MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

FISHERIES DIVISION

Job Progress Report

| | | | |
|---|---|---|---|
| State: | Montana | Title: | Southwest Montana Fisheries Investigation |
| Project: | F-9-R-35 | | |
| Job No. | Ia | Title: | Inventory and Survey of the Water of the Gallatin and Madison Drainages |

## ABSTRACT

Wild brown and rainbow trout population estimates were made on the Hoffman Ranch section of the East Gallatin River located both above and below the Bozeman Sewage Treatment effluent outfall. From 1973 through 1982, wild trout biomass increased 930%. This increase suggests improvement was probably due to improved treatment of the sewage effluent with the addition of secondary treatment in 1971. Wild rainbow trout biomass showed a large decline during 1983 decreasing 65% from 1982 levels. No significant change in this rainbow trout biomass has occurred since 1983. Population estimates of rainbow trout in 1986 above and below the new effluent discharge site show no appreciable difference in biomass levels.

Spawning DeSmet strain rainbow trout at the Willow Creek spawning trap showed a large increase (729%) in spawners from 1982 to 1987. Most of the spawning rainbow in 1987 were those spawned in the tributary streams rather than stocked rainbow.

Gill net data from Hebgen Reservoir for the 1971-1986 period showed an increase in McBride Lake cutthroat trout during years in which spring plants of 7-9 inch fish were used versus the fall plants of 2-4 inch cutthroat trout. Wild rainbow trout numbers have increased 181% from the 1971-74 period to 1986 after cessation of the stocking of fall spawning rainbow trout. Wild brown trout numbers have also increased from an average of 8.1/bottom net set for 1971-74 to a peak of 18.7 in 1984 and 11.8 in 1986.

## BACKGROUND

The East Gallatin River flows through both a heavily developed agricultural and urban area (City of Bozeman). The City of Bozeman discharges treated sewage effluent into the East Gallatin River near its source. Other urban runoff effluents have direct access to the East Gallatin River via tributaries such as Sourdough and Rocky Creeks. Industrial wastes, septic tank effluent and storm sewers also enter these headwater streams. An EPA "Superfund" site is located adjacent to Rocky Creek, a major tributary to the East Gallatin and may be contaminating the river with Pentachlorophenol. In November, 1982, the City of Bozeman began to operate its newest sewage treatment facility with the sewage effluent receiving secondary and some tertiary treatment. The new effluent discharge site was moved approximately 5000 feet downstream from the old site.

Willow Creek Reservoir had been managed since the mid-1950's with annual plants of either catchable-sized (7 inch and larger) or subcatchable-sized (4-6 inch) hatchery-reared fall spawning rainbow trout. By the mid-1970's no viable reproduction of spring spawning wild rainbow trout were present. Prior to the 1960's a rainbow spawning trap was operated on Willow Creek (a tributary stream) during the March-April period and 1-3 million eggs were taken annually.

Hebgen Reservoir has been managed since the mid-1950's with annual plants of either catchable or subcatchable-sized hatchery reared fall spawning rainbow trout. By the mid-1970's Hebgen Reservoir had no viable populations of spring spawning wild rainbow trout. Prior to the mid-1950's spawning runs were large enough to obtain eggs for rearing in hatcheries.

In 1980, the fisheries management plan for Hebgen Reservoir was changed from stocking fall spawning rainbow trout to trying to establish spring spawning runs of cutthroat and rainbow trout. From 1980 through 1985, both spring and fall stocking of McBride Lake Yellowstone cutthroat trout in the reservoir occurred, as well as imprinted in some tributary streams. Beginning in 1984, fall and spring plants of Eagle Lake rainbow trout were also stocked in Hebgen Reservoir. DeSmet rainbow trout were also planted in Hebgen for the first time in August, 1986.

## OBJECTIVES AND DEGREE OF ATTAINMENT

1. To determine fish populations, species composition and growth rates for one section of the East Gallatin River. One section of the East Gallatin River was sampled and is discussed this report.

2. To determine the success of planting 1-2 inch cutthroat trout versus 7-9 inch fall spawning rainbow trout in Hebgen Reservoir. Data is included in this report.

3. To mitigate or enhance habitat alterations due to agricultural, residential, mining, and industrial development. A total of 25 stream alteration projects were examined and commented on during the 1986-87 period. Files are maintained in the regional headquarters.

## PROCEDURES

Electrofishing gear was used to sample fish populations in the East Gallatin River. Electrofishing was conducted by floating through the section in a fiberglass boat utilizing a mobile positive electrode. Population estimates were made using a Peterson mark-and-recapture method. Usually, a 10-15 day period was allowed between marking and recapture trips. Captured fish were measured to the nearest 0.1 inch and weighed to the nearest 0.02 pound. Scales were taken (10/0.5 inch) to determine age and growth rates. Actual mathematical computations were made by a computer programmed to use methods described by Vincent (1971 and 1974).

