F-9-R-28
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MONTANA DEPARTMENT OF FISH, WILDLIFE & PARKS
FISHERIES DIVISION
JOB PROGRESS REPORT

State: Montana
Title: Southwest Montana Fisheries Investigations

Project No.: F-9-R-28

Job No.: IIc
Title: Fishing Regulation Evaluation on Major Trout Waters

Period Covered: April 1, 1979 through March 31, 1980

ABSTRACT

Two study sections were set up on the Madison River between 6.0 and 10.0 miles below Quake Lake to determine the effect of heavy angling pressure on the wild trout populations. One section, Pine Butte, was open to catch-and-release fishing with artificial lures and flies only and the other section (Snoball) remained closed to all fishing. After three years of fishing closure, the Snoball section showed a 398% increase in numbers and 328% increase in biomass of three-year-old rainbow trout from 1976. No additional improvement in the brown trout population was found from 1978. After two years of catch-and-release only fishing in the Pine Butte section, the number of three-year-old & older rainbow trout increased 226% and biomass increased 168%, while similar aged brown trout increased 141% in number and 104% in total biomass from 1977. The total summer mortality for wild rainbow trout was higher in the catch-and-release section, 50%, than for the closed to fishing section, 27%. Angling pressure in the catch-and-release section increased 75% over the first year under catch-and-release only, but the catch rate for wild trout decreased 46% from 2.75 in 1978 to 1.49 trout/hour in 1979.

A creel census-fish population study was set up on the Corwin Springs section of the Yellowstone River to determine the effects of angling pressure on the wild trout populations. Trout population estimates show brown trout to be the predominant trout in the section. Approximately 84% of all trout caught are released rather than being kept. Boat anglers catch 71% of the total trout caught versus 29% for bank anglers. The Corwin Springs section supports 740.7 hours of angling per mile with the summer months of July, August and September accounting for about 70% of the total. The average size of trout kept in 1978-79 is about the same as found in 1963. Brown trout average slightly larger than either cutthroat or rainbow trout with the largest being taken during the winter and early spring months (December-May). Residents comprise 76.7% of the total fishing pressure with peak non-resident use occurring from July through October. Flies are the most common lure type used.

BACKGROUND

The Madison River is a nationally known "blue ribbon" wild trout stream that over the years has received a steady increase in angler use. Studies beginning in 1952 (U. S. Fish & Wildlife Service, 1951) and again in 1967 (Vincent, 1969) show that angling pressure had increased about 14.3% annually during the fifteen year period. Mail surveys of anglers contacted by the Montana Dept. of Fish and Game in 1975 estimated a 5% annual increase in angling pressure from 1967 through 1975. This large increase in angling use from 215 angler-days in 1952 to 953 angler-days per mile use in 1975 could have a detrimental effect on the wild trout population in both numbers and size available to future anglers. Also, there has been considerable controversy as to whether or not fishing from a floating craft has a detrimental effect on the wild trout populations.

In the upper Yellowstone basin, as in most areas, demand for recreation is increasing. Sport fishing, one of the most popular forms of recreation, is a traditionally important industry in this area. The importance of maintaining a quality fishery in the upper Yellowstone River is paramount. Recreation is not the only user of the Yellowstone as agriculture and industry look upon the water for irrigation and potential future power sources. The Yellowstone River today remains the last major undammed river in the lower 48 states. This fact, coupled with the high recreational potential of the river, has created considerable support in maintaining the river in as natural a state as possible. The upper Yellowstone represents 23% of Montana's "blue ribbon" trout water. This 103 mile stretch of the Yellowstone not only supports brown and rainbow trout, but a population of Yellowstone cutthroat trout.

OBJECTIVES AND DEGREE OF ATTAINMENT

To determine the effect of angling on total numbers, size composition, species composition, age composition and total mortality rates on wild trout populations in a section of the Madison and Yellowstone Rivers. Data included in this report.

To monitor the status of wild trout populations in a "closed to fishing" section of the Madison River and compare to "open to fishing" years. Data included in this report.

PROCEDURES

Electrofishing gear was used to sample fish populations in the Snoball and Pine Butte sections of the Madison River and the Corwin Springs section of the Yellowstone River. Population estimates were made in April prior to the opening day of fishing and again in September after most of the angling pressure had ceased in the Madison River and during the spring in the Yellowstone River. On the Madison River, electrofishing was carried out

while floating through the section in a fiberglass boat using the mobile positive electrode system; while in the Yellowstone River, the fixed "boom" electrode system was used on an eighteen foot aluminum boat equipped with an 80 hp outboard jet motor. Two or more "marking" and/or "recapture" trips were necessary where sample sizes were small and/or efficiencies were low. Usually a 10-15 day interval was allowed between marking and recapture trips. Scale samples were taken for age determination. Actual mathematical computations were made by a computer programmed to use methods described by Vincent (1971 & 1974).

