MONTANA DEPARTMENT OF FISH AND GAME

FISHERIES DIVISION

JOB PROGRESS REPORT - SURVEY PROJECT

STATE: Montana

PROJECT NO: F-9-R-23

JOB No: I-a

TITLE: Southwest Montana Fisheries Investigation

TITLE: Inventory of Waters of the Project Area

PERIOD COVERED: January 1, 1974 to January 31, 1975


## ABSTRACT

The fish populations in Hebgen Reservoir were surveyed with bottom-set gill nets during June, July and August of 1971, 1972, 1973 and 1974. Brown trout were the most abundant trout species taken each year and Utah chubs the most abundant rough fish species. A creel census study on Hebgen Reservoir during 1967, 1971 and 1972 showed hatchery rainbow trout being the predominant fish in the creel, comprising between 58 percent of the catch in 1972 to 86 percent in 1967. The catch rate for trout species varied from 0.31 trout per hour in 1972 to 0.42 trout per hour in 1967 and 1971.

Fish populations in Willow Creek Reservoir were surveyed with bottom-set gill nets during June and July of 1973 and 1974 with brown trout being the most abundant trout species caught and white sucker the most abundant rough fish species. A creel census conducted during 1972 and 1973 showed that in 1972 hatchery rainbow trout comprised 87 percent of the catch, whereas in 1973 they comprised only 28 percent of the catch and wild brown trout were predominant in the creel (60 percent of the catch).

Trout population estimates were made on four sections of the Boulder River and one section of the Little Boulder River. The trout population estimates show that a combination of dewatering, heavy metal pollution, sedimentation and streambank vegetation removal has limited wild trout numbers above the Nigger Hollow bridge area. Aquatic insect samples taken in the Boulder River drainage show a low number of Mayfly species in areas where heavy metal pollution was the highest.

Wild trout population estimates were made on three sections of the Madison River and on two sections of O'Dell Creek.


## BACKGROUND

Modern man has the ability not only to affect his own environment, but the environment of most other animals including fish. He has had a serious impact on the wild trout fisheries in Montana. Activities such as logging, mining, agriculture and urban pollution have altered most of the existing streams and lakes to the extent where there have been significant reductions in the existing wild trout numbers.

## OBJECTIVES AND DEGREE OF ATTAINMENT

1. To obtain fish population data on Hebgen Reservoir and conduct a partial creel census. Bottom gill nets were set on Hebgen Reservoir, plus a partial creel census taken. Data are included in the report.

2. To obtain fish population data on Willow Creek Reservoir and conduct a partial creel census. Bottom gill nets were set on Willow Creek Reservoir, plus a partial creel census was conducted. Data are included in the report.

3. To obtain fish population estimates on the Madison River on three established sections. Estimates were made on three sections and data will be included in a later report.

4. To make channel measurements on the Madison River. This work was done. Data is filed in Fisheries Division files at Bozeman.

5. To obtain fish population estimates on two sections of the East Gallatin River. Due to more intensive work on the North Boulder River, this work was postponed to a future year.

## PROCEDURES

Electrofishing gear was used to sample fish populations in the North Boulder River, Madison River and O'Dell Creek. Electrofishing was carried out while floating through a section in a fiberglas boat. Population estimates were made by using the Peterson-type mark-and-recapture method using Chapman's modified formula (Chapman, 1951). Two or more "marking" and/or "recapture" trips were required where sample size was small. There was usually a 10-14 day interval between the marking and recapture runs. Scales were taken to determine age and growth rates. Actual mathematical computations were made by a computor programmed to use methods described by Vincent (1971a and 1974). Movement and fish harvest were determined by use of a numbered plastic Floy fish tag inserted behind the dorsal fin.

Fish populations in Hebgen and Willow Creek Reservoirs were sampled by means of experimental 125 foot gill nets. These nets were set on both the bottom and surface.

Creel census studies were conducted on Hebgen and Willow Creek Reservoirs. These surveys were established to determine species harvest and catch rates. Hatchery rainbow trout were identified by their fins. They had dorsal, caudal, pectoral and pelvic fin deformities and erosion.

## FINDINGS

### Reservoirs

#### Hebgen Reservoir

During the summer months of June, July and August for 1971 through 1974, a fish population study was conducted using gill nets (Figure 1). Six species of fish were taken in these gill net samples: rainbow trout (*Salmo gairdneri*); brown trout (*Salmo trutta*); brook trout (*Salvelinus fontinalis*); cutthroat trout (*Salmo clarki*); mountain whitefish (*Prosopium williamsoni*) and Utah Chub (*Gila atraria*).

