MONTANA STATE DEPARTMENT OF FISH AND GAME
FEDERAL AID IN FISH RESTORATION SECTION
HELENA, MONTANA

JOB COMPLETION REPORT
INVESTIGATIONS PROJECTS

State of Montana

Project No. F-9-R-2 Work Plan No. 2 Job No. II-A & II-B

Title of Job: Cataloging the Waters of the Project Area

Abstract:

As a part of the cataloging project in the southwestern district, a general survey was made of the waters in the Madison River drainage and fish population studies were conducted in the Beaverhead River drainage.

Along with the fishing industry, power and irrigation are the present economic uses made of the water in the survey areas. During the summer most of the small tributary streams (20 second-feet or less) are dewatered for irrigation purposes. Ennis Reservoir is unusual for a reservoir from the fisheries standpoint because it has a relatively stable water level which is conducive to a good fishery. Extreme water fluctuations are characteristic of Hebgen Reservoir, not only in the reservoir itself, but in the river below the dam where the U. S. Geological Survey has recorded flows varying from 5980 to 5 second feet.

Management practices have consisted of regulations and fish planting. Some fishing regulations are still masquerading as conservation acts. More education, evaluation, and study of regulations are needed. The proposed revision of the planting program should be adopted immediately. Many stocking practices appear to have been unwise in view of the evidence concerning survival and contribution to the creel of the hatchery fish. The past stocking program in the Madison drainage called for annual stocking of about 763,000 trout. Only 185,000 of the total were scheduled for lake planting and the remainder for the streams and rivers. The 1953 stocking plan for the Madison River and the two onstream reservoirs was to stock 197,000 legal rainbow trout while the annual yield to the fishermen in the same area is 80,459 trout.

Rainbow and brown trout furnish the majority of the fish to the fishery in the Madison and Beaverhead drainages. Age and growth studies show brown trout consistently grow faster and larger in the Beaverhead drainage, while their growth is comparable in the Madison drainage. Growth is slowest for the eastern brook, usually taking four years to reach seven inches in length, while rainbow and brown trout reach seven inches in two years.

The Madison and Beaverhead drainages are areas of great recreational value and contribute materially to the State's economy. Average annual expenditure by fishermen during the regular fishing season on the Madison River and its two reservoirs amounts to $2,213.40 per mile of stream, or acre of reservoir.

Agencies responsible for the fish and wildlife resources of these areas should be represented when future development plans are made by other agencies that will affect the fishery. With increasing demands for fishing and recreation,

the present productive status should be maintained at all costs. The Madison and Beaverhead drainages can support more fishing without affecting the present productivity, providing other factors in the habitat remain the same or are made better. Present reservoirs can help improve the fishery by attempting to maintain more stable water levels.

Objectives:

The purpose of this project is to determine the physical and chemical characteristics of the waters in the project area; to gather data on species distribution, composition, growth rate; and to catalog these waters for management purposes.

Techniques Used:

During the summer of 1953, the main emphasis was placed on surveying the Madison River drainage in Madison and Gallatin counties, Montana. Supplemental information was collected on fish populations in the Beaverhead drainage, Beaverhead County. An airplane was used for the initial survey of the rivers and their tributaries. Intermittent and dry streams were observed from the air, along with vegetative cover and adverse practices to fish management. Data on other physical features of the drainage were taken from maps and photographs. The remainder of the data were taken on ground survey. Composition and distribution of the various species of fish in the streams were determined by use of the electric shocker and creel census. Contribution of species to the fisherman's creel was determined by creel census and literature. Scale samples for age and growth determinations were collected by an electric shocker, by contacting fishermen, and by angling. All scale samples were sent to Montana State Fish and Game Laboratory, Montana State College, Bozeman, Montana, for age and growth determinations.