An intensive creel census was conducted on the upper fifteen miles of the Madison River between Hebgen Reservoir and Squaw Creek with special emphasis on the 3.0 mile Pine Butte study section. The creel period on this area was from May, 1979 to September 20, 1979. Another intensive creel census was conducted on the Corwin Springs section of the Yellowstone River from October 15, 1978 through October 14, 1979. Creel checks and angler counts were made to determine catch rates; angling pressures; and harvest by age, size and species where applicable. Computations of creel census data was done by a computer using methods described by Neuhold & Lu (1957).

On the Madison River, the Pine Butte study section (3.0 miles in length) was located about six miles downstream from Quake Lake, while the Snoball section (4.5 miles in length) begins about one mile downstream from the end to the Pine Butte section (Figure 1). On the Yellowstone River, the Corwin Springs section (5.0 miles in length) began at the Corwin Springs bridge and ended at the U.S. Forest Service boat launch above Yankee Jim Canyon (Figure 2).

FINDINGS

Madison River

During the first two years of the Madison River creel census fish population study (1975 and 1976) when the daily creel limit was 10 trout or 10 pounds & one trout, the summer mortality for three-year-old & older brown and rainbow trout was unusually high in the Snoball study section (Vincent, 1977). Because of this high mortality rate, the Snoball study section was closed to fishing for the 1977-78 and 1978-79 fishing seasons which resulted in a decrease in the summer mortality rates (Vincent, 1979). The Pine Butte study section which was set up in 1977 to continue the creel census-fish population study with the 10 trout or 10 pound & one trout limit showed the same high summer loss of three-year-old & older trout during the 1977-78 fishing season, thus a catch-and-release artificial lures only regulation was initiated in 1978 (Vincent, 1978). This resulted in lower summer mortalities for three-year-old & older trout for 1978.

Table 1 shows the age structure, total numbers and total biomass estimates for wild brown and rainbow trout in the Snoball and Pine Butte study sections for 1979. The fishing closure initiated in 1977 for the Snoball section was continued through the 1979 fishing season showing a continued increase in