Brown trout were the most common trout species taken in either the bottom or surface sets (Table 1). They comprised from 52.5% (1970) to 96.0% (1974) of the trout taken. During the other study years (1971-1974), approximately 120,000 (5-7 inch) hatchery rainbow trout, plus 300-5000 "retired brood" rainbow trout (17-20 inch) were stocked annually in Hebgen Reservoir. Even with this intensity of stocking, hatchery rainbow trout comprised only 1.9 to 34.7 percent of the trout caught in the bottom sets and 3.6 to 10.2 percent in the surface nets from 1971 through 1975. Generally, wild rainbow trout exceed hatchery rainbows in the gill nets from all years, except 1971. Mountain whitefish were the most common game fish captured in the bottom net sets (50.0 to 68.4 percent), but were never taken in a surface gill net. The largest trout taken in a gill net was a brown trout (35.0 inches long and 21.0 pounds) and generally brown trout were larger than the other trout species (Table 2). Wild rainbow trout always averaged larger than hatchery rainbow trout. Three-year-old brown trout were always the most abundant age group taken in the gill nets, suggesting the yearling and two-year-old trout were less common in the reservoir proper and some might still inhabit the spawning streams (Table 3). A population estimate of brown trout in the South Fork Madison River (spawning stream) in August, 1970 indicated most of the yearlings were still in the stream and had yet to move into the reservoir (Vincent, 1971b).

A partial creel census study was conducted on Hebgen Reservoir during 1967, 1971 and 1972. This census showed that hatchery rainbow trout were predominant in the creel and comprised from a high of 79 percent in 1967 to a low of 59 percent in 1972 (Table 4). A 1952 creel census showed the catch per hour for trout to be 0.36 for shore anglers (U.S. Fish and Wildlife Service, 1952). Previous to the 1952 census, only minor stocking occurred, so most of the creeled trout were probably wild, and rainbows comrpised 61 percent. Since the 1952 catch rate (0.36) and the present rates (0.31 and 0.42) are similar, the heavy stocking has only replaced the wild trout in the creel.

Willow Creek Reservoir:

A gill netting study was carried out on Willow Creek Reservoir from June to August, 1973 and from June to July, 1974 (Figure 2). A total of six species of fish were taken in the gill net sets: (1) white sucker (*Catostomus commersoni*); (2) longnose sucker (*Catostomus catostomus*); (3) brown trout (*Salmo trutta*); (4) rainbow trout (*Salmo gairdneri*); (5) brook trout (*Salvelinus fontinalis*); and (6) Kokanee (*Oncorhychus nerka*). Brown trout was the most abundant game fish present in bottom gill net samples, comprising 85.5 percent (1973) and 89.8 percent (1974) of the total (Table 5). Compared with bottom gill net samples taken by Posewitz (1962) for June, 1960, the 1974 catch per bottom net showed an increase of 139% for brown trout, a 71% decrease in rainbow trout (hatchery and wild combined), and a 55% decrease in sucker numbers. No Kokanee were present in 1960.

During 1972 and 1973, a partial creel census was conducted on Willow Creek Reservoir. The census period was from May 28 through September 15 in 1972 and from May 27 to July 31 in 1973. This census shows that in 1972 hatchery rainbow comprised 87 percent of all trout harvested, but during the 1973 census period they comprised only 28 percent (Table 6). In 1972, 22,676 catchable and 10,000 subcatchable rainbow trout were stocked prior to the census period, while in 1973 a total of 30,163 subcatchables (5 inch) were stocked in March. Four Kokanee salmon were creeled during the 1972 census period showing a low catch rate (0.002/hour). Approximately 50,000 Kokanee fry had been stocked annually during 1971, 1972 and 1973.

