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MONTANA DEPARTMENT OF FISH, WILDLIFE & PARKS

FISHERIES DIVISION

Job Progress Report

State:	Montana	Title:	Southwest Montana Fisheries Investigation
Project No.:	F-9-R-33		
Job No.:	Ia	Title:	Inventory and Survey of the Water of the Gallatin and Madison Drainages

Project Period: July 1, 1984 through June 30, 1985

Report Period: July 1, 1984 through June 30, 1985

ABSTRACT

Wild brown and rainbow trout population estimates were made on a section of the East Gallatin River located immediately below the sewage treatment outflow from the City of Bozeman. From 1973 through 1982, wild trout biomass increased 930%. This increase suggests improvement was probably due to improved sewage treatment with the addition of secondary treatment in 1971. Wild rainbow trout biomass showed a large decline in 1983, decreasing 65% from September, 1982 to September, 1983. The September, 1984 wild rainbow trout biomass estimate showed no significant change from 1983. During the 1983 and 1984 period, no significant decline was noted for wild brown trout. Another study section (Manley) located approximately one mile above the Hoffman Ranch section showed a similar (58%) decline in wild rainbow trout biomass between 1982 and 1984.

Gill netting data from Willow Creek Reservoir from 1973 through 1985 shows after the cessation of fall spawning rainbow trout stocking in 1977, the number of wild spring spawning rainbow trout increased 427% and wild brown trout 94%. Most of the increase in wild rainbow trout numbers was due to introductions of the Lake DeSmet rainbow trout.

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. 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 or 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 reproduction of spring spawning wild rainbow trout. Although 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 were stocked in the reservoir, as well as in some spawning tributaries. Beginning in 1984, fall and spring plants of Eagle Lake rainbow trout were also stocked in Hebgen Reservoir.

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 under Findings.

2. To determine the success of planting 1-2 inch cutthroat trout versus 7-9 inch fall spawning rainbow trout in Hebgen Reservoir. Data will be presented in a future progress report.

3. To mitigate or enhance habitat alterations due to agricultural, residential, mining, and industrial development. To monitor fisheries throughout the drainages. A total of 17 stream alteration projects in the Madison drainage were examined and commented on during the 1983-84 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 per 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).