Fish populations in Willow Creek Reservoir were sampled using 125 foot long 6 foot deep experimental gill nets set overnight. Gill nets were either set on the bottom or at the surface. A fish trap was placed in Willow Creek approximately 500 yards above the reservoir during the March - April period to count and mark spring spawning DeSmet Lake rainbow trout. All captured rainbow trout were sexed. weighed to the neared 0.02 pound and measured to the nearest 0.1 inch.

## FINDINGS

In March, 1971, the City of Bozeman replaced an existing primary treatment plant with a new plant capable of partial secondary treatment. The site of the new treatment plant was located about two miles downstream from the old site. The sewage effluent from the pre-1971 treatment plant was shown to have detrimental effects on wild brown and rainbow trout numbers, biomass, growth rates and reproduction. During the last few years the old plant was in operation (1966-70), fish population surveys showed few or no young-of-the-year or yearling trout, especially brown trout, present from the sewage outfall to the mouth of Middle Creek (Figure 1). Yearling rainbow trout comprised only 5-40% of the total population in this reach during the 1966-70 period (Vincent 1970).

The Hoffman study section was set up to monitor the effect of the effluent from the new sewage treatment plant on the wild trout population. This section was located downstream from the 1971-1982 sewage effluent outfall. This section was then divided into two sections (upper and lower) when the effluent discharge site was moved approximately 4673 feet downstream. Comparisons of wild rainbow trout populations (lbs./mile) had shown a steady increase from 1971-73 through 1982 (Figure 2). During this