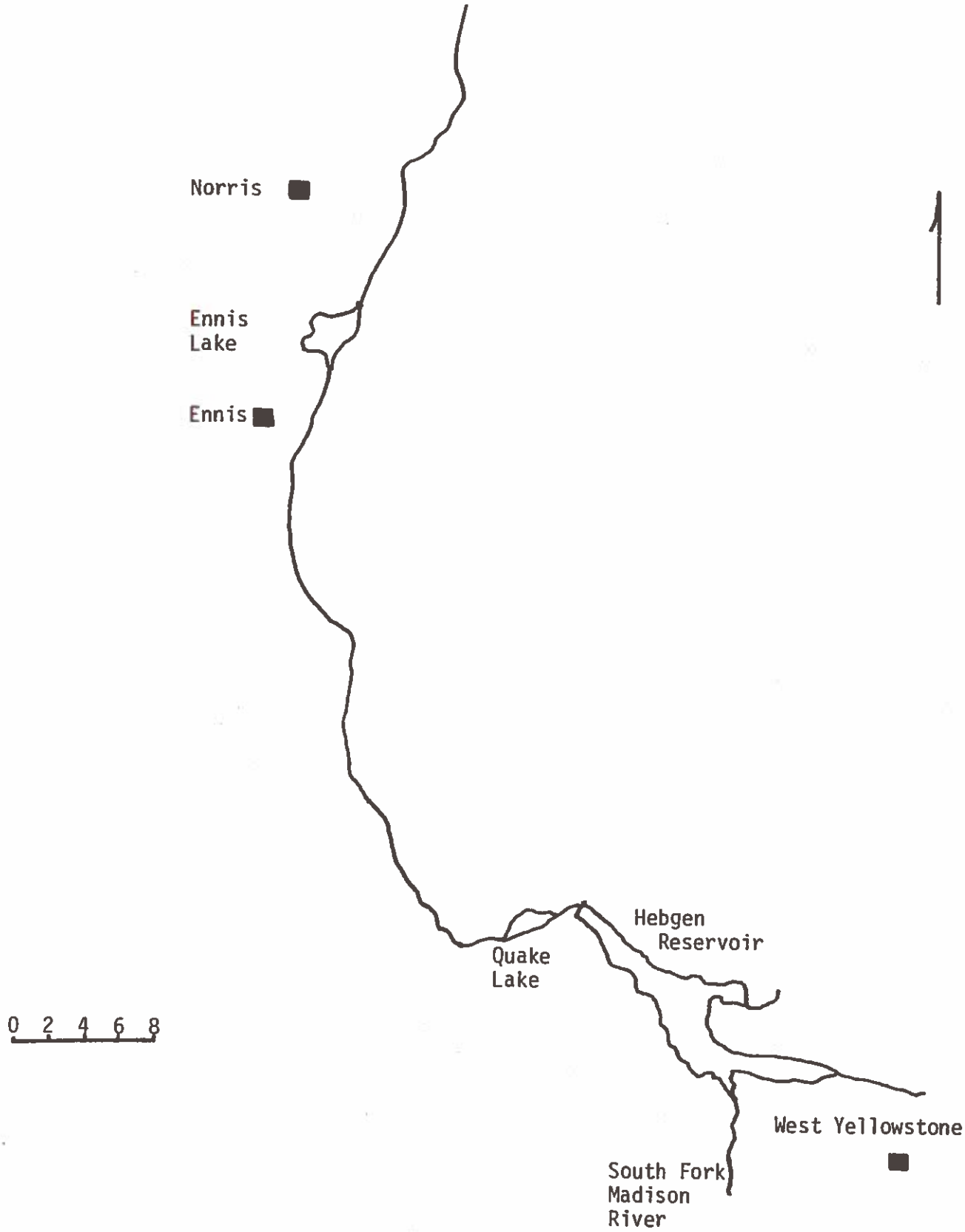


FIGURE 1. Map of the Madison River and Hebgen Reservoir

TABLE 1. Gill net data from Hebgen Reservoir for the years 1971, 1972, 1973 and 1974. Number of gill net sets for each year in parentheses.

| Year | AVERAGE CATCH PER NET SET | | | | | | |
|---|---|---|---|---|---|---|---|
| | Wild Rainbow Trout | Hatchery Rainbow Trout | Brown Trout | Brook Trout | Cutthroat Trout | Mountain Whitefish | Utah Chub |
| | | | Bottom Sets | | | | |
| 1971 (10 | 0.0 | 5.1 | 6.2 | 0.5 | 0.1 | 11.8 | 66.3 |
| 1972 (16) | 0.6 | 0.4 | 8.2 | 0.0 | 0.0 | 17.3 | 19.8 |
| 1973 (19) | 0.6 | 0.3 | 9.6 | 0.1 | 0.1 | 18.5 | 23.5 |
| 1974 (9) | 0.1 | 0.3 | 9.7 | 0.0 | 0.0 | 21.9 | 28.1 |
| | | | Surface Sets | | | | |
| 1971 (6) | 1.0 | 0.2 | 4.3 | 0.0 | 0.0 | 0.0 | 31.7 |
| 1972 1/ | | | | | | | |
| 1973 (11) | 1.7 | 0.6 | 3.6 | 0.0 | 0.0 | 0.0 | 62.5 |
| 1974 (4) | 1.8 | 0.8 | 5.3 | 0.0 | 0.0 | 0.0 | 47.5 |

1/ Only one survace gill net was set in 1972.