Findings:

The Madison River originates in Yellowstone National Park on the Yellowstone Plateau and enters Montana two miles east of West Yellowstone, Montana, at an elevation of 6,650 feet above mean sea level. Immediately after the Madison River enters Montana, it flows into Hebgen Reservoir where it is joined by the South Fork of the Madison River and a number of smaller tributaries. Hebgen Reservoir is formed by a Montana Power Company dam which regulates the flow down the river according to the water needs for generating power at the Ennis Reservoir. Approximately 17 miles below Hebgen Reservoir, the Madison River is joined by the West Fork of the Madison River. After this junction, the Madison River flows in a northerly direction for 40 airline miles through a broad valley and empties into Ennis Reservoir. Ennis Reservoir is formed by another dam, which is owned and operated for power by the Montana Power Company. From the Ennis Dam, the Madison River flows through about 11 miles of a deep canyon known as the Bear Trap Canyon. After emerging from the canyon, the river meanders through another valley until it empties into the Missouri River near Three Forks, Montana. While in Montana the Madison River drains the west slopes of the Madison and Hilgard Mountain ranges, and the east slopes of the Gravelly and Tobacco Root Mountain ranges, comprising a drainage area of 2,485 square miles which is approximately 120 miles in length.

During the period, October 1949 to September 1950, the discharge of the Madison River near Three Forks, Montana varied from 663 second feet March 24, 1950 to 4,170 second feet June 17, 1950.

The gradient of the river in the upper valley above the Ennis Reservoir and in the Bear Trap Canyon is approximately 30 feet per mile. Long riffle areas are common and fish cover generally consists of overhanging bank vegetation and large boulders. Below the Bear Trap Canyon the gradient is about 16 feet per mile and in some sections the main river divides into two to five channels with many gravel and sand bars. Fish cover is abundant in the form of deep pools, undercut bank, and overhanging vegetation. In addition, aquatic vegetation and algae are common and provide additional cover in the river.

Much of the upper drainage is covered with conifer forests and the stream banks are lined with willow, alder, and cottonwood. The lower portion of the drainage is generally more open and flows through a valley with grass, sage, and juniper cover.

Limited chemical analysis indicates the water to be hard and alkaline, and water temperatures during the regular fishing season vary between 40° F. and 70° F. depending upon the time and location of observation.

At the present time power and irrigation are the primary uses made of the waters of the Madison River and tributaries and tentative plans are being made for more development of irrigation and power. During the survey, most of the smaller tributaries (less than 20 second feet) were completely dewatered for irrigation purposes during the summer months. Water diversions for irrigation from the Madison River are common below the Bear Trap Canyon; however, there are only three direct diversions upstream from the Bear Trap Canyon. No specific investigations have been conducted on the Madison drainage to determine the fish losses in irrigation canals. An observation on the West Madison Canal in September, 1948, disclosed a loss of more than 14,000 trout in the first three miles of the canal. The total trout population lost in the 15 miles of the canal was in excess of 40,000 trout (Anonymous, 1953).

Montana Power Company regulates two dams on the Madison River for power purposes. The Hebgen Dam forms a reservoir with a capacity of 345,000 acre feet, and the Ennis Dam has a capacity of 41,000 acre feet of water. The Ennis Reservoir is rather unusual for a reservoir in that it is generally not considered to have adverse affects on the fishery. This is because a more or less stable water level is maintained at Ennis by increasing or decreasing the water releases from Hebgen Reservoir.

Other industries of the survey area are livestock and farming. Farming consists chiefly of raising small grains, and much of the irrigated land is used for production of winter feed for livestock. Gold mining has been important in the drainage and numerous abandoned placer mine sites occur along the creeks on the western slopes of the Gravelly and Tobacco Root mountain ranges.

Many secondary, county, and Forest Service roads are located in the survey area that make most of the more important waters readily accessible to anglers. Most of the high mountain lakes are accessible by trail only; however, the larger more important mountain lakes such as Cliff and Wade Lakes are accessible by automobile. A ten-mile section of the Madison River in Bear Trap Canyon is accessible by trail and partially accessible by a four-wheel-drive vehicle. The lower 15 miles of the river flows through private property, much of which is posted against trespassing.

In addition to being a popular fishing area for Montana people, the Madison River area is undoubtedly one of the most popular tourist fishing areas in the State of Montana.