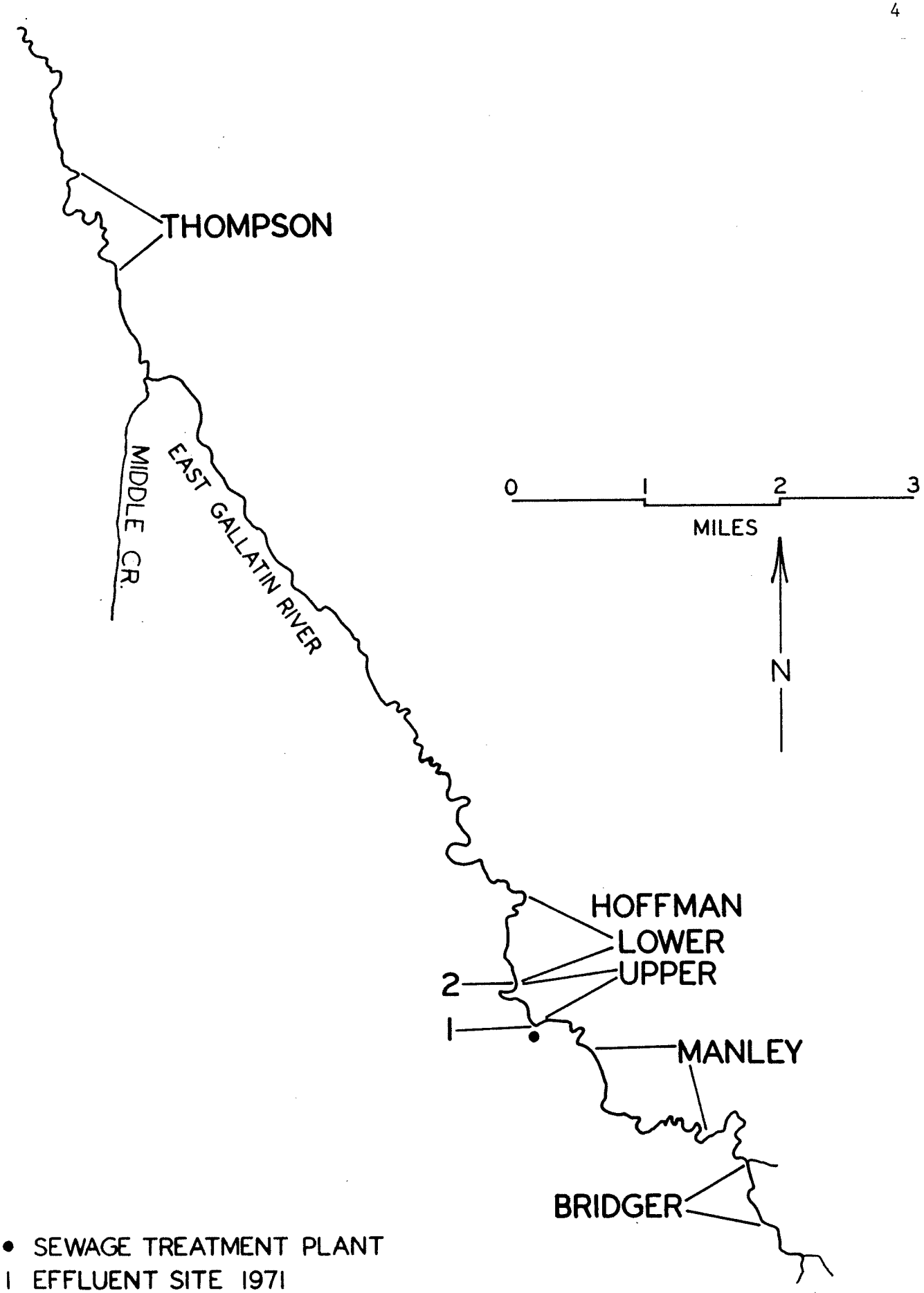
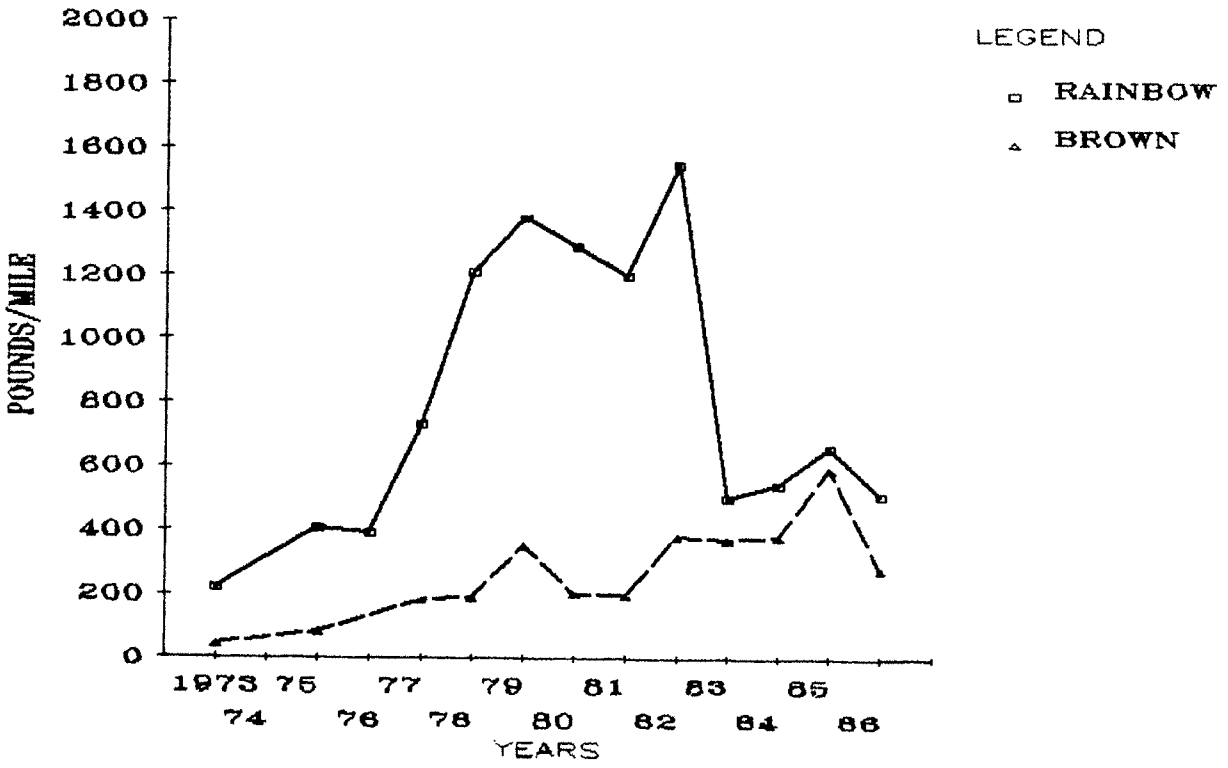



Figure 1. Map of the East Gallatin River study area.

Figure 2. Comparison of Fall(Sept-Oct.) two-year-old and older wild brown and rainbow trout biomass (lbs./mi.) in the Hoffman Ranch section of the East Gallatin River for the 1973 -1986 period. The section length is 10,236 feet in length.




period wild rainbow trout biomass increased 557% in the Hoffman Ranch section. From 1982 to 1983 the rainbow trout biomass decreased 65%. A 1984 wild rainbow trout estimate from the Manley section (above the Hoffman Ranch section) showed a similar 58% decrease from 1982 (Vincent, 1985). Brown trout had shown a 920% increase during this 1971-73 through 1982 period, but did not show any decrease during the 1982 to 1983 period. Wild rainbow trout populations in the Hoffman Ranch section showed a slight increase in biomass from 1983 to 1985, but experienced another smaller (21%) decline from 1985 to 1986. Unlike the 1982-83 decline, brown trout also showed a decrease in total biomass (46%).

Comparison of total biomass of rainbow trout between the upper (above the sewage effluent) and lower (below the sewage effluent) for the 1984-86 period shows similar estimates except for 1985 when the lower section had a 35% higher biomass. A similar comparison for

brown trout shows the upper section to have the greater biomass estimate (lbs./mi.) in all three years, although only in 1985 was the difference very large (49%). This suggests that the present effluent discharge is having little impact on the wild trout population and the large decline in wild rainbow trout biomass since 1982 must be attributed to other sources.

