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MONTANA DEPARTMENT OF FISH, WILDLIFE & PARKS
FISHERIES DIVISION
JOB PROGRESS REPORT

STATE: Montana TITLE: Southwest Montana Fisheries Study

PROJECT NO.: F-9-R-27 TITLE: Investigation of the Influence of

JOB NO.: I-d Clark Canyon Reservoir on the Stream Fishery of the Beaverhead River

PROJECT PERIOD: July 1, 1978 through June 30, 1979

REPORT PERIOD: July 1, 1978 through May 30, 1979

ABSTRACT

Brown and rainbow trout numbers and biomass were determined in the Hildreth Section of the Beaverhead River. Average daily flow (ADF) was measured at the U.S. Geological Survey gage near Grant, MT.

Fall numbers and biomass of age I and older rainbow trout in 1978 were the greatest since the construction of Clark Canyon Dam. Numbers of age III and older rainbow were the greatest since the beginning of the Beaverhead Study in 1967. Mean weights of all rainbow trout age groups in the fall of 1978 were considerably less than any fall of the study period. These decreased growth rates appear to be density related.

Brown trout numbers and biomass in the spring of 1979 showed a slight decrease from 1978 due to a poor year class of age II brown trout. The effect of densities on growth rates of brown trout appears dramatic. Brown trout numbers have increased markedly since 1975 and growth rates of each age group have correspondingly declined.

BACKGROUND

The effect of flow releases from the Clark Canyon Dam on trout populations in the Beaverhead River has been investigated since 1966 by the Montana Department of Fish, Wildlife & Parks. The presence of large numbers of trophy size trout in the upper reaches of the river has characterized the fishery during the study period. The results of this study have been reported by Nelson (1978) and indicated that low (less than 250 c.f.s.) non-irrigation season flows have an adverse effect on survival of larger and older rainbow trout in the upper reaches of the Beaverhead River. The study also showed extreme flow fluctuations during the spawning season adversely effected recruitment into the trout population.

OBJECTIVES AND DEGREE OF ATTAINMENT

The objectives of this project were to determine trout numbers and biomass during fall 1978 and spring 1979 in the Hildreth Section (6,455 ft.) of the Beaverhead River and to evaluate the effect of flow patterns on the trout population in this section. The effect of trout population size on growth rates was to be investigated. Data is presented in this report.

PROCEDURES

Trout population estimates were made using the Peterson mark-and-recapture technique and computations performed by an existing computer program.

Flow was measured at the U.S. Geologic Survey gage station near Grant, MT.

FINDINGS

Rainbow Trout

Fall 1978 estimates for age I and older rainbow trout are compared with estimates from 1972-1977 in Table 1. Fall estimates for brown trout may be inflated due to movement of spawning fish into the section and are therefore not included.

TABLE 1. Estimated fall numbers of rainbow trout by age groups in the Hildreth Section (6,455 ft.) of the Beaverhead River between 1972 and 1978[1/]. 80% confidence intervals in parentheses.

	AGE GROUP				
	I	II	III	IV & Older	Total
1972	140	zero	14	60	214 (±69)
1973	136	114	28	53	331 (±75)
1974	997	143	55	15	1210 (±253)
1975	796	281	26	4	1107 (±321)
1977	274	241	159	26	701 (±131)
1978	895	224	156	63	1338 (±230)

[1/] Population estimate not made in Fall 1976.

Numbers of age I and older rainbow trout in the fall of 1978 were the greatest of the study period. The increase from 1977 was due mostly to a strong age I year class recruited into the population. The causes of this strong year class of age I fish may well be tied to the spawning flows that produced them in 1977. Flows during the peak of rainbow trout spawning activity, March 1-31, 1977, while low (U.S.G.S., 1978), were devoid of drastic fluctuations. This contrasts with the weak year class of age I rainbow trout in 1977 produced by the fluctuating flows of the March 1-31, 1976 period (Wells, 1978). Nelson (1978) found correlation between the low fall numbers of age I rainbow trout from 1969-73 and the violent fluctuations in the spawning flows that produced them.

Numbers of age III and older rainbow trout in the fall of 1978 were also the greatest of any previous fall despite non-irrigation season average daily flows (ADF) (Table 2) that were among the lowest of the study period.

TABLE 2. ADF (cfs) between successive spring and fall estimates of trout populations in the Hildreth Section of the Beaverhead River between 1972 and 1979. Range of ADF in parentheses.