TABLE 2. Average length of fish in inches taken from Hebgen Lake gill net sets for the years 1971 through 1974. Number measured for average length in parentheses.

| Year | Wild Rainbow Trout | Hatchery Rainbow Trout | Brown Trout | Mountain Whitefish | Utah Chub |
|---|---|---|---|---|---|
| 1971 | 15.2 (16) | 11.2 (51) | 15.8 (94) | 13.1 (127) | 9.4 (887) |
| 1972 | 12.4 (9) | 10.8 (6) | 14.4 (150) | 14.6 (295) | 11.1 (355) |
| 1973 | 13.2 (30) | 12.5 (7) | 16.6 (205) | 15.2 (372) | 11.0 (1139) |
| 1974 | 13.7 (8) | 12.1 (5) | 15.0 (104) | 14.4 (197) | 10.7 (443) |

TABLE 3. Relative abundance for each age group of brown trout taken in Hebgen Lake gill nets expressed at percent of total numbers. Number of scales examined to determine age structure shown in parentheses.

| Year | Age Groups | | | | |
|---|---|---|---|---|---|
| | I | II | III | IV | V+ |
| 1971 (102) | | 18 | 34 | 25 | 23 |
| 1972 (86) | 5 | 22 | 48 | 16 | 9 |
| 1973 (217) | 2 | 17 | 47 | 19 | 15 |
| 1974 (104) | 2 | 18 | 43 | 26 | 11 |

TABLE 4. Hebgen Reservoir creel census data showing trout creeled and catch per hour of shore anglers for years 1967, 1971 and 1972. Catch per hour shown in parentheses.

| Month | Hours | Trout Species: Wild Brown | Wild Rainbow | Hatchery Rainbow | Total |
|---|---|---|---|---|---|
| | | | 1967[1] | | |
| May-June | 86.0 | 6 (0.07) | 3 (.03) | 41 (0.48) | 50 (0.58) |
| July | 72.0 | 5 (0.07) | 4 (.06) | 29 (0.40) | 38 (0.53) |
| August | 75.0 | 0 | 4 (.05) | 15 (0.20) | 19 (0.25) |
| Total | 233.0 | 11 (.03) | 11 (0.03) | 85 (0.36) | 107 (0.42) |
| | | | 1971 | | |
| May-June | 567.0 | 54 (0.16) | 38 (0.11) | 240 (0.72) | 332 (0.59) |
| July | 176.5 | 3 (0.02) | 8 (0.05) | 24 (0.14) | 35 (0.21) |
| August | 190.0 | 2 (0.01) | 12 (0.06) | 20 (0.11 | 34 (0.18) |
| Total | 933.5 | 59 (0.06) | 58 (0.06) | 284 (0.30) | 401 (0.42) |
| | | | 1972 | | |
| May-June | 393.0 | 13 (0.03) | 35 (0.09) | 74 (0.19) | 122 (0.31) |
| July | 57.0 | 0 | 9 (0.16) | 7 (0.12) | 16 (0.28) |
| August[2] | - | - | - | - | - |
| Total | 450.0 | 13 (0.03) | 44 (0.10 | 81 (0.18) | 138 (0.31) |

1/ Unpublished creel census data from Montana Fish and Game files.
2/ No data for August, 1972.

TABLE 5. Gill net data from Harrison Reservoir for 1973 and 1974 showing average catch per gill net. Number of net sets shown in parentheses.

| Species | 1973[1] NET SET TYPE: Bottom (11) | Surface (9) | 1974[2] NET SET TYPE: Bottom (15) | Surface (9) |
|---|---|---|---|---|
| White sucker | 47.6 | 27.3 | 33.9 | 10.6 |
| Longnose sucker | 3.5 | 1.9 | 2.3 | 0 |
| Kokanee | 1.4 | 0.9 | 0.8 | 0.2 |
| Brown trout | 14.2 | 9.4 | 14.1 | 1.7 |
| Wild rainbow trout | 0.7 | 1.4 | 0.7 | 4.0 |
| Hatchery rainbow trout | 0.1 | 0.6 | 0.1 | 0.6 |
| Brook trout | 0.2 | 0.1 | 0 | 0 |

1/ Data from June and July.
2/ Data for June.