Table 1. Comparison of fall(Sept.-Oct.) estimates of two-year-old and older wild brown and rainbow trout shown as numbers/mile and biomass (lbs./mi.) for the Hoffman Ranch section during the 1984-86 period. Confidence intervals at the 80% level are shown in parentheses.

| | 1984 | | 1985 | | 1986 | |
|---|---|---|---|---|---|---|
| Section | No. | Wt. | No. | Wt. | No. | Wt. |
| | | | Rainbow Trout | | | |
| Upper | 2694 | 584 | 1005 | 556 | 1201 | 537 |
| | ( 140) | ( 82) | ( 158) | ( 77) | ( 332) | ( 173) |
| Lower | 1139 | 533 | 1430 | 751 | 1332 | 493 |
| | ( 128) | ( 69) | ( 171) | ( 85) | ( 144) | ( 67) |
| | | | Brown Trout | | | |
| Upper | 712 | 352 | 802 | 696 | 376 | 309 |
| | ( 163) | ( 93) | ( 208) | ( 255) | ( 87) | ( 97) |
| Lower | 643 | 256 | 950 | 354 | 365 | 257 |
| | ( 123) | ( 51) | ( 163) | ( 161) | ( 63) | ( 49) |

## Willow Creek Reservoir

A spawning trap on Willow Creek was installed in the spring of 1982 (March-May) to monitor the number of spring spawning rainbow trout moving up the creek to spawn (Figure 3). In 1975, the rainbow trout spawning trap captured only 37 mature male and female trout during the March 1 though May 1 period. In 1977, 103,420 wild spring spawning DeSmet rainbow trout were stocked in Willow Creek Reservoir followed by plants of 104,497 in 1978, 74,820 in 1980, 143,497 in 1981 and 40,000 in 1983. In 1982, the rainbow trout spawning trap captured 608 mature DeSmet rainbow trout. In 1987, 3642 spawning rainbow were captured (Figure 4). Since the spawning run is primarily made up of trout three-years-old and older, the spawning runs from 1982 through 1985 were primarily DeSmet rainbow trout stocked during 1977-81 period. The first major contribution of rainbow spawned in Willow Creek was in 1986 and 1987 when recruitment from 1982, 1983 and 1984 appeared as mature fish.