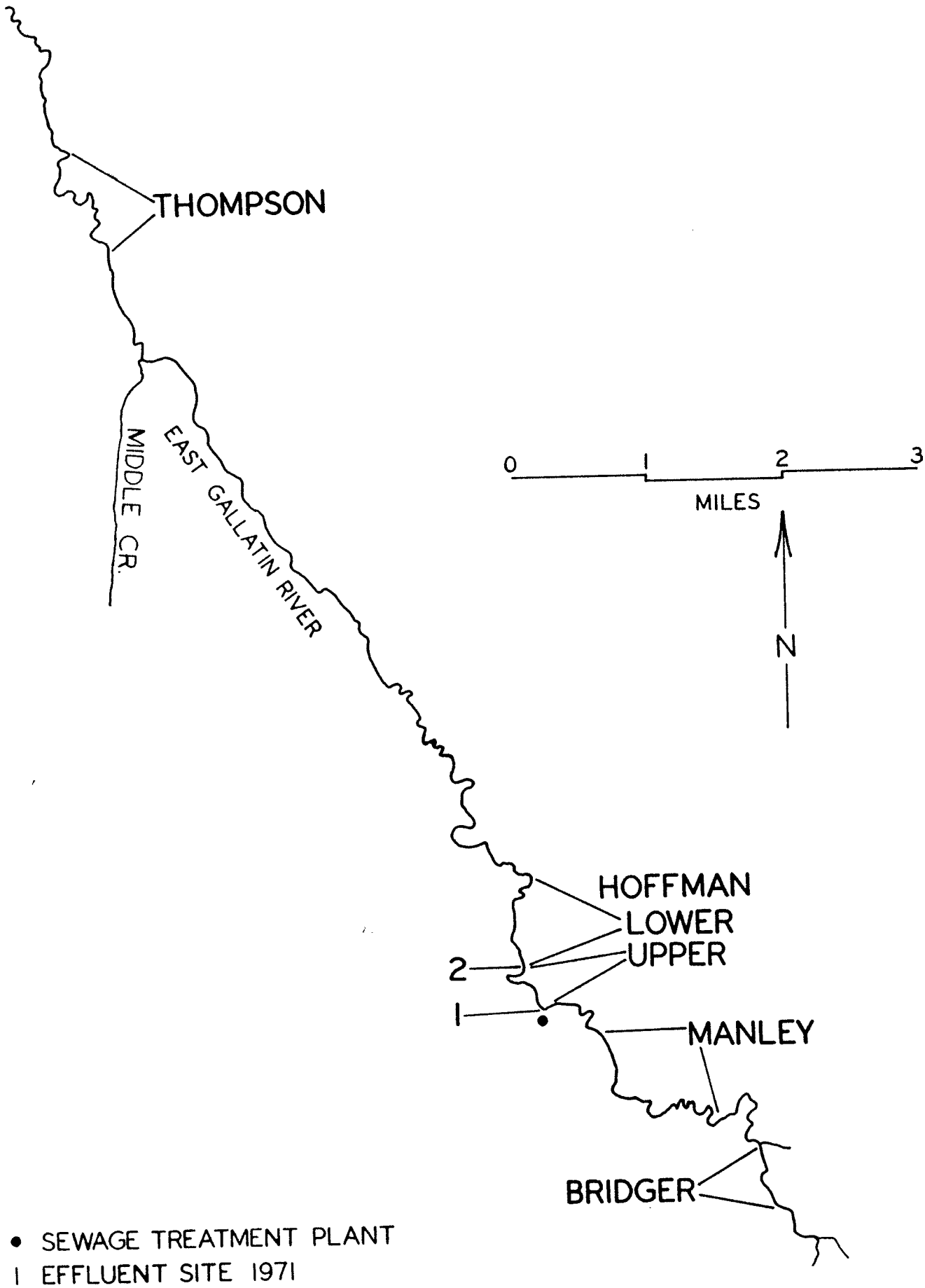
Fish populations in Willow Creek Reservoir were sampled using 125 foot long-6 foot deep experimental gill nets set overnight. Gill nets were either set on the bottom or at the surface. A fish trap was placed in Willow Creek approximately 500 yds. above Willow Creek Reservoir during the March-April period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

FINDINGS

East Gallatin River

In March, 1971, the City of Bozeman replaced an existing primary sewage 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 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 the above reach of the East Gallatin River during those years (Vincent 1970).

Two study sections (Manley and Hoffman Ranch) on the East Gallatin River were set up to monitor the effect of the new sewage effluent on the wild trout populations. The Manley section was located above the new effluent outlet and the Hoffman Ranch section was below. In both study sections, wild rainbow trout populations (lbs./mi.) have shown a steady increase from 1971-73 through 1982 (Figures 2 and 3). During this period wild rainbow trout biomass increased 631% in the Manley section and 557% in the Hoffman Ranch section. During the 1982 to 1984 period both sections showed large declines in total biomass (lbs./mi) with the Manley section decreasing 58% and the Hoffman Ranch section 65%. Brown trout, on the other hand, have only shown moderate increases (37%) in total biomass in the Manley section since 1971. No significant decline was shown for the 1982 to 1984 period. Brown trout populations in the Hoffman Ranch section have shown a 920% increase since 1973 with no significant change for the 1982-84 period, as was shown with wild rainbow trout. Using spring and


THOMPSON
MIDDLE CR.
EAST GALLATIN RIVER
0
1
2
3
MILES
N
HOFFMAN
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2
1
MANLEY
BRIDGER
• SEWAGE TREATMENT PLANT
1 EFFLUENT SITE 1971
2 EFFLUENT SITE 1982
BOZEMAN