The Biennial Report of the Montana Fish and Game Commission (1950-52) shows that 6 per cent of the resident fishing licenses, 28 percent of the non-resident licenses, and 33 per cent of the tourist fishing licenses were sold in Madison and Gallatin Counties in 1952. Information reported by Missouri River Basin Studies (Anonymous, 1953) shows non-resident fishermen were represented to the extent of 55 per cent in the upper one-third of the Madison River, 22 percent in the middle one-third, and 6 percent in the lower one-third. Fishermen were contacted from 40 states, Washington, D. C., Alaska, Canada, and South America during the study. Many of these non-residents and resident fishermen said that they made extended annual fishing and vacation trips to the Madison River--which indicates the popularity and value of the fishing industry on the Madison.

The close proximity of several large centers of Montana populations (Table 1), which are within one day's fishing distance of the survey area, contributes to the fishing industry.

Table 1. Population, 1950

Cities adjacent to the Madison	Population
Great Falls	39,214
Butte	33,251
Helena	17,581
Bozeman	11,325
Anaconda	11,254
Livingston	7,683

The estimated fishing pressure, annual yield, and expenditure (Anonymous, 1953) for the Madison River and the two upstream reservoirs amounted to 40,772 fisherman-days, yielding 80,459 fish weighing 82,682 pounds. The expenditure amounted to $2,213.40 per mile of stream, or acre of reservoir, totaling a $412,500 average annual expenditure by fishermen. It is quite obvious that the money expended for this fishery is an important source of income to the Madison Valley and the State as a whole. It must also be remembered that these totals do not include the pressure, annual yield, and expenditures on the numerous lakes and tributary streams to the Madison River, or the winter fishing season on the Madison River.

Since 1948, age and growth determinations have been made on more than 3,000 scale samples from game fish in the Madison River drainage. Growth rates are equal to other areas in the upper Missouri River drainage. The majority of the scale samples were from rainbow and brown trout, and growth is nearly equal for both species. A slight tendency for faster growth is evident for brown trout during the first four years of life, after which time the rainbow trout grow larger. Rainbow and brown trout appear well suited to the present environment from the standpoint of growth, and provide the most fish to the fishermen's creel. Creel composition by species (Anonymous 1953) for the Madison River shows rainbow trout 65.4 percent, brown trout 22.1 percent, eastern brook trout 0.2 percent, cutthroat trout, 0.2 percent, grayling 0.5 percent, whitefish 6.6 percent, suckers 4.5 percent, and Utah chub 0.6 percent in the fishermen's creel.

A desirable fish present in the drainage is the golden trout (*Salmo aguabonita*), which is found only in some of the high mountain lakes. Little information is available on this species to date; however, it has promise of being an important species in the high mountain lakes fishery.

Other species of fish present in the drainage and generally most abundant in the valley portion of the drainage are: western white sucker, longnose sucker, dace,

sculpin, and burbot. Undesirable introduced fish are the yellow perch, largemouth bass, and carp. A recently introduced minnow by the angler, through the use of small fish for bait, is the Utah chub. It has become especially abundant in Hebgen Reservoir and is established in the Madison River and in one of the high mountain lakes (Cliff Lake).

The present reservoirs on the Madison River provide abundant crops of rough fish for competition with the game fish, and lower the scenic and biological values by fluctuation of the aquatic habitat in the reservoir, as well as in the streams below. The U. S. Geological Survey discharge measurements from 1913 to 1950 on the Madison River above Hebgen Dam show the maximum discharge observed was 2,080 second feet in June, 1943, and the minimum discharge observed was 100 second feet in February, 1933. An entirely different picture occurs in the stability of the stream below Hebgen Dam. The discharge measurements for the period 1938-1950 show a maximum discharge of 5,980 second feet in June, 1943, and an extreme low of 5 second feet in June, 1948. The 5 second-foot flow in June, 1948, was probably not moderated until the Madison River was joined by the West Fork of the Madison River, about 17 airline miles downstream. Downstream dams are responsible for fluctuations in the rivers below them; however, the affects are generally masked by the larger volumes of water involved.