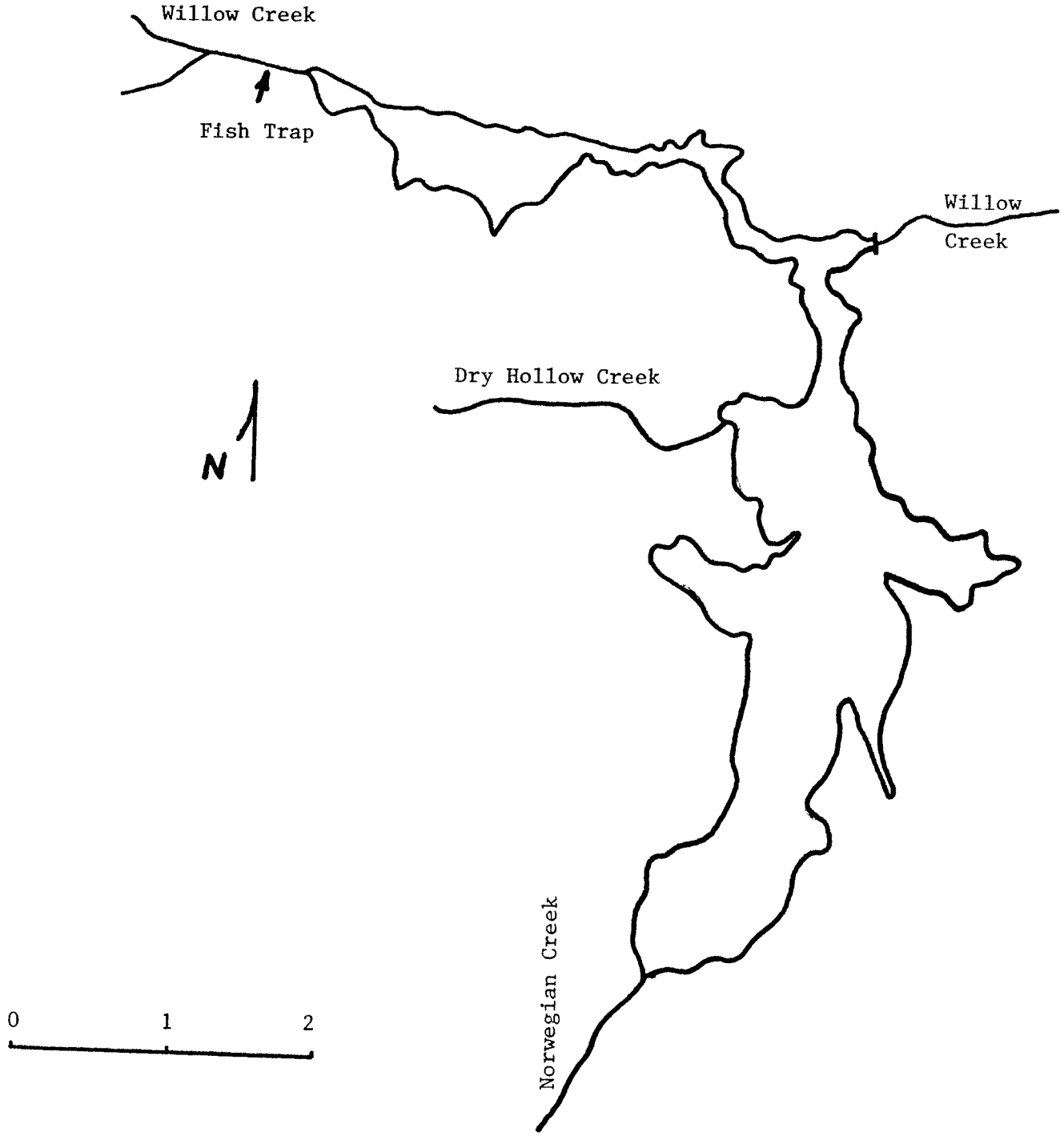
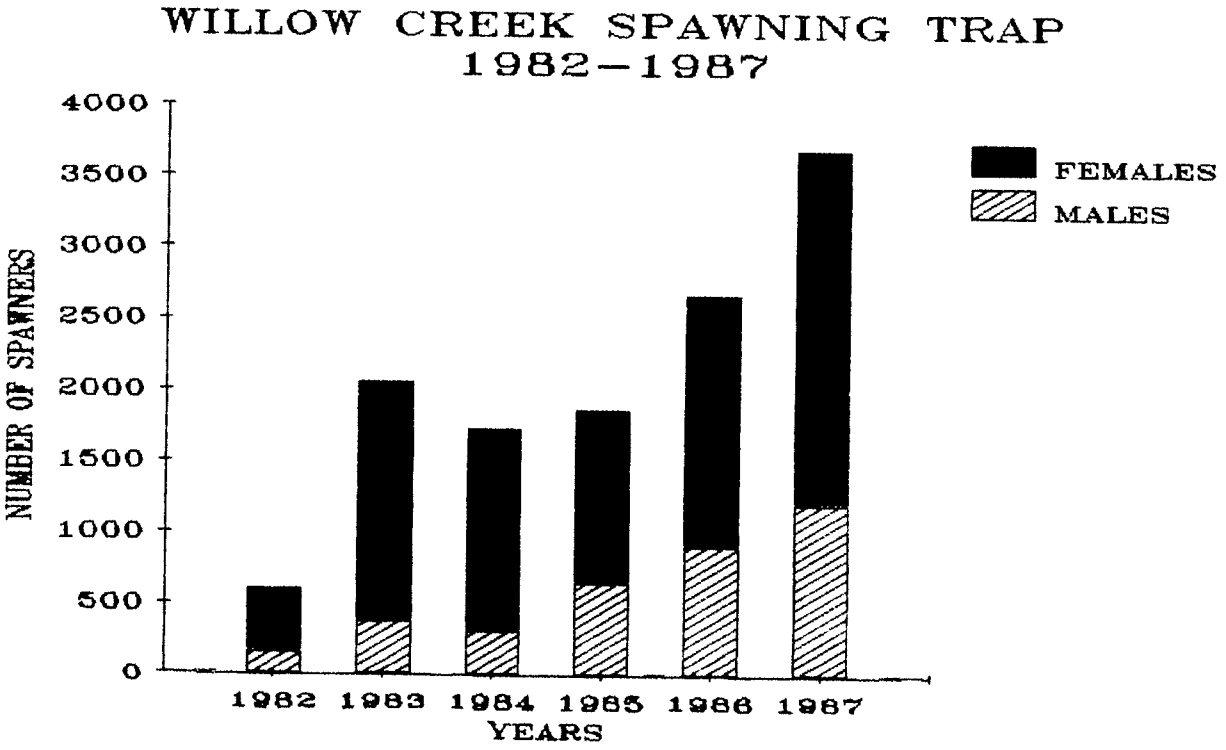



Figure 3. Willow Creek Reservoir

## Hebgen Reservoir

Fish populations in Hebgen Reservoir were monitored by bottom and surface gill nets since 1971 to follow population trends of rainbow, brown and cutthroat trout (Figure 5). From 1954 through 1980, the primary fish stocked in Hebgen

Figure 4. Comparison of numbers of spring spawning DeSmet rainbow trout captured at the Willow Creek spawning trap for the 1982-1987 period. Trap operated from late February through early May.




