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

State: Montana Title: Southwestern Montana Fisheries Study

Project No.: F-9-R-29

Job No.: II-a Title: Investigation of the influence of Clark Canyon Reservoir on the stream fishery of the Beaverhead River

Project Period: July 1, 1980 through June 30, 1981

Report Period: July 1, 1980 through June 30, 1981

ABSTRACT

A slight increase in the population of rainbow trout in the Hildreth section of the Beaverhead River occurred between fall, 1979 and fall, 1980. Biomass of rainbow trout increased dramatically. Increases were attributed to a strong 1977 year class.

Brown trout in Pipe Organ section of the Beaverhead were more abundant in spring, 1981 than in spring, 1976. Age II brown trout were more abundant than in any previous sample. Hildreth section was not sampled in spring, 1981.

Trout populations in the Hildreth section appeared to reach carrying capacity of the stream during the winter of 1977-78. Since then, rainbow trout year classes have been relatively weak in spite of excellent spawning flows. Brown trout year classes have been strong since 1973. Species specific management may be necessary to maintain fishable rainbow trout populations.

BACKGROUND

Effects of flow releases from Clark Canyon Dam on fish populations in the Beaverhead River have been monitored by Montana Department of Fish, Wildlife and Parks since 1966. These studies have shown the Beaverhead to harbor excellent populations of trophy (over five lbs.) rainbow (Salmo gairdneri) and brown trout (Salmo trutta) in its upper reaches. Numbers of trophy trout are adversely affected by flows of less than 250 cfs during the non-irrigation season (October 15 through April 15, Nelson 1978). Reproduction of both rainbow and brown trout in some years has been limited by fluctuating flows during their respective spawning seasons.

Trout populations in the Hildreth section of the Beaverhead River (approximately two miles downstream of Clark Canyon Dam) were relatively stable and probably depressed through 1973. Rainbow trout increased dramatically in 1974 (Figure 1) and brown trout from 1975 through 1977 (Figure 2). Although populations of both species have fluctuated in recent years, both have remained substantially higher than pre-1974 populations. Increased trout populations are attributed to changes in Clark Canyon operation resulting in more favorable flow regimes (Wells 1981). Growth rates of both species declined as populations increased (Wells 1979). Numbers of trophy trout decreased (Wells 1981).

The Hildreth section was not sampled in spring, 1981 due to a legal challenge by landowner Lowell Hildreth over float-fishing on the Beaverhead River on his property. Although Hildreth was enjoined from preventing anglers from floating through his property pending a court decision, 1981 sampling was conducted in the Pipe Organ section (13,125 ft.), approximately six miles downstream of the Hildreth section.

OBJECTIVES AND DEGREE OF ATTAINMENT

To determine trout populations in the Hildreth section of the Beaverhead River. Data are presented.

To evaluate the effect of flow releases on trout populations. Data are presented.

To assess the effect of densities of trout on growth rates. Data are presented.

PROCEDURES

Trout populations were sampled with boat-mounted electrofishing equipment. Hildreth section was sampled in fall, 1980. Pipe Organ section was sampled in spring, 1981. Modified Peterson estimates of trout populations were calculated by age class, with the aid of a computer program.

Flows were measured at a U.S. Geological Survey gauge near Grant, Montana.

FINDINGS

Rainbow Trout

An estimated 1,051 age I and older rainbow trout were found in the Hildreth section in fall, 1980 (163/1,000 ft.), an increase of nearly 200 fish over the 1979 estimate (Table 1). The 1978 rainbow estimate of 1,338 age I and older was the largest estimate on record.