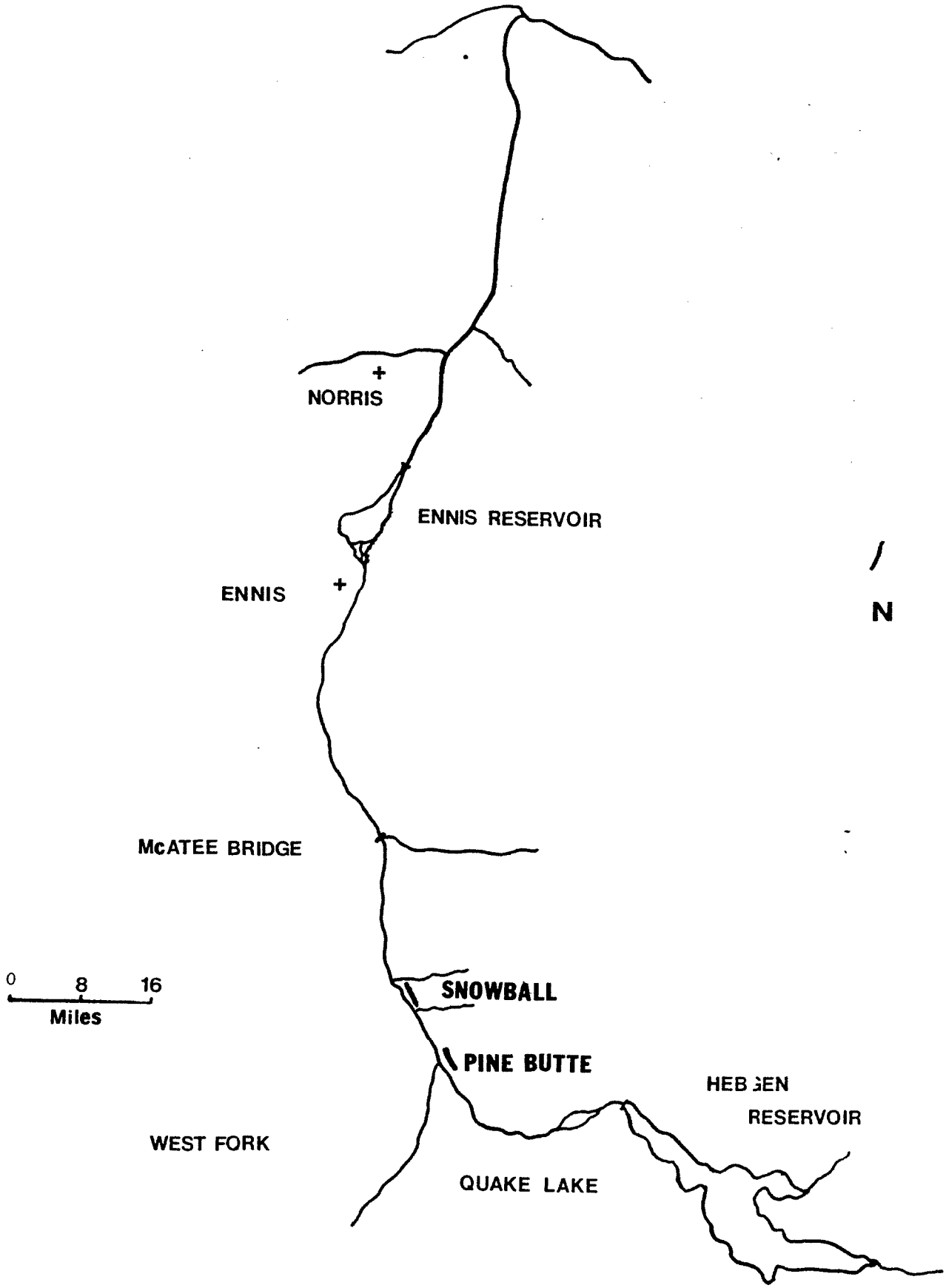
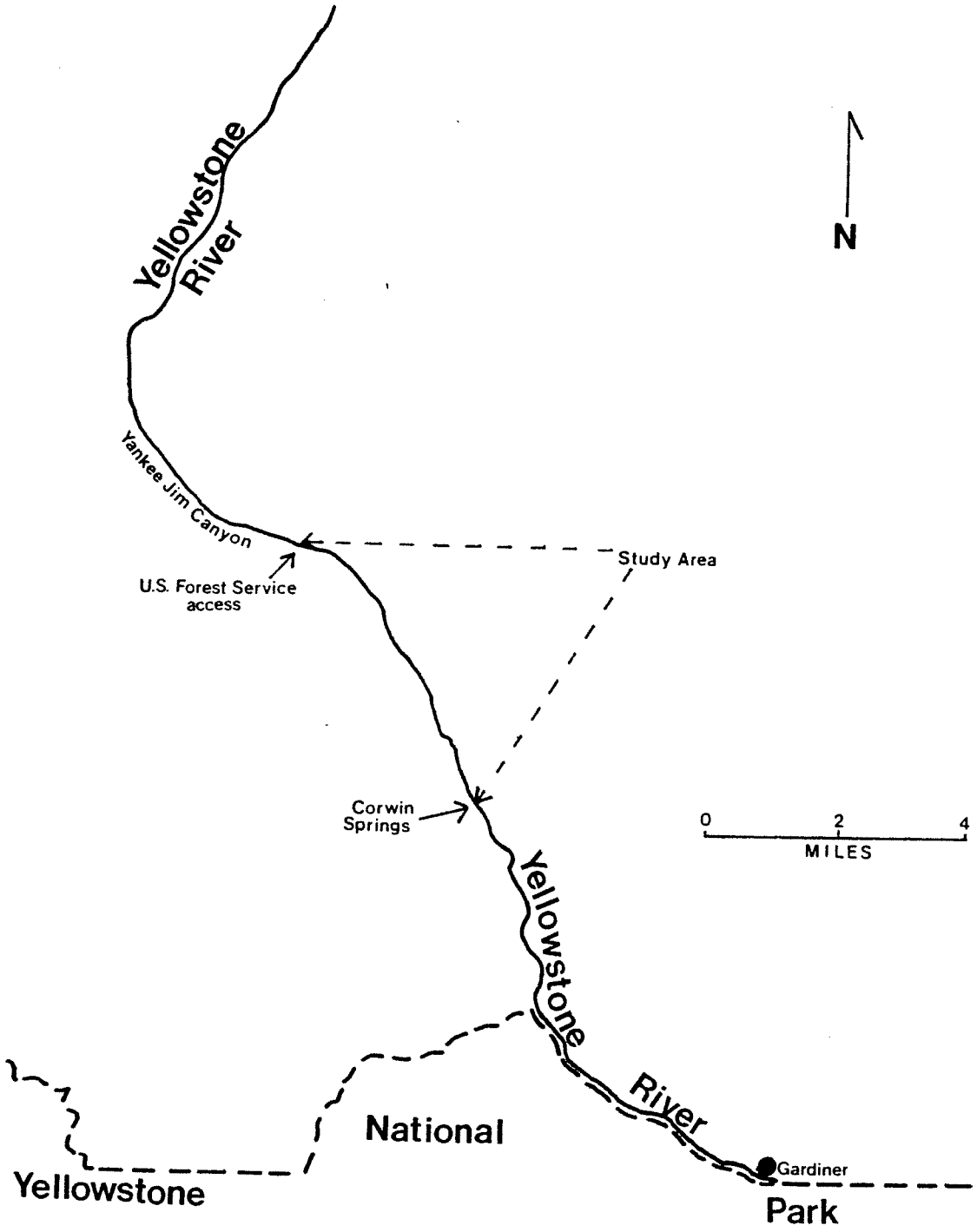


FIGURE 1. Map of the Madison River showing study sections.