Reservoir were various sizes of fall spawning hatchery rainbow trout. Catchable-sized rainbow were stocked for 21 years (1954-1974). Large numbers of subcatchable-sized rainbow (4-6 inches) were stocked from 1968 through 1980. In spite of this stocking, population trends monitored through gill nets showed a very low number of hatchery rainbow trout present in the reservoir during the 1971-74 period (Vincent 1984). Wild rainbow trout were also low in numbers during this 1971-74 period. Stocking of fall spawning rainbow trout was discontinued in 1981 and replaced with the stocking of McBride cutthroat trout in 1979 and spring spawning Eagle Lake rainbow trout in 1983. Approximately 200,000

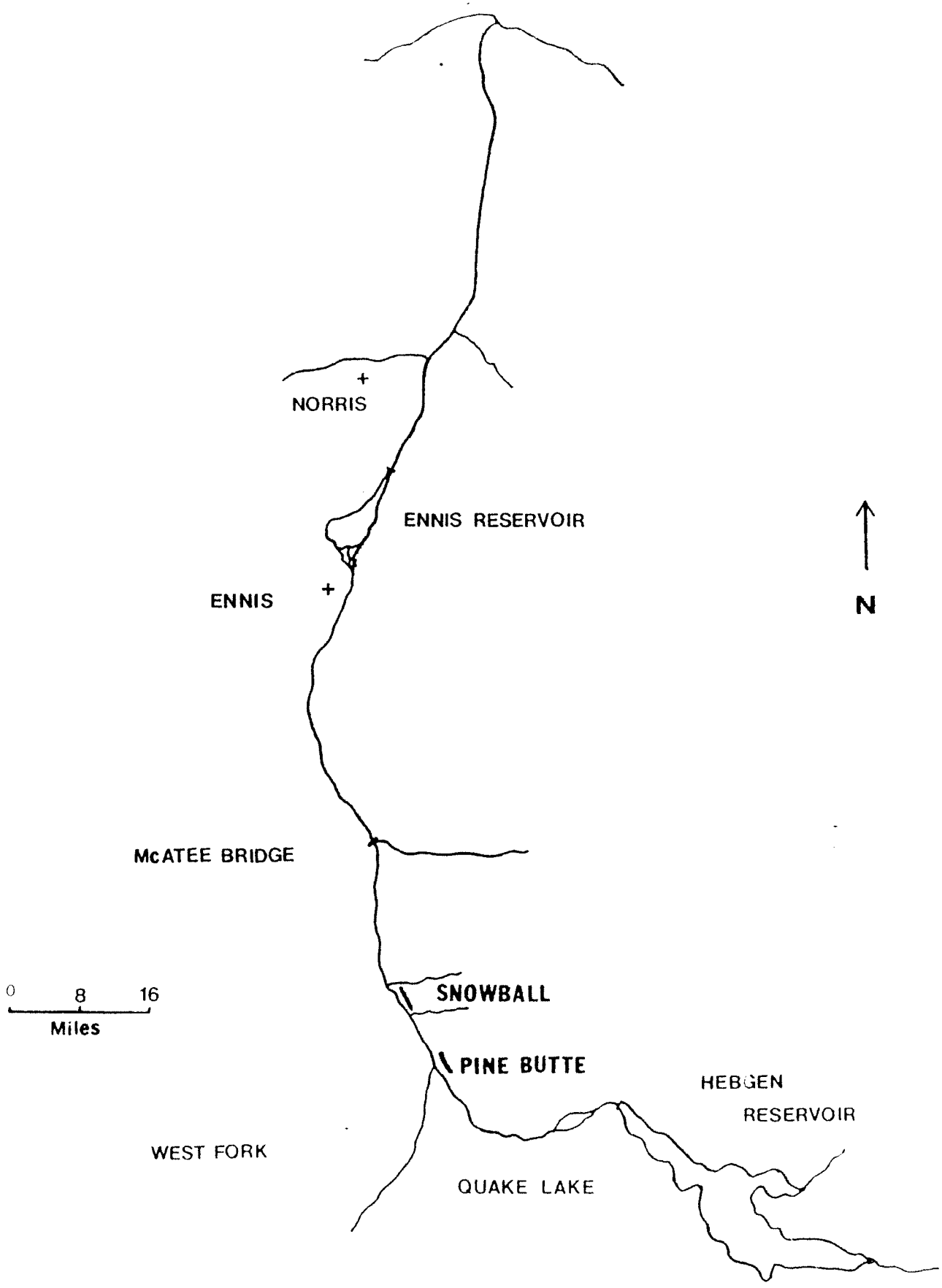
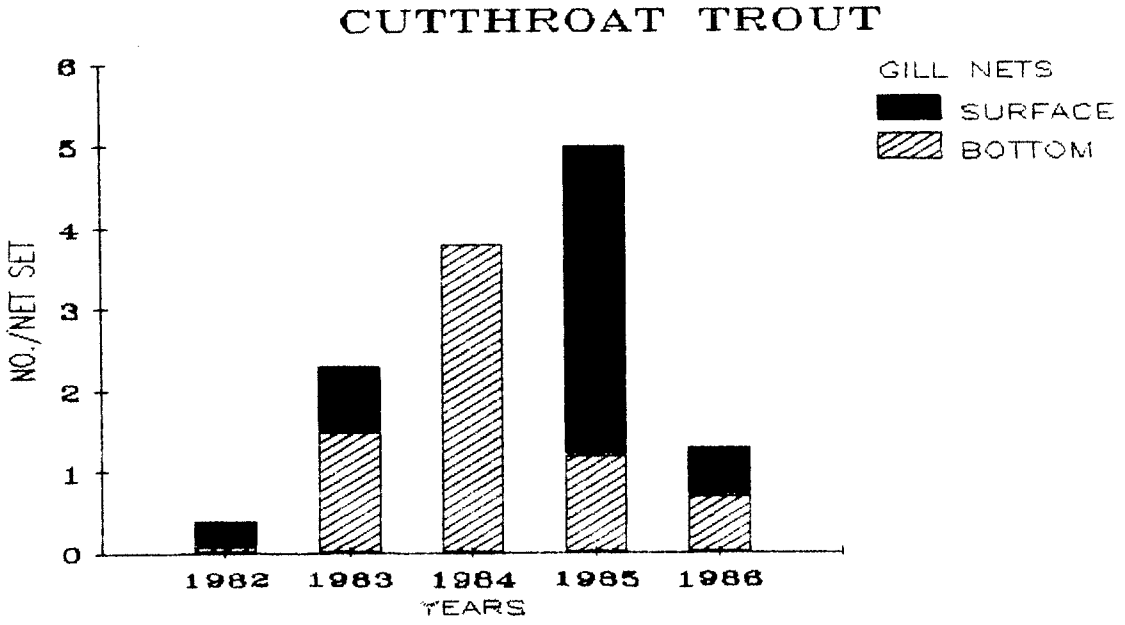