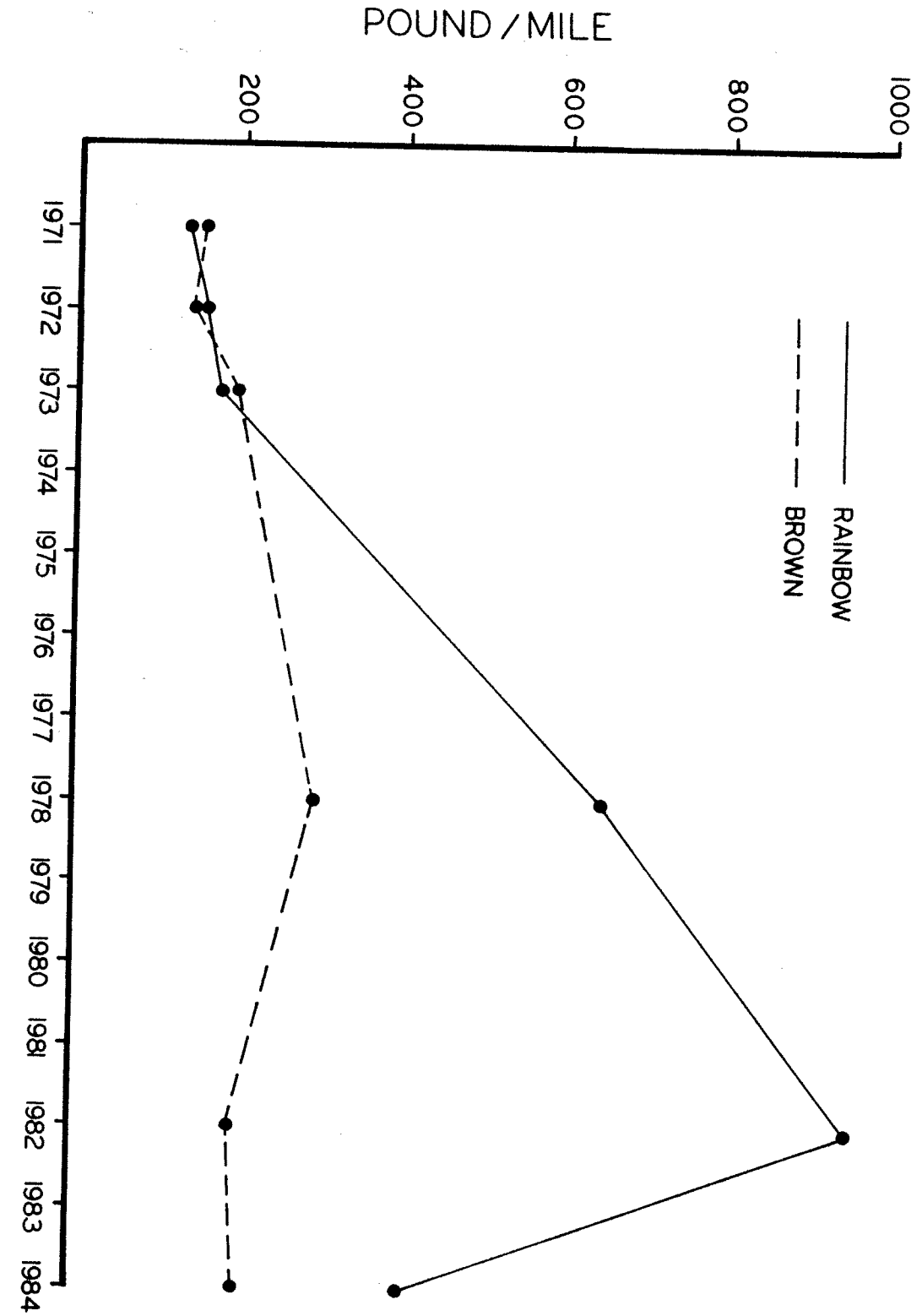

Figure 2. Comparison of two-year-old and older wild brown and rainbow trout biomass (lbs./mi.) in the Manley section of the East Gallatin River from 1971 to 1984.