Figure 2. Map of the study area.



three-year-old & older rainbow trout and a stabilization of larger brown trout numbers and biomass (Table 2). After three years of fishing closure, the three-year-old & older rainbow trout increased 398% in numbers and 323% in biomass or a 31% increase in numbers and biomass over 1978. Brown trout showed no increase in numbers and biomass from 1978 but maintained gains made from 1977 to 1978. The catch-and-release regulation initiated in 1978 was also continued for 1979. Table 3 shows that after two years of catch-and-release fishing, the three-year-old & older rainbow trout had increased 226% in numbers and 168% in biomass, while the brown trout had increased 141% in numbers and 104% in total weight.

After three years of fishing closure on the Snoball section and two years of catch-and-release fishing on the Pine Butte section, there have been substantial increases in the number of larger wild trout. In the Snoball section, large rainbow trout (14 inches & larger) increased from 70 to 181 per mile or 159%; while large brown trout increased from 36 to 240 per mile or 567% (Table 4). After two years of catch-and-release and artificial lures only fishing, the 14 inch and larger rainbow has increased from 89 to 238 per mile or 167% while the large brown trout increased from 150 to 294 per mile or 96% (Table 5).

During years in which angling was allowed in the Snoball section (1975 & 1976), the summer mortality rate for larger rainbow and brown trout (three-years-old & older) was excessively high, 62-75%. During 1977, the first year the section was closed to fishing, this high summer mortality dropped to 18% for rainbow trout and 28% for brown trout. Continued lower summer losses for larger rainbow trout in 1978-30% and 1979-27%, plus lower rates for larger brown trout, 7% in 1978 and 39% in 1979, indicated high summer angling induced mortality was limiting large trout numbers (Table 6). In 1977, the Pine Butte study section showed similar high summer losses of larger trout under the 10 trout or 10 pounds & one trout limit. With the advent of the catch-and-release regulation in 1978, the summer losses of three-year-old & older rainbow decreased from 71% to 47% in 1978 and 50% in 1979 (Table 7). Brown trout mortalities decreased from 44% in 1977 to 34% in 1978 and 11% in 1979. The higher summer losses of three-year-old & older rainbow trout in the Pine Butte section versus the Snoball section probably are due to release mortalities associated with hooking, "playing" and release of the trout back into the river.

Mortality rates of wild trout populations can be divided into two main categories: (1) density independent mortality - that mortality due to such factors as: disease, accidents, old age and some predation which would occur irregardless of population densities; and (2) density dependent mortality - that mortality due to more individuals than existing habitat can support for a given period - angler induced mortality and some other predation can fall within this type. Density independent mortality occurs at a given rate in any population all year, but density dependent mortality can only occur if temporary overpopulation occurs due to reduction of existing habitat and/or to growth of existing individuals and recruitment of new trout. Density independent mortality is generally observed by density-dependent mortality since most calculated mortality rates are the sum of both types. In order to identify the density independent mortality, trout populations must be well below habitat carrying capacities and then the factor(s) "suppressing" the trout population must then be eliminated. Mortality

rates of wild trout population reaching some habitat capacity, should be the density independent mortality. This condition probably occurred in the Snoball section in 1977 when angling (which was holding large trout populations well below carrying capacities) was prohibited. The resulting summer mortality of large rainbow trout (three-years-old & older) should have been only density independent (18%). Similarly during the winter period of 1975-76 and 1976-77, when population densities of older trout were low and little or no fishing occurred, an average density independent mortality rate of 5% occurred. Given existing recruitment rates of about 50%, the total annual mortality rates for large rainbow trout could be 50% without reduction in their number, but due to an annual density independent mortality of 20-25%, the annual induced trout mortality (density dependent mortality) could only be 25-30% without harm to existing size structures. This means that harvest plus release losses should not exceed 30%.

Changing from a 10 trout or 10 pounds & one trout limit in 1977 to a catch-and-release artificial lures only regulation in 1978 has resulted in changes in the catch rate and/or angling pressure. In 1978, the first year of catch-and-release fishing resulted in a 41% drop in angling pressure, but by the second year it had recovered and was 4% higher than in 1977 (Table 8). Total catch rates responded in reverse with a 2.75 trout/hr. in 1978, a 101% increase over 1977, but in 1979 declined to 1.49 or only 9% higher than 1977. Total trout caught ranged from 83% of the spring population of two-year-old & older trout in 1977 to 101% in 1979. In comparing monthly angling pressures, the section shows a steady increase in angler use until it peaks in July (Table 9). This probably corresponds to the peak use by fly fishermen. Catch rates for rainbow trout begin high in May and slowly decline until September where the catch rate is 28% that of May. Catch rates for brown trout do not respond in this manner and seem to be somewhat constant all summer. Brown trout represent 20% of the spring wild trout population two-years-old & older and represent 23% of the summer catch.

It is apparent that with the reduction in trout harvest in the catch-and-release section, the wild trout population is able to expand in the older and larger trout groups, but that total catch rates may be dependent, in this case, on total angling pressure.