FIGURE 5. Map of the Madison River showing study sections.

to 300,000 (2-4 inch) cutthroat trout were stocked during July-August from 1979 to 1983. Because of initial poor survival of this size trout, spring plants of 6-8 inch cutthroat began in 1983. Plants of 105,000 in 1983, 83,000 in 1984 and 22,000 in 1985 were made.

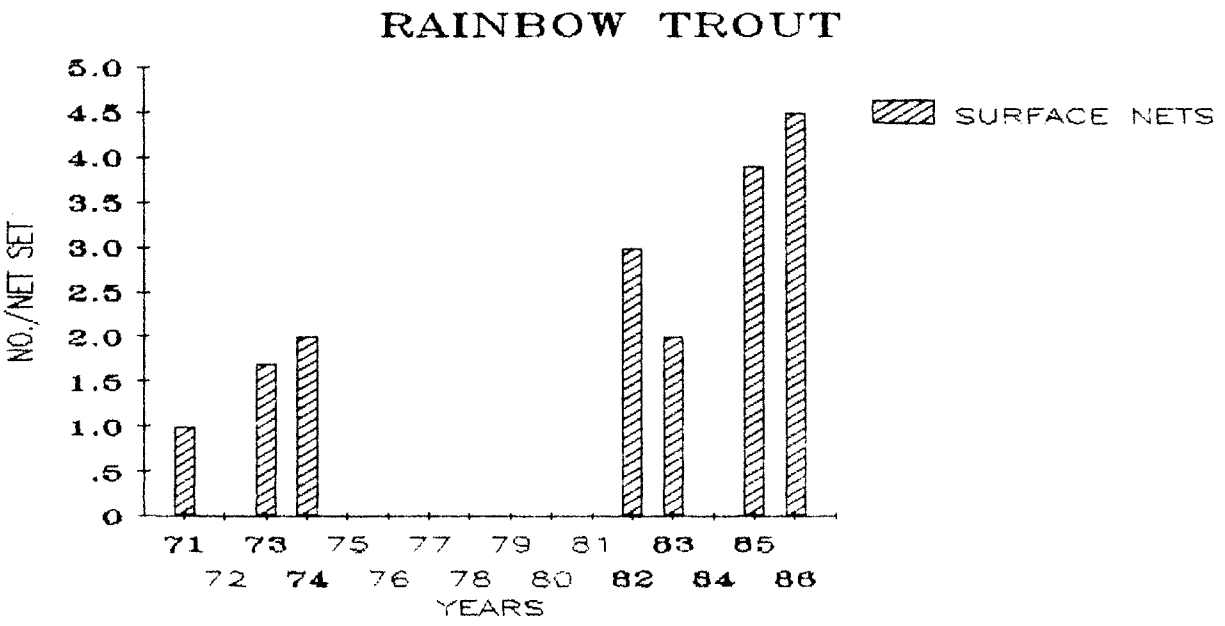
Bottom and surface gill net sets made from 1982 through 1986 showed McBride cutthroat trout numbers increased significantly when spring planting of larger cutthroat trout was initiated in 1983 with numbers peaking in 1985 ( Figure 6). The 1986 gill netting data showed a large decline in numbers of cutthroat trout which was preceded by a very small spring plant of 22,000 in 1985. This indicated that the abundance of cutthroat trout in the reservoir was dictated by the number of large cutthroat trout planted the pervious spring and little natural reproduction was occurring in tributary streams as this time.

