hunt (1966) and Peterson (1970) showed that early morning and late evening fishing were only a small percentage of the overall fishing pressure.

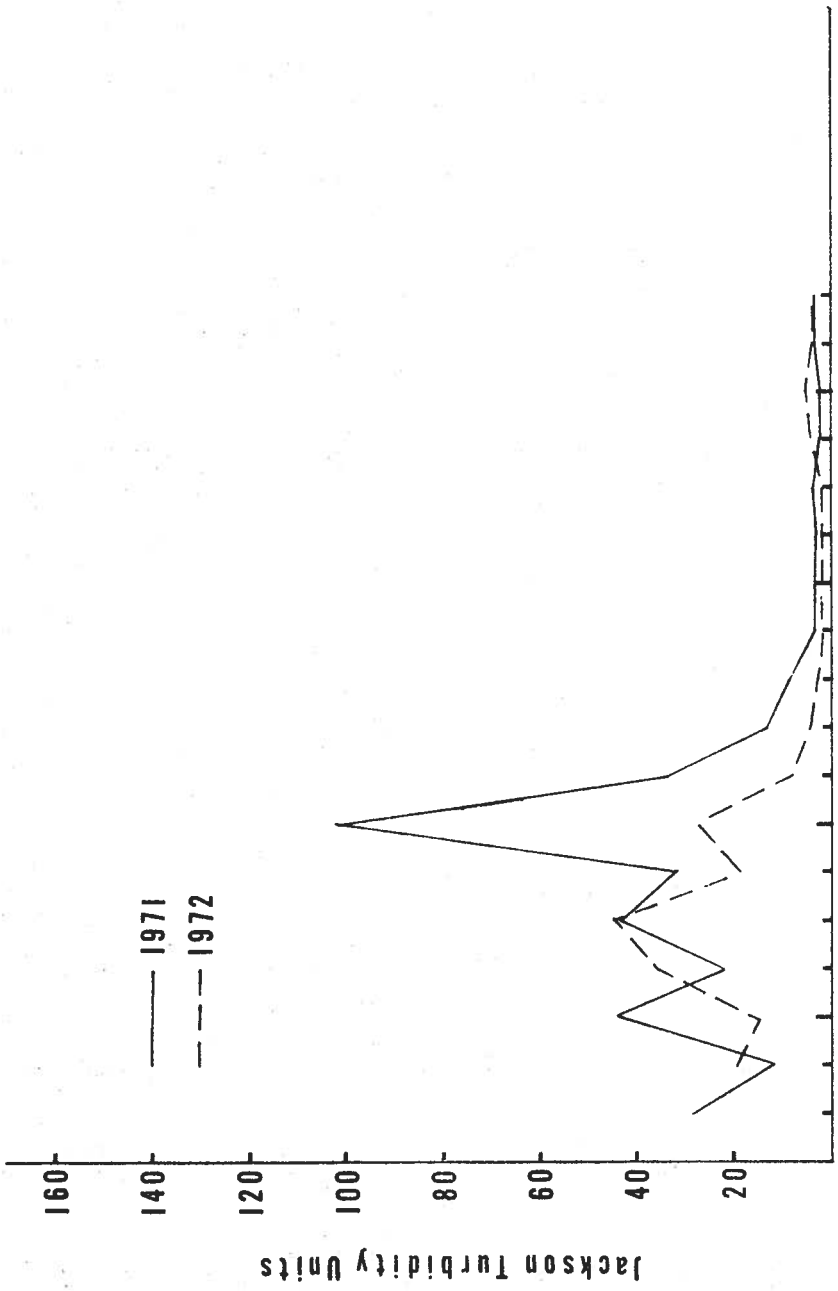

Figure 5. Turbidity for the West Gallatin River at the second highway bridge, 1971 and 1972.

Considering all periods the average length of the fisherman day ranged from 2.40 to 4.01 hours. In general, the average length increased as the season progressed and was greater on weekdays than on weekends-holidays (Table 2).