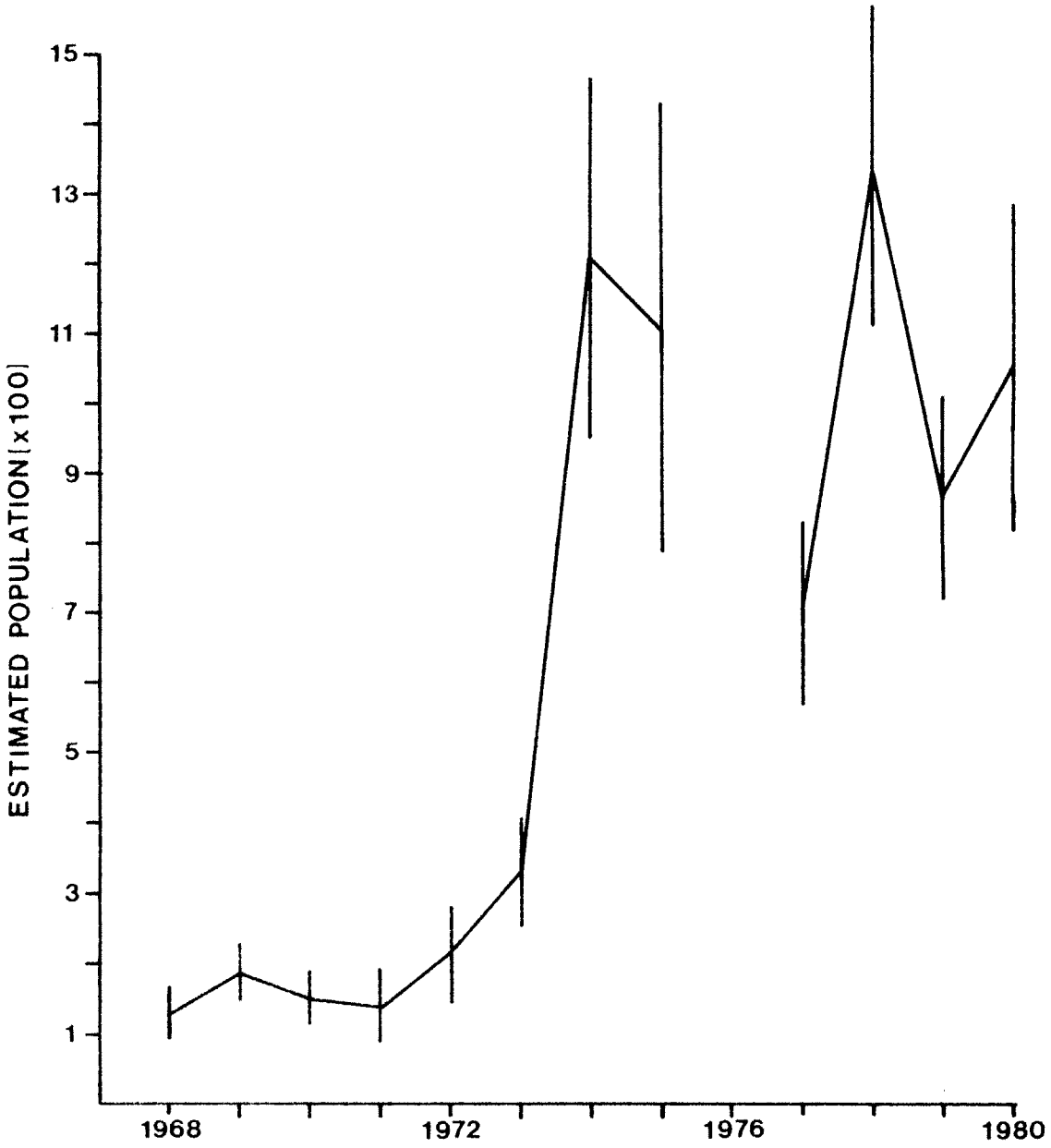

Figure 1. Fall rainbow trout population estimates and 80 percent confidence limits in the Hildreth section (6,455 ft.) of the Beaverhead River, 1968-80.