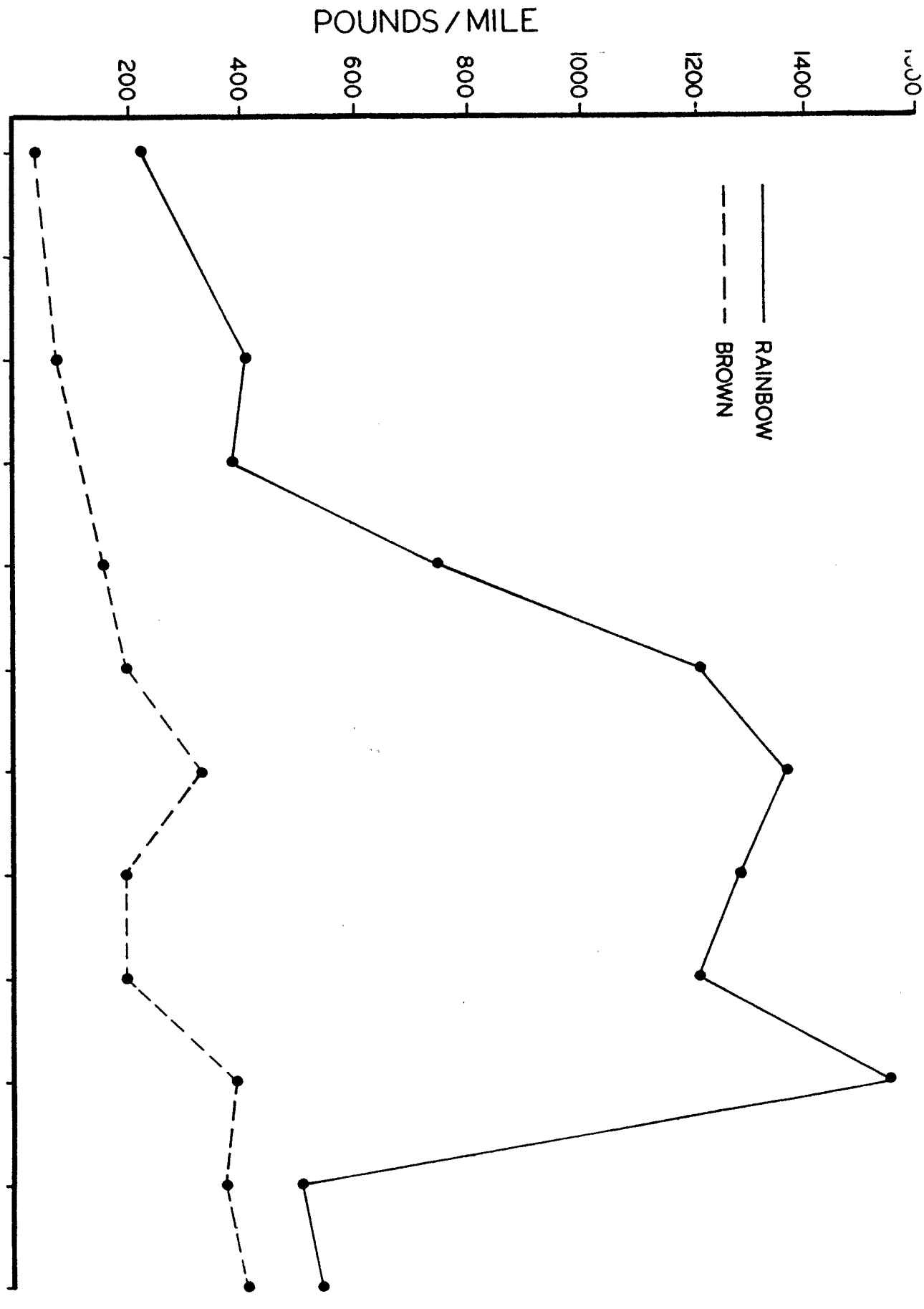

Figure 3. Comparison of two-year-old and older wild brown and rainbow trout biomass (lbs./mi.) in the Hoffman Ranch section of the East Gallatin River. Estimates are made for the Sept.-Oct. period (fall).