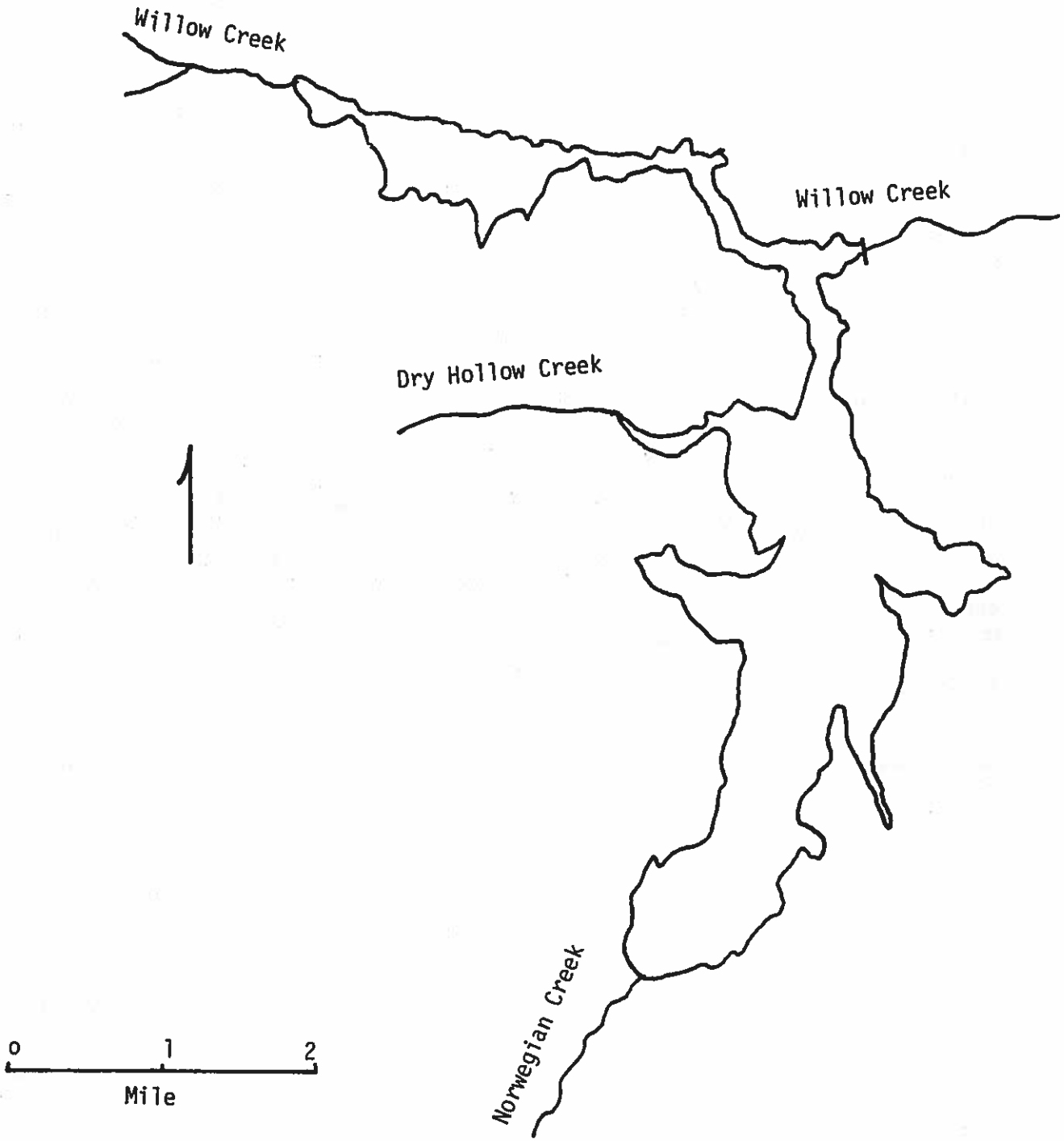


FIGURE 2. Willow Creek Reservoir

TABLE 6. Willow Creek Reservoir creel census data showing trout creeled plus catch per hour for 1972 and 1973. Catch per hour shown in parentheses.