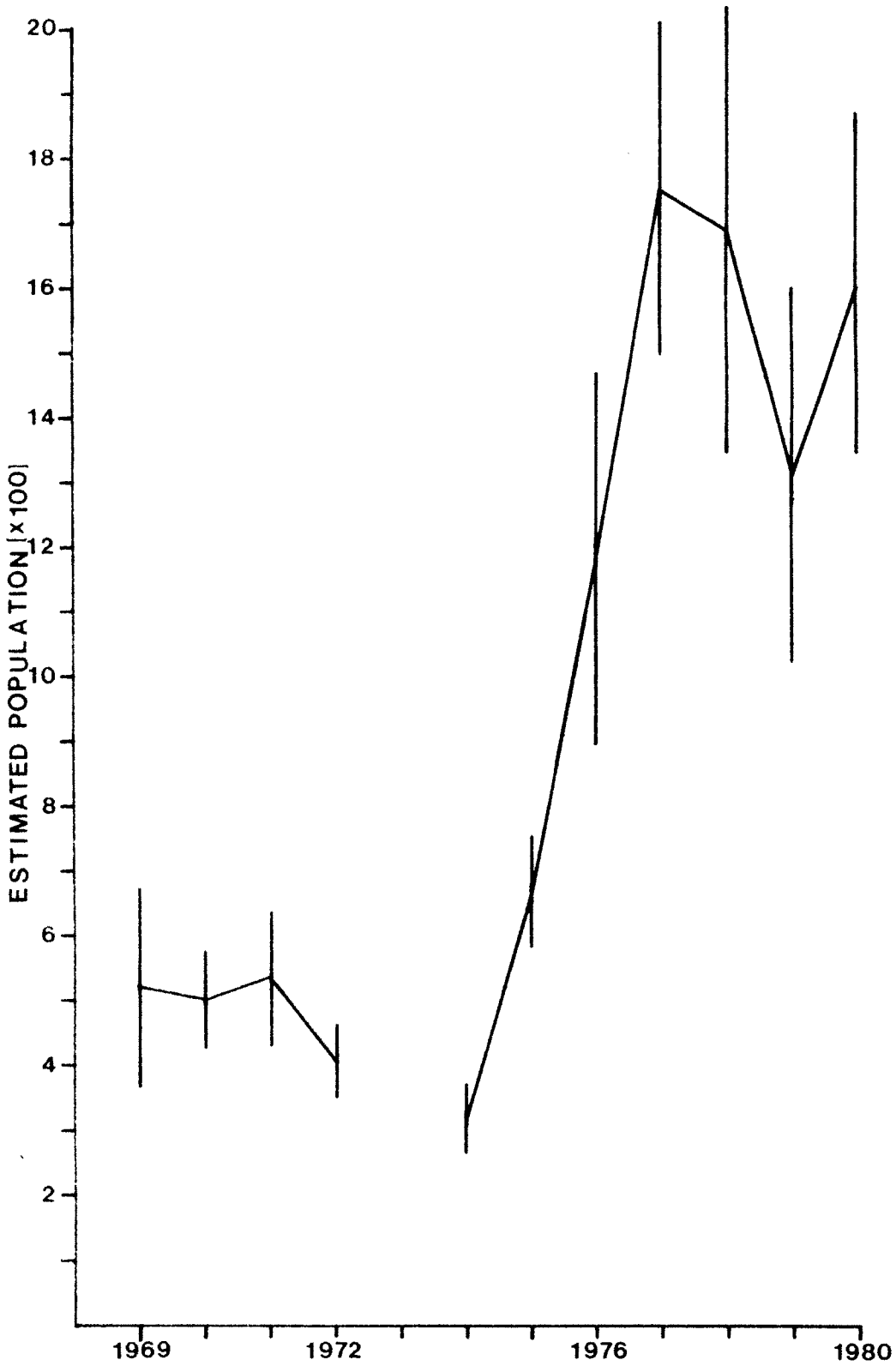

Figure 2. Spring brown trout population estimates and 80 percent confidence limits in the Hildreth section (6,455 ft.) of the Beaverhead River, 1969-80.

Table 1. Estimated fall populations of rainbow trout in the Hildreth section of the Beaverhead River (6,445 ft.) by age class, 1968-80. 80% confidence intervals in parentheses.