Table 2. Comparison of total number and weight (lbs.) per mile of wild brown and rainbow trout for three sections upstream from the sewage effluent outfall and two sections below in the East Gallatin River. Estimates made during March, 1984. Confidence intervals at the 80% level are shown in parentheses.

Age Group	Section				
	XIVb	Manley	Hoffman (upper)	Hoffman (lower)	Thompson[1/]
			Rainbow Trout		
II	416	224	305	86	-
III	333	174	594	206	-
IV & older	736	647	795	847	-
Total	1485(±140)	1045(±82)	2694(±311)	1139(±128)	609(±98)
Total Wt. (lbs.)	490(±33)	404(±26)	584(±82)	533(±69)	477(±74)
			Brown Trout		
II	126	133	344	244	-
III	102	78	191	251	-
IV & older	97	121	177	148	-
Total	325(±50)	332(±56)	712(±163)	643(±123)	260(±57)
Total Wt. (lbs.)	210(±28)	203(±25)	352(±93)	256(±51)	200(±41)

[1/] No estimates of age groups available with estimates including only three-year-old and older trout.

fall population estimates of wild trout, it was found that the largest portion of the rainbow decline occurred between the March, 1983, estimate and the Sept., 1983, estimate. During this period, the total rainbow biomass declined 55% (Table 1). Spring and fall rainbow trout estimates for 1984 showed no significant recovery of total biomass. Further analysis of spring-fall estimates for the 1977-84 period show two-year-old and older rainbow trout having a 23-63% gain in total biomass from spring to fall for the years 1977, 1979 and 1980. But in 1983 and 1984, there was a 55% and 26% decline, respectively. Even though no significant decline in wild brown trout biomass was noted for this 1983-84 period, spring-fall biomass estimate gains, which averaged 39% for the 1977-80 period, were only 3% in 1983 and a 39% decrease for 1984. Although the reason for the wild rainbow trout biomass decline is unknown, population data suggest most of this decline occurs during the summer period, especially during 1983.

Comparisons of two-year-old and older wild brown and rainbow trout populations were made between five study sections (Table 2). Three of these study sections (Bridger, Manley and upper Hoffman) were located above the 1982 sewage effluent site. The 1984 comparison of two-year-old and older rainbow trout biomass showed little difference between any of the study sections although the upper Hoffman section was slightly higher than the other four. Comparison of wild brown trout biomass again showed little variation between sections, except for the upper Hoffman which was 45% higher than the average for the other four sections. This data suggest that the present sewage effluent is having little effect on wild trout populations.

Willow Creek Reservoir

Fish populations in Willow Creek Reservoir were monitored by surface gill nets since 1973 to follow population trends of wild brown trout, wild rainbow trout and fall spawning hatchery rainbow trout (Figure 4). During the 1958-1976 period, the primary fish stocked in this reservoir were various sizes of fall spawning rainbow (Table 3). From 1958 through 1972, catchable-sized rainbow trout (7 inches and larger) were stocked annually with sub-catchable (4-6 inches) stocking being initiated in 1967 and continued through 1976. In 1977 a spring spawning strain of rainbow trout was introduced using 1-3" rainbow trout raised from eggs taken from a spawning trap in Lake DeSmet Wyoming. Approximately 70,000 to 140,000 were stocked annually in 1977, 78, 80 and 81 to establish sufficient numbers to provide a base for a self-sustaining wild population. Gill netting data shows that since the 1977-1981 introductions of DeSmet rainbow, the number of rainbow trout per gill net set has increased 427% (Table 4). During this 1973-1985 period, brown trout numbers per surface set has increased 94%.