The total number of fisherman days for each period was determined by dividing the total number of fisherman hours by the average length of the fisherman day for that period (Table 2). The number of fisherman days was greater for section B than for section A during both years. The number of fisherman days increased 8.2 percent in section A and 22 percent in section B from 1971 to 1972. The number of fisherman days during strata three and four was greater than during strata one and two. The fishing intensity per day as measured by fisherman days was again higher for weekends-holidays than for weekdays.

Estimated total fisherman days per stream mile was 181 for section A and 224 for section B during 1971 while during 1972 these values were 196 and 274 for sections A and B, respectively. The nine aerial counts of fisherman were made between 2 and 4 p.m. and were compared to the average of the two road counts at these times to provide an index for estimating fishing intensity on parts of the river not censused and for correcting fishing intensity estimates in sections A and B. The indexes for correcting the counts for the sections were 1.61 for section A and 1.16 for section B. These adjustments increased the fisherman days in sections A and B to 291 and 260 during 1971 and

TABLE 2. TOTAL NUMBER OF FISHERMAN DAYS AND AVERAGE LENGTH OF THE FISHERMAN DAY (IN PARENTHESES) FOR EACH STRATA AND SECTION DURING 1971 AND 1972.

Strata	1971			1972		
	A	B	Total	A	B	Total
I Weekends-Holidays	209(2.23)	284(2.48)	493	114(3.10)	153(4.01)	267
I Weekdays	97(2.60)	246(2.40)	391	171(2.60)	209(3.50)	305
II Weekends-Holidays	177(3.20)	281(2.95)	458	149(2.69)	379(2.74)	528
II Weekdays	96(3.22)	274(2.53)	370	233(2.26)	330(3.73)	563
III Weekends-Holidays	279(3.32)	283(3.73)	562	290(3.07)	504(3.31)	794
III Weekdays	429(3.17)	503(3.53)	932	518(2.94)	806(3.58)	1324
IV Weekends-Holidays	253(3.54)	335(3.35)	588	271(3.41)	371(3.62)	642
IV Weekdays	451(3.90)	410(3.55)	861	426(3.06)	553(2.89)	979
Total Weekends-Holidays	918	1183	2101	824	1407	2231
Total Weekdays	1073	1433	2506	1348	1898	3246
Grand Total	1991	2616	4607	2172	3305	5477

to 316 and 318 during 1972. Fisherman counts during flights showed that non-censused portions of the river accounted for 27.5 percent of the total fishing while the censused portions accounted for 72.5 percent. Fishing intensity on the entire river in the canyon was projected using both indexes and was 213 and 246 fisherman days per stream mile during 1971 and 1972, respectively. Peterson (1970) found 635 and 534 fisherman days per stream mile for two years on Big Spring Creek and Vincent (1969) found 490 and 590 fisherman days per stream mile for two years on the Madison River.

Although fishing intensity was not great for the entire river when compared to Big Spring Creek and the Madison River, some portions of the West Gallatin had much higher fishing intensities than others (Table 3). Fisherman days per stream mile for the subsections in section A (not corrected by data from aerial flights) ranged from 515 in subsection A-1 (2.9 miles) during 1972 to 27 in subsection A-3 (2.2 miles) during 1971. Of the total fishing pressure in section A, 69.2 and 71.4 percent was in subsection A-1 during 1971 and 1972, respectively while subsection A-3 accounted for only 2.9 and 4.4 percent, respectively. In section B fishing pressure was more evenly distributed with the percent of fisherman days in the various subsections during both years ranging from 7.0 to 29.1. Fisherman days in section B ranged from 99 to 383.

TABLE 3. THE TOTAL NUMBER AND PERCENT OF FISHERMAN DAYS PER STREAM MILE FOR EACH SUBSECTION DURING 1971 AND 1972.