| Month | Hours | Trout Species | | | |
|---|---|---|---|---|---|
| | | Wild Brown | Wild Rainbow | Hatchery Rainbow | Total |
| | | | 1972 | | |
| June | 634 | 20 (.03) | 18 (.03) | 245 (0.39) | 283 (0.45) |
| July | 288 | 4 (.01) | 18 (.06) | 116 (0.40) | 138 (0.48) |
| August | 527 | 8 (.02) | 10 (.02) | 171 (0.32) | 189 (0.36) |
| September | 273 | 1 (.004) | 8 (.03) | 73 (0.27) | 82 (0.30) |
| | | | 1973 | | |
| May-June | 353 | 42 (0.12) | 10 (0.03) | 20 (0.06) | 72 (0.20) |
| July | 140 | 1 (0.01) | 1 (0.01) | 1 (0.01) | 3 (0.02) |

## Rivers

### Boulder River

Wild trout population estimates were made on four sections of the Boulder River and one in the Little Boulder River, a tributary stream (Figure 3). Three species of trout (brown, brook and rainbow) were found in the five study sections. The only section in which brook and rainbow trout were found in significant numbers was Elkhorn (Table 7). Wild trout numbers were lower in the upper Boulder River sections (Elkhorn, Carey and Nigger Hollow) where extensive areas are annually dewatered for irrigation, periodic heavy metal pollution exists, excessive sedimentation occurs, and much streambank vegetation has been destroyed. The two sections where these environmental abuses are less (Little Boulder River and Shaw Ranch) show higher trout populations.

A 1973 streamflow survey done during July and August showed that four miles of the Boulder River were completely dewatered and another 20 miles having severe dewatering (U.S. Soil Conservation Service, 1974). The main dewatering included the Carey Ranch and Nigger Hollow study sections.

There has been a significant amount of mining activity in the upper Boulder drainage in the past. Much of this mining has been for the heavy metals such as gold, silver, copper, lead and zinc. Elser and Marcoux (1970) found acidic effluents from tailing piles entering such tributary streams as Cataract, High Ore and Basin Creeks. Since heavy metal pollution can damage the wild trout fisheries and its food source, aquatic insects, eight stream sediment sample sites and 10 aquatic insect sampling sites were set up on the Boulder and some of its tributaries. The sediment samples were taken either from the stream bed or the immediate floodplain and analyzed for heavy metal concentrations (Table 8). Aquatic insects were sampled with a Surber square-foot bottom sampler during July and October, 1974 (Table 9). The heavy metal concentrations of copper, lead, and cadmium were high in the Boulder River from Basin to a site 16 miles below the town of Boulder. This area included the Elkhorn fish population study section. Zinc concentrations were high in all areas of the Boulder River drainage sample. Insect samples taken in sites where copper, lead and cadmium concentrations were high showed fewer Mayfly species and numbers than it sites of lower heavy metal concentrations.