Yellowstone River

Spring population estimates made for brown, rainbow and cutthroat trout in the Corwin Springs section during 1978 and 1979 are shown in Table 10. Brown trout are the most abundant trout species found, especially in the larger size groups such as the 10-17.9 inch size category. Cutthroat trout probably are the least abundant trout species in this section of the Yellowstone. Population data is based on low recapture numbers, which results estimates of questionable accuracy.

In comparing catch rates for the four game species present, mountain whitefish had the highest catch rate comprising 44% of all fish caught (Table 11). Brown trout had the highest catch rate for any trout species present. These higher catch rates probably are due to their higher abundance

rather than their high vulnerability. On the other hand, the cutthroat and rainbow trout which are considerably less abundant than brown trout have catch rates only 18% and 49% lower than brown trout, respectively. In comparing total trout caught, all three trout species are about equal with rainbow comprising 34% of the catch, brown trout 33% and cutthroat 33% (Table 12). Only in trout kept over 14 inches does brown trout predominate accounting for 53% of the total kept (Table 13). Most of the trout caught in this section of the Yellowstone River are released as 83% of the rainbow, 84% of the brown and 85% of the cutthroat are released. Also, boat anglers release more trout than shore anglers with 89% released versus 49% (Table 14). Boat anglers also catch more trout, accounting for 71% of the total catch of trout. Shore anglers seem to be more selective towards brown trout, accounting for 49% of the brown trout catch, but only 17% of the rainbow and 23% of the cutthroat; while float anglers account for 83% and 77% of the rainbow and cutthroat, respectively. This high incidence of rainbow and cutthroat trout in the creel and in the catch versus their lower numbers in the population makes them very susceptible to overexploitation.

Total angling pressure for this section is 3704 hours during the period of study from Oct. 15, 1978 through October 14, 1979 or 740.7 hrs./mile. In comparing angling pressure on this section of the Yellowstone with other larger rivers in the area, the fishing pressure was lower than either the Gallatin River near the Karst Ranch or the Upper Madison River in the Snoball and Pine Butte sections (Table 15). July had the highest monthly fishing pressure accounting for about 35% of the annual (Figure 3). The three months of July, August and September accounted for about 70% of the total annual pressure. These three months also are the months of the highest boat use accounting for 60% of their total pressure and 41% of the annual angling pressure.

In comparing the average size of game fish caught during the July-September, 1979 period with that found by Johnson (1963) for the same period, the brown trout showed no change, wild rainbow trout slightly smaller and cutthroat trout slightly larger (Table 16). The largest brown trout appear to be taken during the winter and early spring (December-May).

During the period of census, 76.7% of the anglers checked were residents of Montana with the remaining 23.3% being non-residents (Table 17). Non-residents were the most numerous during the July through October period, as 91.7% of their use occurred then. A greater percent of non-residents used boats (68.8%) when fishing than did residents (29.1%) and is probably a result of commercially guided trips.

Flies were the most common bait type, comprising 42% of the total use versus 20% each for hardware and bait (Table 18). Boat anglers showed the highest preference for flies with 82% selecting this bait type. Shore anglers more commonly chose bait (50%) versus 3% for boat anglers. The higher use of bait by shore anglers and flies by boat anglers could also explain higher success in catching of brown trout by shore anglers and rainbow-cutthroat by boat anglers.

Figure 3. Estimated fisherman hours during each month in the study area.