Section	Subsection	Length (Miles)	1971 Number Per Mile	1971 Percent	1972 Number Per Mile	1972 Percent
A	1	2.9	492	69.2	515	71.4
	2	3.1	92	13.8	86	12.7
	3	2.2	27	2.9	42	4.4
	4	2.9	100	14.1	83	11.5
B	1	1.8	277	19.1	346	19.2
	2	2.4	317	29.1	383	28.3
	3	2.0	99	7.6	114	7.0
	4	2.0	238	18.2	266	16.4
	5	3.6	189	26.0	263	29.1

Yield

Catch rates (fish caught per hour) for all game fish combined were computed for each section, for weekdays and weekends-holidays, and for each stratum, using separately information from interviews and from card returns (Table 4). Catch rates determined from card information were higher than those from interview data. Peterson (1970) found that catch rates from card information were lower than those from interview information. This difference was probably a result of the editing of census card hours that was done in this census but not done by Peterson. The interview information was used in projection of catch statistics as it was considered the most accurate. Catch rates for various periods and sections ranged from 0.25 to 0.97. Peterson (1970) found catch rates ranging from 0.31

TABLE 4. CATCH PER HOUR INCLUDING ALL GAME FISH COMPARING WEEKDAYS WITH WEEKENDS-HOLIDAYS, 1971 AND 1972.

	Interview Information							
	Weekdays				Weekdays-Holidays			
Stratum	A 1971	B 1971	A 1972	B 1972	A 1971	B 1971	A 1972	B 1972
1	.43*	.40*	.33*	.32*	.95	.90	.44	.87
2	.29	.63	.92	.56	.48	.36	.55	.44
3	.79	.48	.88	.56	.74	.38	.97	.50
4	.54	.34	.57	.26	.44	.25	.29	.39
Weighted Average	.60	.44	.72	.46	.63	.43	.59	.50
	Card Information							
1					.86	1.05	.59	.96
2	.62	1.02	1.23	.67	.43	.72	1.09	.56
3	1.01	.60	1.33	.58	.81	.47	.82	.68
4	.76	.39	.63	.42	.69	.37	.46	.47
Weighted Average	.81	.61	.90	.58	.71	.61	.74	.66

*Catch rates were applied as no field observations were made.

to 1.24 during two years on Big Spring Creek. Spence (1971) found yearly catch rates ranging from 0.60 to 0.91 in a ten year census on Rock Creek, Montana.

The differences in catch rates between weekends-holidays and weekdays were small. Catch rates for section A were consistently higher than those for section B for both years. Weighted average catch rates were slightly lower during 1972 than during 1971. Although there was considerable variation in catch rates for the various periods, stratum three catch rates were generally higher than those for other strata, particularly in section A. This may be partially attributed to the catch of hatchery trout, most of which were planted near the beginning of stratum three. Catch rates of wild rainbow trout for various sections and years ranged from 0.15 to 0.35 and for hatchery rainbow from 0.05 to 0.30 (Table 5). With the exception of whitefish in section A, 1972 catch rates of other fish were less than or equal to 0.08.

The yield was calculated as the product of the total fishing pressure (fisherman hours) and the catch rate. The yields from each section were calculated separately for weekdays and weekends-holidays, and for each stratum to compensate for possible differences between the various periods. The total yield for each study year then became the sum of the strata yields for each section. Number, percent of total, and catch rates by type of game fish are presented in Table 5.

TABLE 5. ESTIMATED CATCH RATES AND YIELD OF GAME FISH DURING 1971 AND 1972.

	1971						1972					
	A			B			A			B		
Species	No.	Percent	Catch Rate	No.	Percent	Catch Rate	No.	Percent	Catch Rate	No.	Percent	Catch Rate
Wild Rainbow	1882	46.8	.29	2903	80.3	.35	939	22.3	.15	2638	49.6	.24
Hatchery Rainbow	1497	37.2	.23	405	11.2	.05	1880	44.9	.30	2330	43.8	.21
Brown Trout	36	.9		138	3.8	.02	34	.8		93	1.7	
Cutthroat Trout	94	2.3	.01	24	.7		118	2.8	.02	78	1.5	
Brook Trout	0	0	0	9	.2		0	0	0	8	.2	
Mountain Whitefish	512	12.8	.08	139	3.8	.02	1225	29.2	.19	171	3.2	.02
Total	4021		.61	3618		.44	4196		.66	5318		.47