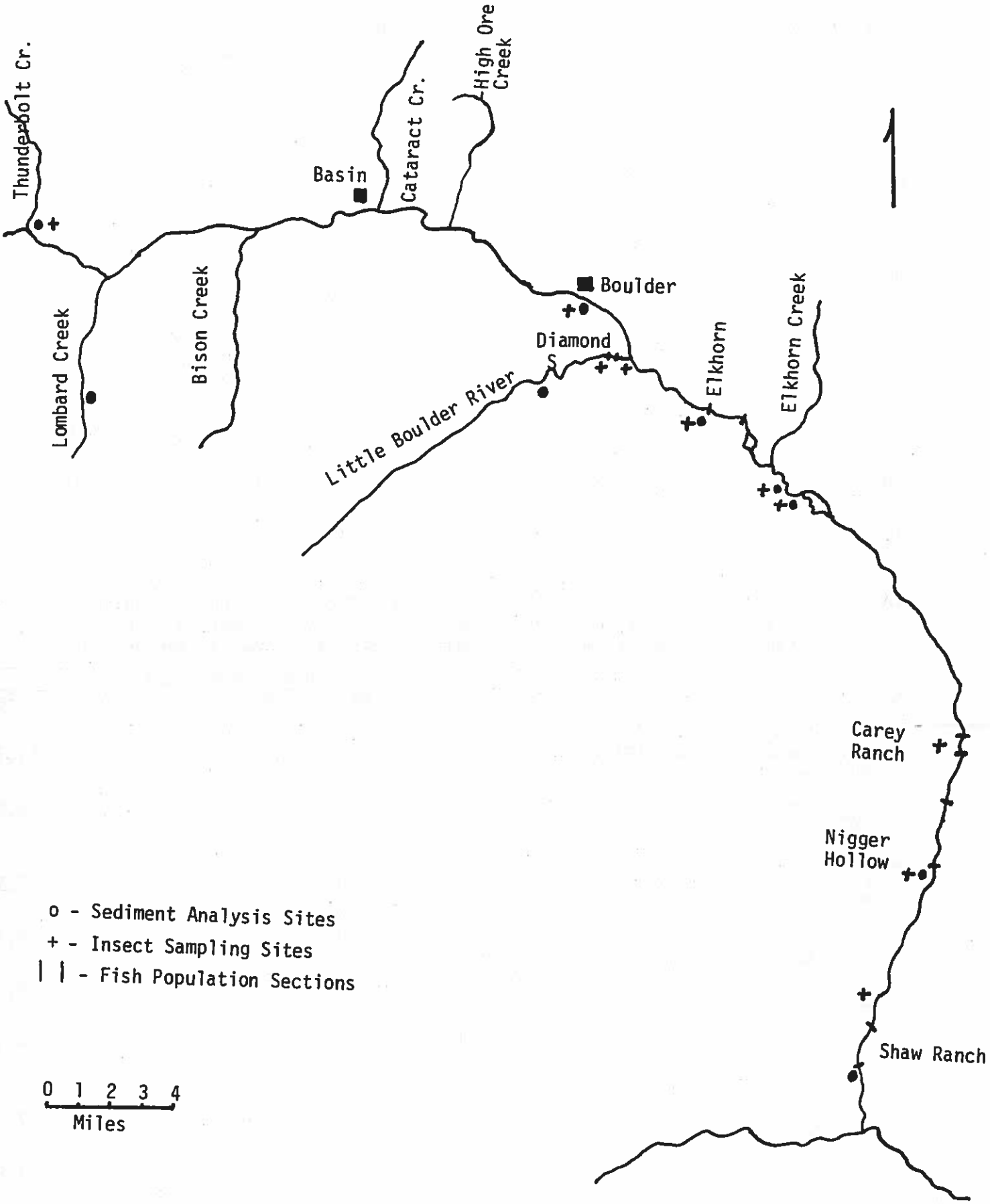


FIGURE 3. Map of Boulder River Drainage

TABLE 7. Wild trout population estimates for four sections of the Boulder River and one section on the Little Boulder River. Numbers and pounds are shown per 1000 feet. Confidence intervals are shown in parentheses.

| Section & Location | Trout Species | Age Structure I | II | III+ | Total Number | Pounds |
|---|---|---|---|---|---|---|
| Little Boulder Diamond-S - 440 feet | Rainbow | 17 | 21 | 14 | 52 (±10) | 18.6 (±3) |
| | Brown[1/] | - | - | 18 | 18 (±3) | 30.6 (±8) |
| Total | | | | | 70 | 49.2 |
| Elkhorn 8500 feet | Rainbow | 6 | 3 | 1 | 10 (±3) | 2.7 (±1) |
| | Brown | 5 | 4 | 4 | 13 (±4) | 7.8 (±3) |
| | Brook | 10 | 5 | 1 | 16 (±5) | 4.7 (±1) |
| Total | | | | | 39 | 15.2 |
| Carey Ranch 3200 feet | Brown | 20 | 24 | 8 | 52 (±6) | 26.6 (±3) |
| Nigger Hollow 12,200 feet | Brown | 12 | 21 | 7 | 40 (±9) | 15.4 (±3) |
| Shaw Ranch 6150 feet | Brown | 169 | 55 | 18 | 242 (±60) | 70.2 (±10) |

1/ Insufficient data to estimate one and two-year-old brown trout

TABLE 8. Stream sediment analysis of heavy metals for streams on the Boulder River and some tributaries. Samples tested by U.S. Bureau of Mines Laboratory, Butte, Mt. Dates samples taken are shown in parentheses.