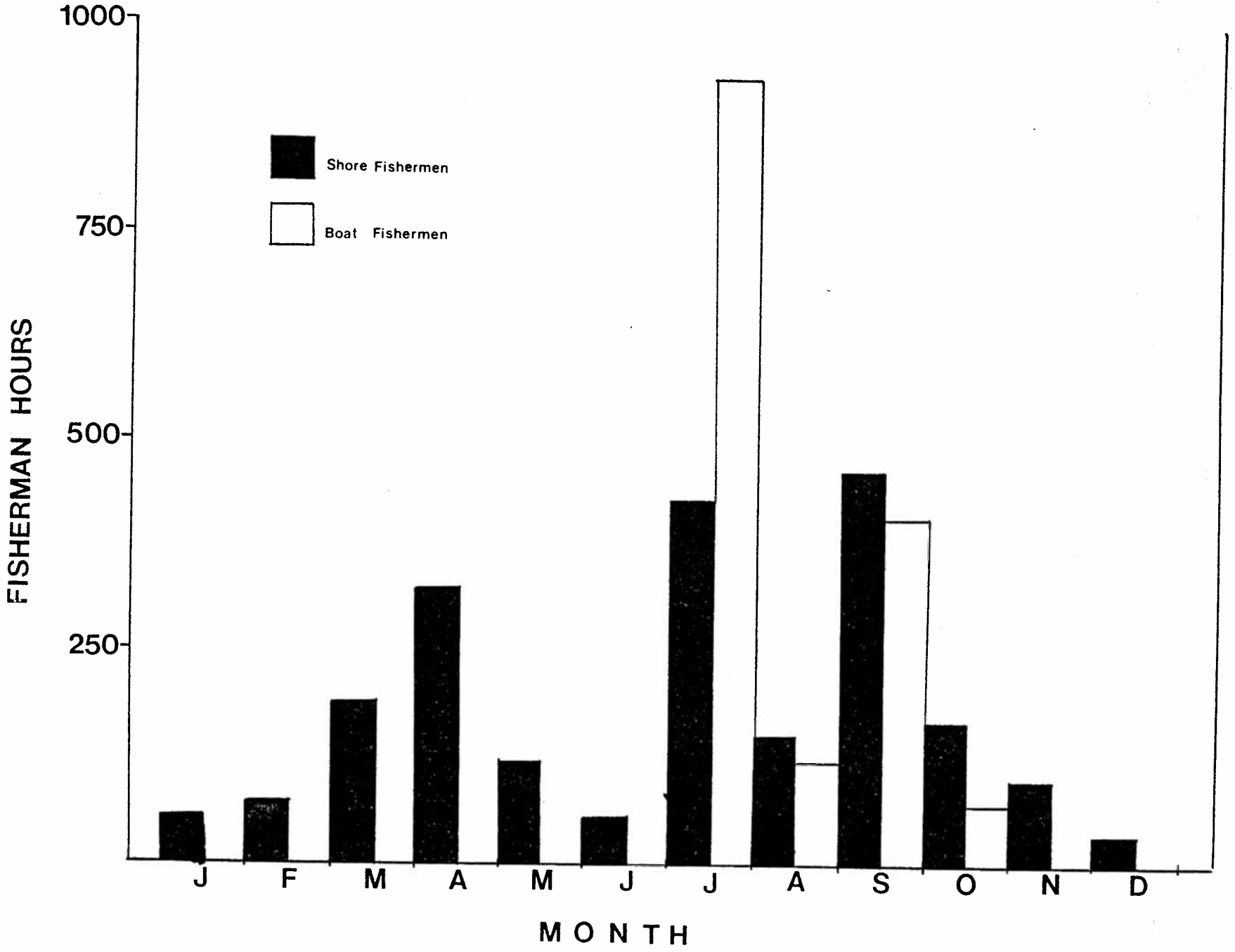


Table 1. Wild brown and rainbow trout population, biomass and age structure estimates for the Snoball and Pine Butte sections of the Madison River for 1979. Confidence intervals at the 80% level are shown in parentheses.

	Spring Population Estimate (April)	Fall Population Estimate (Sept.)	Spring Population Estimate (April)	Fall Population Estimate (Sept.)
	Pine Butte - 3.0 miles		Snoball - 4.5 miles	
		Rainbow Trout		
Age Group				
I	1/	4654	1/	4344
II	3110	2350	2010	1450
III	4153	1901	3238	1885
IV	1133	649	2165	1837
V & older	329	237	1545	1333
	8725 (±1094)	9791 (±1365)	8958 (±1446)	10849 (±1909)
Total Wt. (lbs.)	4821 (±617)	4120 (±595)	5379 (±1036)	5369 (±1103)
		Brown Trout		
Age Group				
I	1/	1263	1/	898
II	725	652	2/	731
III	963	909	1440	873
IV & older	471	376	1085	672
	2159 (±523)	3200 (±673)	2525 (3/)	3174 (±528)
Total Wt. (lbs.)	1545 (±423)	2427 (±718)	2132 (3/)	2564 (±624)

1/ No spring estimate for yearling rainbow and brown trout.

2/ Insufficent recaptures to make estimate.

3/ No confidence interval for two-year-old & older brown trout.

Table 2. Comparison of changes in brown and rainbow trout numbers and biomass in the Snoball section from Sept., 1976, (when open to fishing), to Sept., 1979. This section was closed to fishing starting in 1977. All trout are three-years-old & older.

Year	Sept. Population Estimate	Sept. Total Biomass Estimate (lbs.)	Percent Change From Sept., 1976 Numbers	Biomass
		Rainbow Trout		
1976	1016	986	-	-
1977	2721	2377	168%	141%
1978	3865	2916	280%	196%
1979	5056	4224	398%	328%
		Brown Trout		
1976	435	534	-	-
1977	1096	1430	152%	206%
1978	1650	2050	279%	284%
1979	1545	2021	255%	278%

Table 3. Comparison of changes in brown and rainbow trout numbers and biomass in the Pine Butte section from Sept., 1977, (following a year with the 10 trout or 10 pounds and one trout limit) with Sept., 1978 & 1979 (years of catch-and-release fishing with artificial lures and flies). All trout are three-years-old & older.

Year	Sept. Population Estimate	Sept. Total Biomass Estimate (lbs.)	Percent Change From Sept., 1977 Numbers	Pounds
		Rainbow Trout		
1977	854	885	-	-
1978	1453	1376	70%	55%
1979	2787	2372	226%	168%
		Brown Trout		
1977	533	835	-	-
1978	705	1155	32%	38%
1979	1285	1701	141%	104%

Table 4. Comparison of changes in the number of brown and rainbow trout in the Snoball section following the fishing closure in 1977. Numbers are shown as trout per mile.