Wild and hatchery rainbow trout contributed 84 percent of the total game fish taken in section A and 91.5 percent of the total game fish taken in section B during 1971 while during 1972 these values were 67.2 and 93.4 percent for sections A and B, respectively. Of the remaining game fish taken, mountain whitefish contributed most particularly in section A where they represented 12.8 and 29.2 percent of the total catch in 1971 and 1972, respectively. The catch of whitefish may be biased upwards as a result of interviewing a disproportionate number of times one individual who fished mainly for whitefish. Catches of brown trout and cutthroat trout were similar in magnitude and in no period or section did either exceed 3.8 percent of the total catch. More cutthroat trout than brown trout were caught in section A while more brown trout than cutthroat trout were caught in section B. A few brook trout were caught in section B.

Hatchery rainbow trout contributed 37.2 percent of all game fish taken in section A and 11.2 percent taken in section B during 1971 while during 1972 these values were 44.9 and 43.8 percent in sections A and B, respectively. These values may be biased toward the catch of hatchery rainbows since most interviews were made in easily accessible areas where most of the hatchery fish were planted. From 1971 to 1972 the take of hatchery rainbows increased 25.6 percent in section A and 475 percent in section B while the take of wild rainbows decreased 50 and 9.1 percent in sections A and B, respectively. There was an

increase in the catch rate of hatchery trout accompanied by a decrease in the catch rate of wild rainbow trout in both sections from 1971 to 1972. The estimated percent return of hatchery rainbow trout during 1972 was 41.8 and 46.6 percent for sections A and B, respectively.

During 1971, an estimated 4,021 game fish were caught and kept in section A during 1,991 fisherman days for an average of 2.32 fish per fisherman day while in section B during the same year 3,618 game fish were caught and kept during 2,616 fisherman days for an average of 1.38 fish per fisherman day (Table 6). During 1972, in section A an estimated 4,196 game fish were caught and kept during 2,172 fisherman days for an average of 1.93 fish per fisherman day while in section B during the same year an estimated 5,318 game fish were caught and kept during 3,305 fisherman days for an average of 1.61 fish per fisherman day. The yield was directly related to the hours fished except for strata two in section A and B, 1971 and for strata four for section A during both years. During the latter strata the yield was lower than would be expected based on hours fished. The total yield was higher on weekdays for both sections both years but yield per day was greater for weekends-holidays as would be expected since weekends-holidays had the highest fishing intensity per day.

The water surface area of each study section was approximated from four width measurements taken in each section during the high water period. Harvest in pounds per acre for each game species is

TABLE 6. ESTIMATED TOTAL YIELD OF GAME FISH FOR EACH STRATA AND SECTION ON WEEKDAYS AND WEEKENDS-HOLIDAYS, 1971 AND 1972.

	1971				1972			
	A		B		A		B	
Stratum	WD*	WE-H**	WD	WE-H	WD	WE-H	WD	WE-H
1	108	443	235	633	147	155	236	537
2	89	271	439	296	463	222	691	460
3	1075	687	845	402	1342	862	1629	829
4	955	393	490	278	737	268	416	520
Total	2227	1794	2009	1609	2734	1504	2972	2346

*Weekdays
**Weekends-Holidays

presented in Table 7. Harvest of wild trout ranged from 5.65 to 13.15 pounds per acre and for all wild game fish from 12.84 to 18.23. Section A had the highest yield per acre for all wild game fish but section B had the highest yield per acre for wild trout. Peterson (1970) found a harvest ranging from 29 to 104 pounds per acre of wild trout for two sections during two years on Big Spring Creek.

During 1971, 2,657 game fish were caught and released in section A and 1,523 in section B while during 1972 these values were 2,114 and 1,375, respectively. These were 37 and 25 percent of the total fish caught during both years in sections A and B, respectively. Of the fish released approximately 95 percent were trout and 5 percent were whitefish. The highest percent of release of fish occurred during strata four, particularly in section A. Peterson (1970) found that

TABLE 7. POUNDS PER SURFACE ACRE OF EACH TYPE OF GAME FISH FOR EACH SECTION, 1971 AND 1972.