FALL TO FALL	NO. OF DAYS	ADF (cfs)	ADF (cfs) IRRIGATION	ADF (cfs) NON-IRRIGATION
1972-73	378	453 (167-1115)	616	316
1973-74	379	433 (57-1065)	675	200
1974-75	376	451 (60-1365)	773	97
1976-77	357	369 (96-839)	435	306
1977-78	-	366 (99-979)	590	163
SPRING TO SPRING				
1972-73	-	-	-	-
1973-74	-	-	-	-
1974-75	382	394 (57-1065)	681	126
1975-76	351	624 (101-1365)	792	439
1976-77	372	523 (112-1075)	713	338
1977-78	358	290 (16-839)	421	152
1978-79	-	398 (195-948)	558	232

Fall 1978 biomass estimates for age I and older rainbow trout are compared with estimates from 1972-1977 in Table 3. Fall estimates for brown trout biomass may be inflated due to movement of spawning fish into the section and are therefore not included. Fall, 1978 biomass estimates are the greatest since 1974.

TABLE 3. Estimated fall biomass (lbs/6455 ft.) of rainbow trout by age groups in the Hildreth Section of the Beaverhead River between 1972 and 1979[1/]. 80% confidence intervals in parentheses.

	AGE GROUP				
	I	II	III	IV & Older	Total
1972	146	0	33	301	480 (±177)
1973	164	306	113	320	903 (±251)
1974	1189	321	170	77	1857 (±379)
1975	721	676	84	23	1504 (±352)
1977	243	583	532	119	1477 (±251)
1978	651	415	412	248	1726 (±230)

[1/] Estimate note made in fall 1976.

One means of assessing growth in fishes is by comparing mean weights of year classes over a period of years. The mean fall weights by age groups for rainbow trout captured by electrofishing are presented in Table 4.

TABLE 4. Mean fall weights (pounds) by age groups for rainbow trout captured by electrofishing in the Hildreth Section of the Beaverhead River from 1972-1978.

	RAINBOW TROUT AGE GROUPS			
Fall	I	II	III	IV & Older
1972	1.05	-	2.37	5.02
1973	1.19	2.76	3.86	6.29
1974	1.19	2.24	4.94	5.23
1975	0.91	2.40	3.26	5.64
1977	0.89	2.42	3.35	4.56
1978	0.73	1.86	2.65	3.94

Mean weights of all rainbow trout age groups in the fall of 1978 are considerably less than any fall of the study period. The influence of rainbow trout age group densities on growth rates was investigated. Density-growth relationships could not be shown by simple linear regression for any specific age group of rainbow trout. However, densities of age I and older rainbow trout in 1978 were the greatest of the study period and mean age-group weights were the least. Mean weights of all age groups decreased dramatically from 1977 to 1978, a time when numbers of age I and older rainbow trout were nearly doubling. The combination of a strong year class of age I rainbows recruited to the population and apparent increased survival of age III and older rainbows may be acting together to affect growth rates.

Brown Trout

Spring 1979 estimates for age II and older brown trout are compared with estimates from 1972-78 in Table 5. Spring estimates for rainbow trout are inflated due to movement of spawning fish into the section and are therefore not included.

TABLE 5. Estimated spring numbers of brown trout by age groups in the Hildreth Section (6,455 ft.) of the Beaverhead River between 1974 and 1978. 80% confidence intervals in parentheses.

	AGE GROUP				
	I	II	III	IV & Older	Total
1974	-	32	90	195	317 ($\pm$50)
1975	-	467	61	142	670 ($\pm$82)
1976	-	624	420	139	1183 ($\pm$285)
1977	-	864	410	475	1752 ($\pm$259)
1978	-	565	791	338	1694 ($\pm$352)
1979	-	329	536	442	1307 ($\pm$291)

Numbers of age II and older brown trout in the spring of 1979 had decreased slightly from 1977-78 (Table 5). This decrease was mostly a result of a weak year class of age II brown trout. Numbers of age II brown trout were the lowest since 1974. This weak year class may well have been caused by fluctuating flows between the brown trout spawning period in the fall of 1976 and the time of fry emergence in the spring of 1977. Flows during the peak of spawning in 1976 (Oct. 15-Nov. 15) were fairly high (450 cfs) and devoid of fluctuation, however, flow was reduced markedly during January and February, 1977 and dropped below 100 cfs in early March. This drastic drop in flow may have dewatered gravels containing brown trout eggs spawned during the previous fall.

Spring 1979 biomass estimates for age II and older brown trout are compared with estimates from 1972-1978 in Table 6. Spring estimates for rainbow trout are inflated due to movement of spawning fish into the section and are therefore not included.

TABLE 6. Estimated spring biomass of brown trout by age groups in the Hildreth Section (6,566 ft.) of the Beaverhead River between 1974 and 1979. 80% confidence intervals in parentheses.