Size	Year 1975	1976	1977	1978	1979
	10 trout or 10 lbs. & one trout limit		Closed to Fishing		
			Rainbow Trout		
10-14 inches	637	307	1127	1152	1038
14 inches & larger	60	70	136	153	181
			Brown Trout		
10-14 inches	181	190	478	441	224
14 inches & larger	39	36	125	225	240

Table 5. Comparison of changes in the number of brown and rainbow trout per mile in the Pine Butte section following the change to catch-and-release fishing in 1978.

Size	10 trout or 10 lbs. & one trout limit 1977	Catch & Release Only with Artificial Lures 1978	1979
		Rainbow Trout	
10-14 inches	563	1321	1807
14 inches & larger	89	153	238
		Brown Trout	
10-14 inches	262	394	338
14 inches & larger	150	213	294

Table 6. Comparison of summer mortality for three-year-old & older brown and rainbow trout in the Snoball section between years open to fishing (1975 & 1976) and years closed to fishing (1977 through 1979).

Year	Spring Population Estimate (April)	Fall Population Estimate (Sept.)	Summer Mortality Rate (Apr. through Sept.)	Total Trout Kept (Percent of Spring Population)
			Rainbow Trout	
1975[1/]	5141	1612	75%	1364 (27%)
1976[1/]	4045	1016	75%	848 (21%)
1977[2/]	3247	2661	18%	0
1978[3/]	5526	3871	30%	0
1979	6948	5056	27%	0
			Brown Trout	
1975[1/]	1388	379	73%	331 (24%)
1976[1/]	1134	435	62%	386 (34%)
1977[2/]	1520	1096	28%	0
1978[3/]	1775	1650	7%	0
1979	2526	1545	39%	0

[1/] Data from Vincent, 1977.

[2/] Data from Vincent, 1978.

[3/] Data from Vincent, 1979.

Table 7. Comparison of summer mortality for three-year-old & older brown and rainbow trout in the Pine Butte section between 1977 when the creel limit was 10 trout or 10 pounds and one trout and 1978-1979 when catch-and-release only fishing was allowed.

Year	Spring Population Estimate (Apr.)	Fall Population Estimate (Sept.)	Summer Mortality Rate (Apr.-Sept.)
		Rainbow Trout	
1977[1/]	2973	854	71%
1978[2/]	2731	1453	47%
1979	5614	2787	50%
		Brown Trout	
1977[1/]	945	533	44%
1978[2/]	1062	706	34%
1979	1444	1285	11%

[1/] Data from Vincent, 1978.

[2/] Data from Vincent, 1979.

Table 8. Comparison of angling pressure, catch rates and total two-year-old & older trout caught for the Pine Butte section from 1976 through 1979. Confidence intervals at the 95% level are shown in parentheses.

Year	Spring Trout Population (II+)	Angling Pressure (hrs.)	Catch Rates (trout/hr.)	Total Trout Handled[1/]
1976[2/]	-	6693 (±811)	-	-
1977[3/]	10,820 (±1665)	7111 (±505)	1.37	9061
1978[4/]	12,351 (±1501)	4208 (±200)	2.75	11,561
1979	10,884 (±1328)	7376 (±725)	1.49	10,984

[1/] Total trout caught.

[2/] Only angling pressure data available.

[3/] Vincent, 1978.

[4/] Vincent, 1979.

Table 9. Comparison of monthly angling pressure, average catch rates, and total brown and rainbow trout caught and released for 1979.

Month	Angling Pressure (hrs.)	Catch Rates (Fish/Hr.) Rainbow Trout	Brown Trout	Total Fish Handled[1/] Rainbow Trout	Brown Trout
May	337	2.15	0.39	727	132
June	1041	1.86	0.43	1938	442
July	2701	1.19	0.31	3222	826
Aug.	1885	0.93	0.40	1758	742
Sept.	1412	0.61	0.34	856	341
Total	7376	1.15	0.34	8501	2483

[1/] Total trout caught and released.

Table 10. Population estimates for wild brown, cutthroat and rainbow trout for Spring, 1978 and 1979 for the Corwin Springs section of the Yellowstone River.

Date	Size Groups (inches) 6.0-9.9	10.0-13.9	14.0-17.9	6.0 & larger	18.0 & larger
		Rainbow Trout			
Spring, 1978	305	259	29	595	-1/
Spring, 1979	-1/	867	-1/	-1/	-1/
		Brown Trout			
Spring, 1978	943	1150	1130	3295	72
Spring, 1979	-1/	1553	1050	-1/	-1/
		Cutthroat Trout			
Spring, 1978	817	-1/	-1/	-1/	-1/
Spring, 1979	-1/	543	-1/	-1/	-1/

1/ Insufficient recaptures for population estimate or numbers to low to estimate.