Type of Game Fish	1971 A	1971 B	1972 A	1972 B
Wild Rainbow	9.77	11.69	4.89	10.14
Cutthroat	.38	.08	.47	.25
Brown Trout	.41	1.36	.39	.92
Brook Trout	0	.02	0	.02
Total Wild Trout	10.56	13.15	5.65	11.33
Hatchery Rainbow Trout	4.24	.99	5.32	5.69
Total-All Trout	14.80	14.14	10.97	17.02
Mountain Whitefish	5.26	1.23	12.58	1.51
All Wild Fish	15.82	14.38	18.23	12.84
All Fish	20.06	15.37	23.55	18.53

during early and mid summer 17 percent of the fish caught on Big Spring Creek were released while during late summer about 50 percent were released.

Age and Growth

Scale samples were taken randomly from an estimated 5.2 percent of the wild trout caught in the study sections during the two census years. Of the 468 samples taken, 87 percent were from wild rainbow trout, 8 percent from cutthroat or rainbow-cutthroat hybrid trout, and 5 percent from brown trout (Table 8). Of the wild rainbow trout

TABLE 8. AGE GROUPS AND AVERAGE CALCULATED TOTAL LENGTHS AT EACH ANNULUS FOR TROUT TAKEN DURING 1971 AND 1972. THE PERCENT COMPOSITION OF EACH TAXON BY AGE GROUP IS IN PARENTHESES.

Year	Species	Age Group	Number	Average Total Length	Annulus 1	2	3	4	5
1971	Rainbow Trout	I	3(1.1%)	7.6	4.6				
1971	Rainbow Trout	II	66(23.7%)	8.8	3.7	7.2			
1971	Rainbow Trout	III	148(53.2%)	11.0	3.4	6.7	10.0		
1971	Rainbow Trout	IV	60(21.6%)	12.4	3.0	6.0	8.7	11.2	
1971	Rainbow Trout	V	1(.4%)	16.5	3.2	5.8	7.2	12.4	15.0
Total			278		3.4	6.7	9.6	11.2	15.0
1972	Rainbow Trout	I	5(3.6%)	7.3	4.0				
1972	Rainbow Trout	II	45(32.4%)	9.2	3.9	7.1			
1972	Rainbow Trout	III	72(51.8%)	10.9	3.5	6.4	9.0		
1972	Rainbow Trout	IV	15(10.8%)	13.2	3.1	5.9	9.1	11.5	
1972	Rainbow Trout	V	2(1.4%)	16.0	3.5	5.7	8.2	11.6	14.1
Total			139		3.6	6.6	9.0	11.5	14.1
71-72	Cutthroat Trout	I	1(2.7%)	9.0	6.4				
71-72	Cutthroat Trout	II	23(62.2%)	9.2	3.7	7.1			
71-72	Cutthroat Trout	III	13(35.1%)	11.8	3.7	6.8	9.6		
Total			37		3.8	7.0	9.6		
71-72	Brown Trout*	I	2(8.7%)	7.0	3.8				
71-72	Brown Trout	II	1(4.3%)	8.8	4.8	7.6			
71-72	Brown Trout	III	14(60.9%)	13.3	3.9	8.1	11.4		
71-72	Brown Trout	IV	6(26.1%)	16.7	3.9	7.8	11.7	14.8	
Total			23		3.9	8.0	11.5	14.8	

*A 23 inch Brown Trout was not included.

aged, 26.6 percent were age group II, 52.8 age group III, and 18 age group IV. Only 2.6 percent of the samples taken were of fish younger than II or older than IV. Of the 37 cutthroat trout aged, 2.7 percent were age group I, 62.2 age group II, and 35.1 age group III. Of the 24 brown trout aged 8.3 percent were age group I, 4.2 age group II, 58.3 age group III, and 25 age group IV. The largest fish measured was a brown trout 23 inches long that weighed approximately five pounds and was six years old. Three other brown trout of similar size were known to have been taken during the census.