Management practices in the Madison River drainage have consisted of regulations and fish plantings. Regulations have generally been an open season from about May 17 to November 15, with the aggregate bag and possession limit on trout, char, salmon, and whitefish being 15 fish, not to exceed 10 pounds and one fish. Many exceptions to the general regulations as to season and limits are listed by counties and smaller subdivisions, many of which have no proven biological basis and have been a regulation trap for some unsuspecting fishermen. The limit of from 5 to 10 fish during various years on Hebgen Lake has apparently helped to increase the fishing pressure on Cliff and Wade Lakes where the limit was 15 fish. Regulations as a management tool are to help distribute fishing pressure and harvest of the fish. They should be based on sound principles instead of conforming to current opinions.

The past planting program in the drainage called for annual planting of approximately 763,000 trout of various sizes. According to the five-year plan, only 185,000 of the total were scheduled for lake planting and the remainder for the streams and rivers. A specific instance of unwise use of the hatchery fish can easily be seen from results of studies on the Madison River and its two onstream reservoirs.

The 1953 stocking plan for this area called for planting of 197,000 legal rainbow trout while the total annual yield of trout to the fishermen in this same area is 80,459 trout (Anonymous 1953). Even if all the rainbow trout caught were hatchery fish, the most they could contribute to the creel is 65.4 percent of the total yield, the other 34.6 percent of the fish in the creel being species other than rainbow trout. In view of the present inconsistency between rainbow stocked and known yield of rainbow trout to the creel, it is recommended that the proposed revision of the planting program be adopted immediately.

Beaverhead Survey

During the 1953 season, a study of game fish species composition, distribution, and age and growth was made with an electric fish shocker in the Beaverhead River Drainage. Since this was part of the general cataloging program, the results will be briefly summarized in this completion report. The study was not intended

to determine total populations present in the streams; however, most of the shocking was complete enough to be indicative of the total poundage and "keeper" trout available to the fishermen. No data were taken on the two species of suckers which were present in varying amounts in different streams. Some of the popular fishing streams were selected for shocking and the sportsmen were invited to observe and participate in the operations so they might obtain a better picture of the fishery in their areas.

The eastern brook trout holds its top-ranking position as the most undesirable "trout" in the streams of the Beaverhead drainage. In a stream such as Bloody Dick Creek where they are the only species present, the population is typically large numerically and very low in weight (Table 2) much of which seems to be the result of slow growth (Table 3) which might be alleviated somewhat by increased harvest of fish. In such cases, the size and numerical limits are apparently more of a detriment to the fishery than a conservation measure. For instance, it takes the eastern brook trout four years to grow seven inches (Table 3) and by that time over 95 percent of them have died from old age and other causes, which did not leave many for the angler when the seven inch legal size limit was still in effect. In some streams, the eastern brook trout appears to be losing its dominance since brown trout have been introduced. As in the case of Decker Creek (Table 2), this stream, according to the local sportsmen, was filled ten years ago with small eastern brook trout similar to those caught in Bloody Dick Creek at the present time.

In some streams in Montana the brown trout grows slower than rainbow trout and it is considered that the reason for the abundance of large brown was due to its not being taken as readily by the angler as the rainbow trout. This does not seem to be entirely the case in the Beaverhead drainage. Results of age and growth studies show that the brown consistently grew faster and larger than the rainbow trout. This was true even when the two species occurred together in water that outwardly appeared more suitable for rainbow trout, such as in the upper Ruby River.

Big Sheep Creek is considered to receive high fishing pressure for the Beaverhead drainage and produces good fishing. In the area shocked there were no other species present except whitefish, and rainbow trout reproduction appeared to be excellent, judging from the large number of small fish present. Reports by local sportsmen indicated that the fishing in the lower part of the creek had fallen off. Little time was available for shocking in this area other than to shock to see what species were present. As had been the case in many places where the fishing has been reported on the decrease, brown trout were found in the lower Big Sheep Creek, and it will probably be but a matter of time before brown trout become the dominant species making it more difficult for the average fishermen to catch their usual amount of fish in Sheep Creek.