A spawning trap on Willow Creek set up to monitor the amount of spring spawning rainbow trout moving up the creek to spawn showed that in 1982 a total of 608 mature rainbow trout were captured in the March-May spawning period (Table 5). Of the 608 captured, 73% were mature females. By 1983, the total captured had increased to 2,061 of which 81% were mature females. The 1985 spawning run totaled 1,867 of which 65% were mature females.

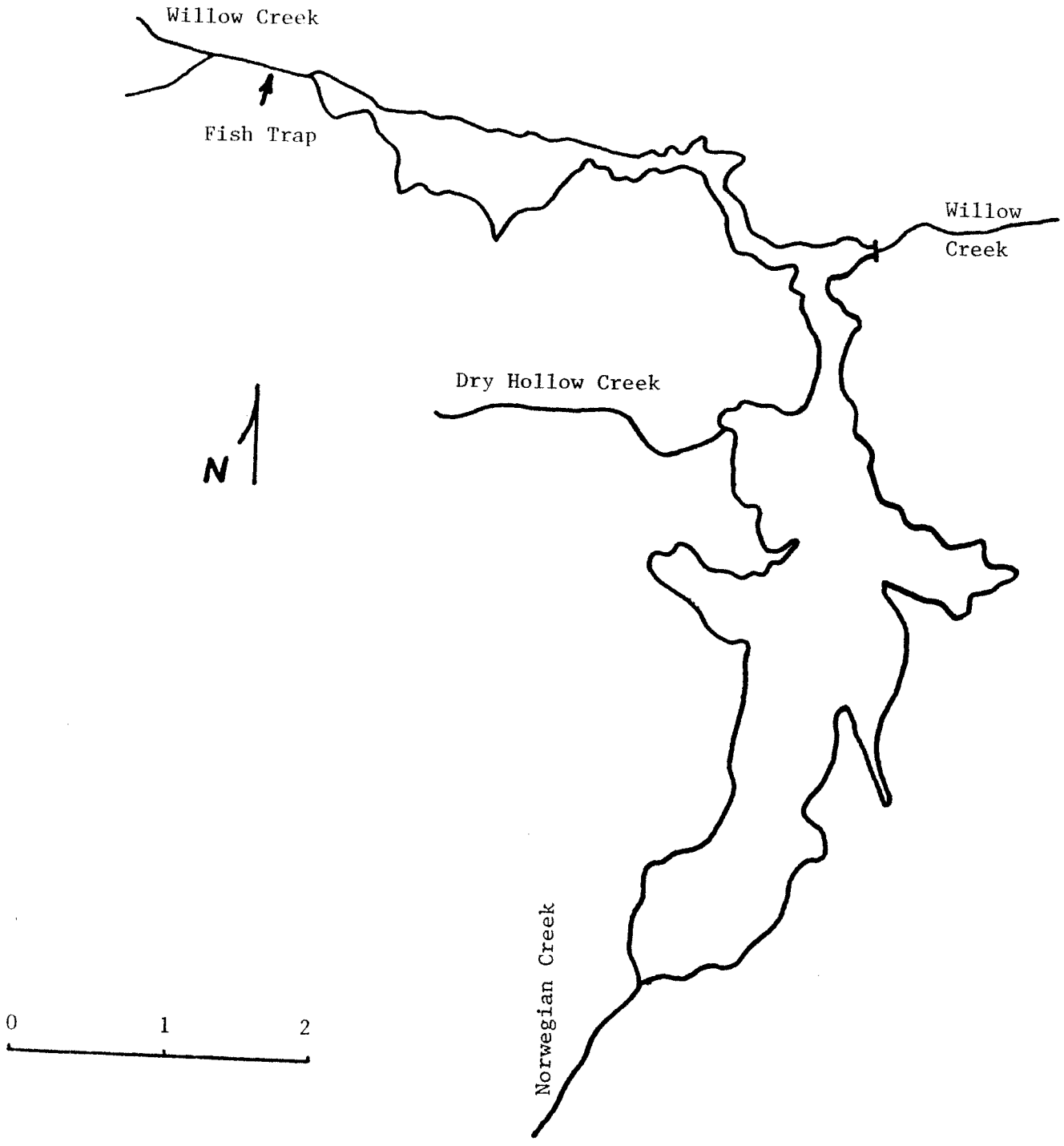

Figure 4. Willow Creek Reservoir

Table 3. Trout stocking records for Willow Creek Reservoir, 1954-1984 (stocking size in inches).

	Fall Spawning Rainbow			Spring Spawning Rainbow		
Year	1 - 3"	4 - 6"	7" & larger	1 - 3"	4 - 6"	7" & larger
1954-58[1/]	69,913	-	520[2/]			
1959-66[1/]	-	-	36,197			
1967	-	30,571	32,533			
1968	-	83,954	11,804			
1969	-	45,000	-			
1970	-	49,035	4,499			
1971	-	-	29,992			
1972	-	-	30,351			
1973	-	30,163	-			
1974	-	30,000	-			
1975	-	30,000	-			
1976		30,000	-			
1977	-	-	-	103,420		
1978				104,160		
1979				-		
1980				74,820		
1981				143,497		
1982				-		
1983				40,000		
1984				-	1,210	

[1/] Average number stocked per year.

[2/] All stocked in 1954.

Table 4. Average number of fish sampled per surface gill net set in Willow Creek Reservoir for the 1973-84 period. Number of net sets per year shown in parentheses.

Year	Wild Rainbow Trout	Hatchery Rainbow Trout	Brown Trout	Eastern Brook Trout
1973(9)	2.0	0.9	1.7	0
1974(9)	4.0	0.6	1.7	0
1980(7)	3.8	-	2.1	0.3