	Age Class				
	I	II	III	IV & older	Total
1968	81	14	19	16	130 (±32)
1969	81	61	27	18	187 (±41)
1970	56	41	43	10	150 (±38)
1971	10	25	69	34	138 (±51)
1972	140	0	14	60	214 (±68)
1973	136	114	28	53	331 (±75)
1974	997	143	55	15	1,210 (±253)
1975	796	281	26	4	1,107 (±321)
1976			no estimate		
1977	274	241	159	26	700 (±131)
1978	895	224	156	63	1,338 (±230)
1979	290	462	74	39	865 (±144)
1980	301	204	429	117	1,051 (±234)

The fall, 1980 Hildreth rainbow population was dominated by the 1977 year class (age III), which comprised 41 percent of the total population. The estimated 117 age IV and older rainbow trout was nearly twice the previous largest estimate (1978). Catch of trophy rainbow trout increased to an average of 2.5 per trip, the highest level since 1974 (Figure 3). The estimate of age I rainbow trout (301 fish) indicates a relatively weak 1979 year class, comparable to the 1976 and 1978 year classes.

Estimated fall, 1980 rainbow biomass in the Hildreth section was 2,665 lbs., substantially higher than any previous estimate (Table 2). The 1977 year class accounted for 54 percent of the total. Biomass estimates for age III and age IV and older rainbow were the highest of record.

Mean weights in 1980 were the greatest since 1974 (Table 3), in spite of increasing numbers of fish. Mean weights of rainbow trout in 1980 were substantially higher at all ages than in 1978 or 1979. Mean weights were not as large as they were during years of reduced trout populations however.