	AGE GROUP				
	I	II	III	IV & Older	Total
1974	-	34	167	645	846 ($\pm$129)
1975	-	406	121	503	1030 ($\pm$146)
1976	-	503	666	512	1681 ($\pm$371)
1977	-	669	667	1288	2624 ($\pm$555)
1978	-	488	1170	878	2536 ($\pm$543)
1979	-	296	860	1057	2213 ($\pm$536)

Biomass estimates for the spring of 1979 follow the same pattern as numbers, reflecting a poor age II year class. Total biomass of age II and older brown trout remained in excess of 2000 pounds for the third consecutive year.

The mean spring weights by age groups for brown trout captured by electrofishing, 1974-1979, are presented in Table 7.

TABLE 7. Mean spring weights (pounds) by age groups for brown trout captured by electrofishing in the Hildreth Section of the Beaverhead River from 1974-1979.

	BROWN TROUT AGE GROUPS		
Spring	II	III	IV & Older
1974	1.06	1.87	3.30
1975	0.87	1.98	3.55
1976	0.81	1.59	3.68
1977	0.77	1.63	2.71
1978	0.86	1.48	2.60
1979	0.90	1.61	2.39

Mean weights of age II, age III and age IV & older brown trout appear to be strongly density related. Estimated numbers of ages II, III, and IV and older brown trout explain 94%, 90% and 86% of the annual variation in mean weights of each age group, respectively.

DISCUSSION

Rainbow trout numbers have increased markedly since 1973. This is particularly evident in increases of age III and older rainbow during 1977-79. While density-growth relationships could not be demonstrated by simple linear regression for specific age groups, decreases in growth rates have followed increases in densities, particularly for age III and older rainbow.

The effect of densities on growth rates of brown trout appears dramatic. Brown trout numbers have increased markedly since 1975 and growth rates of each age group have shown a corresponding decline.

The effect of fishermen on the trout population of this portion of the Beaverhead River has not been investigated. However, current harvest rates do not appear excessive, given the increasing numbers and decreasing growth rates of trout through the spring of 1979.

Since 1973-74 there has been a tremendous increase in the numbers of trout in this section of the Beaverhead River. These increases have been directly attributable to more favorable flow releases from Clark Canyon Dam. These more favorable flow releases have resulted from increased cooperation from the operators of the dam, the East Bench Irrigation Unit.

While there are nearly five times as many trout in 1979 as there were in 1973, we have only seen a 2 or 3 fold increase in biomass. This discrepency reflects the decreased growth rates associated with increasing densities. While growth rates continue to be higher than other rivers in southwest Montana, the decreases may have implications for the trophy nature of this fishery. Table 8 compares numbers of trophy trout ($\geq$5.0 lbs.) captured by electrofishing during the course of the study period. Numbers of these large brown trout captured was greatest in 1974-75 when the population of brown trout was less than half of the 1979 population. Numbers of trophy brown trout captured decreased from 1975 through 1979 while the population of age IV and older brown trout increased.

This same relationship is operating on trophy size rainbow which appear to have been most numerous in 1973-74 when the rainbow population size was small. Numbers of these large rainbows captured decreased drastically from 1974 to 1975, probably due to mortality associated with extremely low non-irrigation season flow (Nelson, 1978). Non-irrigation season flow has been more favorable since 1975 and despite increased numbers of age IV and older rainbow in the population, numbers of trophy size rainbow captured remain less than half of those captured in 1973-74.

TABLE 8. Numbers of brown and rainbow trout ≥5.0 lbs. captured by electrofishing in the Hildreth Section (6455 ft.) of the Beaverhead River between 1966 and 1979.

Spring	Brown Trout ≥5.0 lbs. Number Captured	No. Electrofishing Runs	No. Captured/Run
1967	0	2	0
1968	0	3	0
1969	0	4	0
1970	0	3	0
1971	0	4	0
1972	3	4	0.8
1973	-	-	-
1974	10	4	2.5
1975	13	5	2.6
1976	4	4	1.0
1977	5	4	1.3
1978	5	4	1.3
1979	2	4	0.50

Fall	Rainbow Trout ≥5.0 lbs. Number Captured	No. Electrofishing Runs	No. Captured/Run
1966	3	2	1.5
1967	2	2	1.0
1968	11	3	3.7
1969	5	3	1.7
1970	8	4	2.0
1971	11	4	2.8
1972	9	4	2.3
1973	16	3	5.3
1974	13	3	4.3
1975	1	4	0.3
1977	7	4	1.8
1978	6	4	1.5

RECOMMENDATIONS

This project should be continued. The effects of flow regime on recruitment and survival of trout should continue to be evaluated. The effect of densities of trout on growth rates should continue to be evaluated. Efforts should be made to preserve the trophy nature of this fishery.

LITERATURE CITED

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Waters referred to: Beaverhead River - 3-01-0500-01