Figure 6. Comparison of McBride cutthroat trout numbers in Hebgen Reservoir using bottom and surface gill net sets for the years 1982-86.



Surface gill nets were used to determine relative wild rainbow trout numbers in Hebgen Reservoir and showed very low numbers in the early 1970's ,averaging 1.6/net for 1971-74 (Figure 7). With the cessation of fall spawning rainbow trout

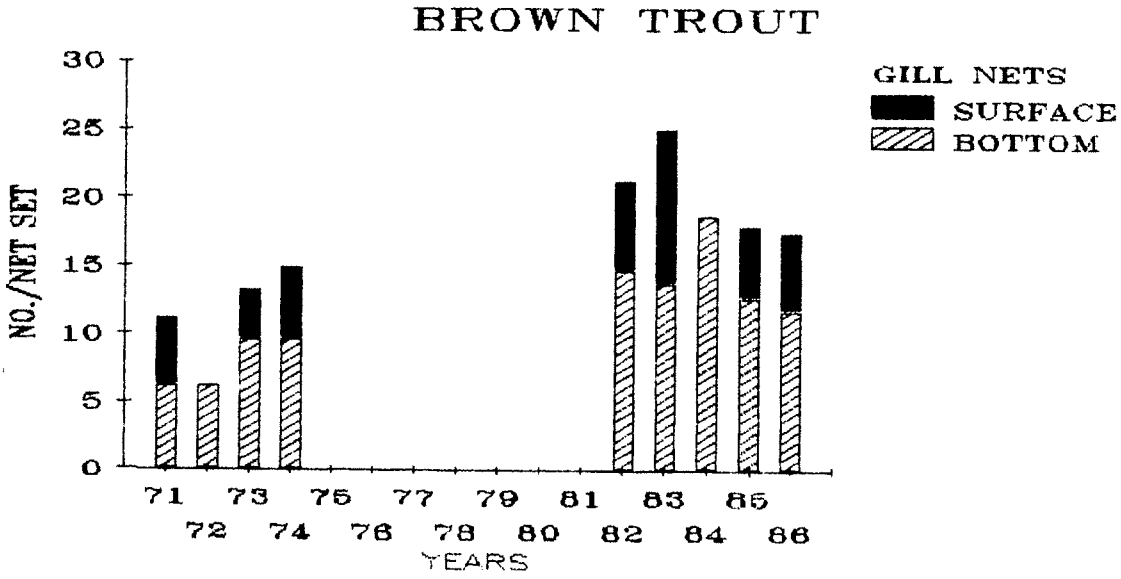
Figure 7. Comparison of wild rainbow trout numbers in Hebgen Reservoir from 1971-86 using surface set gill nets.




stocking in 1980, wild rainbow numbers in the surface gill nets have increased to 4.5/net in 1986. Only a small portion of the 1986 gill net sample of rainbow trout were the stocked Eagle Lake strain indicating that natural reproduction in tributary streams had increased from the 1971-74 levels.

Wild brown trout numbers in Hebgen were monitored using a combination of surface and bottom gill net sets (Figure 8). From 1971-74 brown trout were the most abundant trout species in Hebgen Reservoir averaging 8.1/bottom net set. Beginning with the 1980's netting brown trout numbers showed a substantial increase in numbers with 14.7/bottom set in 1982, 13.8 in 1983 and a maximum 18.7 in 1984. It is unknown what caused this increase in brown trout numbers, but the increases did coincide with the cessation of fall spawning rainbow trout stocking.

Figure 8. Comparison of wild brown trout numbers in Hebgen Reservoir for the 1971-86 period using surface and bottom gill net sets. Numbers shown as trout per set.




No surface nets set in 1984.

## LITERATURE CITED

Vincent, E. R. 1970. Evaluation of river fish populations. Job Completion Report, Federal Aid in Fish and Wildlife Restoration Acts. Montana Project No. F-9-R-18, Job VII.

Vincent, E. R. 1971. River electrofishing and fish population estimates. Prog. Fish Cult.

Vincent, E. R. 1974, Addendum to river elctrofishing and fish population estimates. Prog. Fish. Cult.

Vincent, E. R. 1984. Inventory and survey of the water of the Gallatin and Madison Drainages. Job Progress Report, Federal Aid in Fish and Wildlife Restoration Acts. Montana Project No. F-9-R-32, Job Ia.

Prepared by: E. Richard Vincent
Date: August 3, 1987
Waters reported: East Gallatin River 09-1710-01
Willow Creek Res.
Hebgen Reservoir