| Station | Heavy Metals ppm Cu | Pb | Ni | Zn | Cd | Fe |
|---|---|---|---|---|---|---|
| Little Boulder River | | | | | | |
| Above Diamond S (Aug. 1974) T5N, R5W, S9 | 41.5 | 25.0 | 16.0 | 116.0 | 1.0 | 59,700 |
| Lowland Creek (Aug. 1974) T5N, R7W, S14 | 28.0 | 26.5 | 12.5 | 176.0 | 1.0 | 18,900 |
| Boulder River | | | | | | |
| Near mouth Thunderbolt (Aug. 1974) T6N, R7W, S21 | 117.0 | 70.0 | 10.0 | 675.0 | 3.5 | 22,900 |
| Elkhorn Bridge (Oct. 1974) T5N, R3W, S19 | 281.0 | 840.0 | 24.0 | 1750.0 | 14.0 | 49,750 |
| Gravel Pile Area (Aug. 1974) T5N, R3W, S33 | 460.0 | 338.5 | 11.5 | 3525.0 | 9.0 | 26,900 |
| Gravel Pile Area (Aug. 1974) Floodplain sediments T5N, R3W, S33 | 278.0 | 1810.0 | 9.0 | 3375.0 | 90.5 | 19,900 |
| Quaintance Bridge (Aug. 1974) T4N, R3W, S12 | 234.0 | 203.0 | 11.0 | 1725.0 | 6.5 | 27,900 |
| Nigger Hollow Bridge (Oct. 1974) T3N, R2W, S31 | 93.5 | 60.0 | 13.5 | 713.0 | 3.0 | 27,850 |
| Shaw Bridge (Oct. 1974) T2N, R3W, S35 | 123.0 | 98.5 | 12.0 | 837.0 | 4.0 | 29,850 |

TABLE 9. Numbers of aquatic insects from three square foot samples during July and October, 1974, sampling on the Boulder and Little Boulder Rivers. (October samples in parentheses).

| Station | Insect Orders | | | | | |
|---|---|---|---|---|---|---|
| | Ephemer-optera | Plecoptera | Coleoptera | Odonata | Trichoptera | Diptera |
| L. Boulder River | | | | | | |
| Diamond S T5N, R4W, S10 | 29 (58) | 17 (86) | 14 (15) | 0 (0) | 43 (51) | 29 (11) |
| Highway Bridge[1/] T5N, R4W, S10 | 11 (-) | 1 (-) | 16 (-) | 0 (-) | 19 (-) | 35 (-) |
| Boulder River | | | | | | |
| Near mo. Thunderbolt T6N R7W S21 | 39 (91) | 9 (15) | 0 (4) | 0 (0) | 224 (59) | 0 (1) |
| Boulder Hwy Bridge[2/] T6N R4W S33 | - (0) | - (10) | - (2) | - (0) | - (0) | - (3) |
| Elkhorn Bridge T5N R3W S19 | 1 (38) | 9 (54) | 0 (1) | 0 (0) | 2 (31) | 11 (39) |
| Gravel Piles T5N R3W See | 5 (4) | 178 (65) | 0 (1) | 1 (0) | 567 (308) | 7 (0) |
| Quaintance Bridge[2/] T4N R3W S13 | - (0) | - (0) | - (0) | - (0) | - (2) | - (6) |
| M. Carey Ranch T3N R2W S8 | 1 (1) | 216 (65) | 7 (5) | 0 (0) | 1183 (1280) | 4 (19) |
| Nigger Hollow Br. T3N R2W S31 | 1 (1) | 75 (44) | 4 (34) | 3 (3) | 444 (690) | 5 (23) |
| Elliot Bridge T2N R3W S24 | 1 (30) | 15 (13) | 6 (32) | 0 (1) | 405 (1891) | 42 (3) |

1/ Not sampled October 10, 1974.
2/ Not sample July 31, 1974.

## Madison River

Trout population estimates were made on three sections of the Madison River (Burnt Tree, Norris and Varney). Spring trout population estimates were made on the Norris and Burnt Tree sections, and fall population estiamtes were made on the Burnt Tree and Varney sections. Results of the 1974 population data will be compiled and presented in a future progress report.

## O'Dell Creek

Trout popualtion estimates were made on two sections of O'Dell Creek during May, 1974, and on one section during September, 1974. A total of 300 wild brown and rainbow trout were tagged for future movement and angler harvest information. Results of the 1974 population data will be compiled and presented in a future progress report.

## REFERENCES


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Prepared by: E. Richard Vincent

Date: July 28, 1975

Waters Referred To:

Hebgen Reservoir - 13-846-5
Willow Creek Reservoir - 10-8000-1
Boulder River - 19-0840-01
Little Boulder River - 10-566-01
Lowland Creek - 10-4440-01
Madison River - 13-3440-01
O'Dell Creek - 13-4400-01
Basin Creek - 10-0120-01
South Fork Madison - 13-5400-01