1981(11)	9.4	-	2.2	0.3
1982(13)	4.2	-	1.8	0.1
1984(4)	9.0	-	3.8	-
1985(8)	15.8	-	3.3	0.1

Table 5. Number of spring spawning rainbow trout captured at the Willow Creek spawning trap for the year 1982-85. Average length shown in inches.

	Female		Males		Total	
Year	Number	Ave. Length	Number	Ave. Length	Number	Ave. Length
1982	444	18.4	164	17.4	608	18.1
1983	1678	19.2	383	18.6	2061	19.1
1984	1419	19.2	314	16.8	1733	18.8
1985	1209	18.5	658	16.9	1867	17.9

LITERATURE CITED

Vincent, E. R. 1971. River electrofishing and fish population estimates. Prog. Fish. Cult. Vol. 33, No. 3, pp. 163-169.

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

Prepared by: E. Richard Vincent

Date: August 13, 1985

Water Referred to: East Gallatin River D9-1710-01

Willow Creek Reservoir 10-9440-5

Table 1. Comparison of spring (Mar.) and fall (Sept.) estimates of total biomass (lbs./mi.) of two-year-old and older brown and rainbow trout for the Hoffman Ranch section of the East Gallatin River for the 1977-84 period. Confidence intervals at the 80% level are shown in parentheses.

Year	Spring Biomass Estimate (Mar.)	Fall Biomass Estimate (Apr.)	Biomass Change
		Rainbow Trout	
1977	395(±37)	645(±74)	+63%
1979	997(±112)	1228(±192)	+23%
1980	919(±74)	1144(±82)	+24%
1983	976(±74)	436(±27)	-55%
1984	559(±50)	414(±52)	-26%
		Brown Trout	
1977	77(±14)	86(±26)	+12%
1979	171(±50)	176(±89)	+61%
1980	106(±12)	152(±36)	+43%
1983	240(±61)	248(±55)	+ 3%
1984	308(±56)	187(±53)	-39%