Samples taken from wild rainbow trout were combined for the two study sections for each year as there was little difference in age structure and growth between the two sections. Data from both sections and years were combined for cutthroat and brown trout because of the small sample sizes. The average increment added each year was similar for the rainbow and cutthroat trout but was greater for brown trout. Purkett (1950) found that fish from two sections of the West Gallatin River in the canyon (roughly corresponding to sections A and B) had no significant differences in growth rates. However, no brown trout were collected in the canyon area during his study. He also found from fish taken from the river in the valley area that after the first year brown trout exceeded all other species of trout in annual growth increment. The average length of the rainbow trout at the end of each year of life was: I-3.5 inches, II-6.6 inches, III-9.4 inches,

IV-11.2 inches, and V-14.4 inches. Cutthroat trout averaged 3.8 inches at I, 7.0 inches at II, and 9.6 inches at III while brown trout averaged 3.9, 8.0, 11.5, and 14.8 inches at annuli I-IV, respectively. Growth rates of rainbow and brown trout were about the same as the average for these species in Montana streams while cutthroat trout in the West Gallatin River had greater than average growth (Peters, 1964).

Characteristics of Fishing Parties

Party size ranged from one to 13 individuals in 1971 and from one to 21 in 1972. Two was the most predominant party size, representing about 39 percent of the total each year. The average party size was 3.19 for 1971 and 3.14 for 1972. No significant differences in average party size occurred between sections or strata but party size was generally greater on weekends-holidays than on weekdays. The mean number of people in the party that were fishing was 2.17 during 1971 and 2.23 during 1972. Of the total fisherman interviewed during 1971 sixty-six percent were males, 17 percent females, and 17 percent children while during 1972 these values were 64, 20, and 16 percent, respectively. Individuals in the party were classified according to one of three categories based on residence; locals were those persons residing within an easy one day round trip to the West Gallatin and including Three Forks, Livingston, West Yellowstone and intermediate points; residents were those persons residing in Montana but outside

the above limits; and tourists were those persons from out-of-state. Of the total people interviewed in section A for both years combined, locals accounted for 39.7 percent, tourists 45.0 percent, and residents 15.5 percent while these values for section B were 44.8, 37.3, and 17.9 percent, respectively. Of the parties interviewed on weekends-holidays combined for both section and years, locals accounted for 51.2 percent of the total, tourists 31.6 percent, and residents 17.2 percent while for those interviewed on weekdays the percentages were 22.3, 61.9, and 15.8, respectively. During strata one and two combined for both sections and years, locals accounted for 59.5 percent of the total, tourists 26.9 percent, and residents 13.6 percent. During strata three and four combined for both sections and years, these values were locals 31.9 percent, tourists 49.7 percent, and residents 18.4 percent. These data showed that section A, strata three and four, and weekdays were characterized as tourist fisheries while section B, strata one and two, and weekends-holidays were characterized as local fisheries.

Fishing Success

The percent of parties that caught a limit of trout (10 per individual) ranged from 2.7 to 5.9 considering both sections during both years while the percentage of parties that took no fish ranged from 23.8 to 33.8. Card information was used to obtain these values

as it represented complete fishing days. Because card information was used the contribution of hatchery trout to the limits could not be differentiated. However, the lowest number of parties catching limits and the second highest number catching no fish occurred in section B during 1971 which was also the section and year that had the lowest catch of hatchery fish. If the limit of trout per individual were five the percentage of parties that caught limits would have ranged from 11.0 to 18.8 and the total trout catch would have decreased by 19.9 percent. Peterson (1970) found that 3.0 and 3.8 percent of the parties caught a limit of ten fish per individual during two years on Big Spring Creek while the percentage of parties catching five fish per individual was 17.7 and 12.4. He also found that the percentage of parties catching no fish was 29.4 and 37.4.

In section A during both census years and in section B during 1972 parties of tourists caught more trout than did parties of locals or residents. The success of the tourists was partially dependent on stocked fish since data from the interviews showed that the percentage of hatchery trout in the total catch for tourists, residents, and locals was 51.6, 29.7, and 14.5, respectively.

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