Analysis and Recommendations:

The Madison River drainage is highly productive to the fishermen, especially of large fish, and probably can support more fishing without affecting the present productivity providing other factors in the habitat remain the same. The drainage has a well-known reputation and represents a popular local and tourist trout fishing area of great recreational value and contributes materially to the economy of Montana. With increasing demands for fishing and recreation, every effort should be made to maintain this drainage in its present productive status.

Table 2. Results of electric stream census of 300-foot sections in the Beaverhead River drainage, 1953, (total length determined to the nearest 0.1 inch, weight to nearest 0.01 pound).

Location	Species	Number of Fish	Total Weight	Average Weight	Average Length	Per cent of Total Number	Per cent of Total Weight
Bloody Dick Cr.	Eb	254	12.66	0.05	4.8	100	100
Big Sheep Cr.	Rb	60	40.76	0.60	10.3	73	*
	Wf	22	*	*	*	27	*
Decker Cr.	LL	28	38.14	1.36	13.6	67	77
	Rb	11	9.47	0.86	12.6	26	19
	Eb	3	1.89	0.63	11.3	7	4
Ruby River (1)	LL	45	24.76	0.55	10.1	50	37
	Rb	13	4.16	0.32	9.5	14	6
	Wf	33	37.95	1.15	14.1	36	57
Clear Cr.**(2)	LL	47	10.49	0.22	8.1	100	100
Ruby River (3)	LL	9	14.55	1.62	15.9	36	73
	Rb	13	3.20	0.25	8.4	52	16
	Wf	3	2.14	0.71	13.4	12	11
Ruby River (4)	LL	1	2.21	2.21	18.4	3	29
	Rb	22	4.75	0.22	7.7	92	62
	Wf	1	0.67	0.67	12.3	3	9
Ruby River (5)	Rb	9	2.98	0.33	7.5	100	100

Rb - Rainbow, LL - Brown (Loch Leven), Eb - Eastern brook, Wf - whitefish

*Whitefish not weighed in Big Sheep Creek
**Clear Creek is a side channel of the Ruby River

Sections in Ruby River numbered in numerical order from mouth to headwaters.

Table 3. Summary of the average calculated total lengths in inches for trout collected by use of the electric shocker in the Beaverhead River drainage during 1953; age determinations by the scale method.

Location	Species	Number of Fish	Year of Life 1	2	3	4	5
Bloody Dick Cr.	Eb	43	2.6	4.5	6.0	7.5	
Big Sheep Cr.	Rb	56	3.5	8.2	11.6	12.2	
Decker Cr.	LL	21	4.3	10.3	14.4	18.2	20.4
	Rb	10	3.9	8.6	11.9		
Ruby River	LL	92	3.7	8.4	11.9	14.6	15.8
	Rb	57	3.1	6.1	8.7	11.5	

Scale samples taken from fish captured in random shocking sections.

Agencies responsible for the fish and wildlife resources of these areas should be represented when future development plans are made by other agencies that may affect the fishery.

Above all, the conservation agencies responsible for the fish and wildlife in this area should intensify their efforts in educating the sportsmen to the effect that dams will not create a lasting trout fishing utopia.

Recommendation is made that the now-proposed revision of the planting program be given the utmost consideration and that a critical evaluation be made of the fishing regulations in Madison and Beaverhead drainages.

Recommendation is made that the cataloging of the streams and lakes be continued in the southwestern district in order to plan a better fishery management program.

Summary:

This completion report contains a summary of the data compiled in 1953 on a survey of the Madison and Beaverhead River drainages in the southwestern district. The Madison drainage represents a popular local and tourist fishing area of unlimited recreational value and contributes much to the economy of the State. Fisherman expenditures on the Madison River and the two reservoirs covered by this survey amount to $412,500 annually. This annual expenditure does not include the vast network of tributary streams and lakes, or the winter fishing season.

Data and Reports:

Original data and reports are filed at the southwestern district headquarters at Bozeman, Montana.

Literature cited:

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1953 A three-year creel census and fisherman-expenditure study, Madison River, Montana, 1950-1952. U.S.D.I., Fish & Wild. Ser., Mo. River Basin Studies, 53 pp.(Mimeo.).

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