Table 11. Estimated catch rates for game fish for shore and boat anglers for the Oct. 15, 1978 to Oct. 14, 1979 creel census period. Catch rates include both fish kept and those released.

Angler Type	Catch Rate (Fish/Hr.) Rainbow Trout	Brown Trout	Cutthroat Trout	Mtn Whitefish	Total Trout	All Game Fish
Shore1/	0.12	0.37	0.20	0.77	0.69	1.45
Boat	0.27	0.21	0.29	0.56	0.77	1.33
Total	0.39	0.58	0.49	1.23	1.46	2.78

1/ Less than 15% of the shore anglers were interviewed during the July-Sept., 1979 census period.

Table 12. Estimated total number of game fish kept and released during the Oct. 15, 1980 to Oct. 14, 1979 creel census period.

Month-Year	Rainbow Trout		Brown Trout		Cutthroat Trout		Mtn. Whitefish		Total Trout	
	Kept	Released	Kept	Released	Kept	Released	Kept	Released	Kept	Released
Jan., 1979	7	0	13	0	6	0	165	0	26	0
Feb., 1979	17	0	0	6	6	6	172	0	23	12
Mar., 1979	28	0	14	0	7	0	63	7	49	0
Apr., 1979	7	14	70	35	14	49	42	52	91	98
May, 1979	0	13	7	53	7	20	0	33	14	86
June, 1979	6	0	0	19	6	0	0	19	12	19
July, 1979[1/]	240	1509	77	917	162	1415	0	2443	479	3841
Aug., 1979[1/]	0	92	39	106	78	177	117	335	117	375
Sept., 1979[1/]	74	261	91	655	19	161	108	679	184	1077
Oct., 1978-79[2/]	7	11	11	46	14	14	11	71	32	71
Nov., 1978	0	0	23	8	0	0	7	0	23	8
Dec., 1978	0	0	8	0	4	0	39	0	12	0
Total	386	1900	353	1845	323	1842	724	3639	1062	5587

[1/] Less than 15% of the shore fishermen were interviewed during these months.

[2/] October data included 1-14 period in 1979 and 15-31 period in 1978.

Table 13. Estimated number of game fish kept in the Corwin Springs section from Oct. 15, 1978 through Oct. 14, 1979.

Species	Size Groups (inches)				
	6.0-9.9	10.0-13.9	14.0-17.9	18.0 & larger	6.0 & larger
Rainbow Trout	24	301	61	0	386
Brown Trout	19	167	157	9	353
Cutthroat Trout	36	227	60	0	323
Mtn. Whitefish	0	693	23	8	724

Table 14. Estimated number of trout and mountain whitefish kept and released by shore and boat fishermen from Oct. 15, 1978 through Oct. 14, 1979 in Corwin Springs section.

Species	Shore Anglers		Boat Anglers	
	Kept	Released	Kept	Released
Rainbow Trout	101	279	285	1621
Brown Trout	238	834	115	1011
Cutthroat Trout	204	286	119	1556
Mtn. Whitefish	723	761	0	2878
Total	1266	2160	519	7066

Table 15. Comparison of angling pressure between the Pine Butte and Snoball sections on the Madison River; Karst section on the Gallatin River and Corwin Springs section on the Yellowstone River.

Snoball Madison River May 15-Sept. 15, 1976	Pine Butte Madison River May 19-Sept. 20, 1979	Karst Gallatin River May 19-Sept. 20, 1978	Corwin Springs Yellowstone River Oct. 15, 1978-Oct. 14, 1979
Angling Pressure/Mile			
1487	2459	1190	741

Table 16. Average length for each game fish species kept during certain time periods for 1963, 1978 and 1979. Length are shown in inches.

Period	Species			
	Rainbow Trout	Brown Trout	Cutthroat Trout	Mtn. Whitefish
July-Sept., 1963	12.7	13.9	10.7	12.4
July-Sept., 1979	12.4	13.9	11.9	13.0
June, 1979-Nov., 1978	12.3	13.3	11.9	12.9
Dec., 1978-May, 1979	11.0	14.6	12.4	12.1
Oct., 1978-Sept., 1979	11.9	13.9	12.0	12.2

Table 17. Residency of anglers using the Corwin Springs study section from Oct. 15, 1978 to Oct. 14, 1979.

	Resident		Non-Resident	
Sex	Male - 90.5%	Female - 9.5%	Male - 89.6%	Female - 10.4%
Method	Shore - 70.9%	Boat - 29.1%	Shore - 31.2%	Boat - 68.8%
Total	76.7%		23.3%	

Table 18. Comparison of lure types used by shore and boat anglers during 1978 and 1979. Figures shown in percent.

	Lure Type				
	Bait	Sculpin	Hardware[1/]	Flies	Combination[2/]
Shore Anglers	31	19	28	17	5
Boat Anglers	3	0	8	82	7
Total	20	12	20	42	6

[1/] Includes metal spinners, spoons, etc.

[2/] Anglers using two or more lure types per day.

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