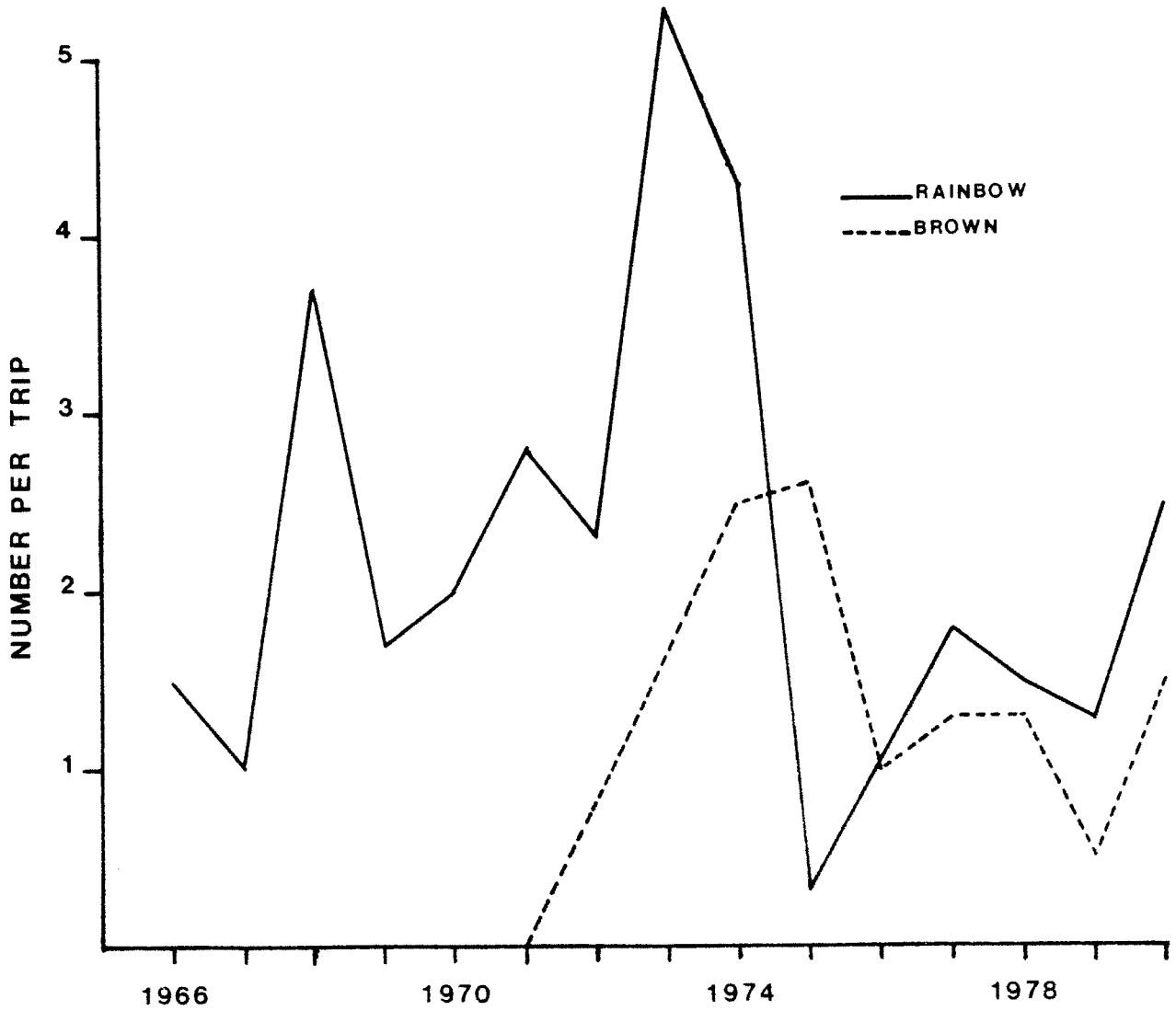

Figure 3. Catch of trophy (≥5 lbs.) rainbow and brown trout per electrofishing trip in the Hildreth section (6,455 ft.) of the Beaverhead River, 1966-80.

Table 2. Estimated fall biomass (lbs.) of rainbow trout in the Hildreth section (6,445 ft.) of the Beaverhead River by age class, 1968-80.

	Age Class				
	I	II	III	IV & older	Total
1968	109	31	80	101	321
1969	78	176	105	78	437
1970	54	99	173	49	375
1971	9	61	270	171	511
1972	146	0	33	301	480
1973	164	306	113	320	903
1974	1,189	321	270	77	1,857
1975	721	676	84	23	1,504
1976			no estimate		
1977	243	583	532	119	1,477
1978	651	415	412	249	1,727
1979	190	930	217	163	1,500
1980	289	433	1,447	496	2,665

Table 3. Mean fall weights (lbs.) of rainbow trout in the Hildreth section of the Beaverhead River by age class, 1968-80.

	Age Class			
	I	II	III	IV & older
1968	1.35	2.30	4.33	6.12
1969	0.97	2.88	3.92	4.45
1970	0.97	2.43	4.06	4.71
1971	0.93	2.47	3.93	5.01
1972	1.05	--	2.37	5.02
1973	1.20	2.76	3.86	6.29
1974	1.19	2.24	4.94	5.23
1975	0.91	2.40	3.26	5.64
1976		no estimate		
1977	0.89	2.42	3.35	4.56
1978	0.73	1.86	2.65	3.94
1979	0.65	2.01	2.93	4.19
1980	0.96	2.12	3.37	4.24

No valid estimate of mortality of larger (age III+) rainbow trout could be obtained in 1980. Annual fall to fall mortality in the Hildreth section has ranged from 28 percent to 94 percent since 1968-69, with a mean value of 62 percent. Throughout the period of record, mortality of large rainbow trout has appeared to be inversely related to non-irrigation season (October 16-April 15) flows.

Brown Trout

An estimated 225 brown trout per 1,000 ft. of stream resided in the Pipe Organ section in spring, 1981, an increase of 26 percent over the estimated 1976 population (Table 4).

Table 4. Estimated spring populations (fish per 1,000 ft.) of age II and older brown trout in Pipe Organ section of the Beaverhead River. Section length has varied from 8,513 ft. to 14,162 ft. 80 percent confidence limits in parentheses.

	Age Class			
	II	III	IV & older	Total
1968	51	24	21	96 ($\pm$23)
1969		no estimate		
1970	64	54	4	122 ($\pm$15)
1971	32	74	32	138 ($\pm$37)
1972	72	43	51	166 ($\pm$21)
1973		no estimate		
1974	12	44	29	85 ($\pm$11)
1975		no estimate		
1976	93	87 (III & older)		180 ($\pm$30)
1977-80		no estimate		
1981	150	58	17	225 ($\pm$24)

Estimates for Pipe Organ section are reported in fish per 1,000 ft. to facilitate comparisons. Total populations in Hildreth and Pipe Organ sections are not comparable due to differences in section length. The Pipe Organ section sampled in 1981 is approximately 1,000 ft. shorter than that sampled in 1976.

The spring, 1981, brown trout population was dominated by a strong 1979 year class (age II). Age II fish comprised 67 percent of the total population (150/1,000 ft.), the highest density of age II brown trout ever sampled in either Hildreth or Pipe Organ sections. Success of the 1979 year class is probably due to excellent spawning and incubation season flows during water year 1979.

Age III and older brown trout were slightly less abundant in spring, 1981 than in 1976. An estimated 75 age III and older brown trout per 1,000 ft. were found in Pipe Organ section in 1981, versus 87 per 1,000 ft. in 1976.

Total brown trout biomass in Pipe Organ section was slightly higher in 1981 (216 lbs./1,000 ft.) than in 1976 (204 lbs./1,000 ft.). However, distribution of biomass over age classes changed dramatically. Age III and older brown trout comprised 69 percent of total biomass in 1976 but only 50 percent in 1981 (Table 5).

Mean weights of brown trout in the 1981 Pipe Organ sample were similar to those collected from 1970-76. Mean weights in Pipe Organ section have always been significantly lower than in Hildreth section (Table 6).

Table 5. Estimated spring biomass (lbs. per 1,000 ft.) of brown trout in Pipe Organ section of the Beaverhead River. Section length has varied from 8,513 ft. to 14,162 ft.

	Age Class			
	II	III	IV & older	Total
1970	47.2	83.8	9.9	140.9
1971	24.3	94.0	56.3	174.6
1972	45.9	54.8	103.4	204.1
1973		no estimate		
1974	9.6	71.6	70.1	151.3
1975		no estimate		
1976	63.7	140.6 (III & older)		204.3
1977-80		no estimate		
1981	107.0	73.0	36.1	216.1

Table 6. Mean spring weights (lbs.) of brown trout by age class in the Hildreth (H) and Pipe Organ (PO) sections of the Beaverhead River, 1970-81.

	Age II		Age III		Age IV & older	
	H	PO	H	PO	H	PO
1970	0.94	0.74	1.89	1.55	2.98	2.38
1971	0.87	0.75	1.73	1.27	2.65	1.76
1972	0.94	0.64	1.82	1.28	3.07	2.01
1973	--	--	--	--	--	--
1974	1.06	0.80	1.87	1.68	3.30	2.35
1975	0.87	--	1.98	--	3.55	--
1976	0.81	0.69	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	--
1980	0.79	--	1.65	--	2.67	--
1981	--	0.71	--	1.25	--	2.16
Mean	0.88	0.72	1.73	1.41	2.96	2.13

DISCUSSION

Prior to 1973, trout populations in the Hildreth section of the Beaverhead River were probably limited by poor reproduction. Flows during both rainbow and brown trout spawning and incubation seasons often fluctuated and as a result, weak year classes were produced. Since 1973, flows have generally been more favorable. Both species began producing strong year classes in 1973. Total trout biomass (age II and older fish) increased rapidly to a peak in 1977-78 (Figure 4). Since 1977-78, biomass has remained near 4,000 lbs. (620 lbs. per 1,000 ft.), suggesting trout populations have reached the stream's carrying capacity. Total winter trout biomass is estimated using fall rainbow trout biomass (age I+ and older) and spring brown trout biomass (age II and older). Thus, winter biomass of rainbow trout is probably slightly over-estimated and biomass of brown trout is underestimated.

Factors other than reproduction may now be limiting trout production in the Hildreth section. Rainbow trout year classes since 1978 have been weak despite excellent spawning and incubation flows. If carrying capacity of the stream has been reached, then perhaps predation and/or competition rather than spawning flows are limiting recruitment of rainbow to the fishery. Recruitment of brown trout does not appear to be adversely affected by higher population densities. However, evidence that brown trout are under stress is provided by furunculosis outbreaks in the summer of 1978, 1979 and 1980 (Wells 1981).

It is likely that total trout biomass in the Hildreth section during winter, 1980-81, exceeded 4,000 lbs. due to a significant increase in rainbow

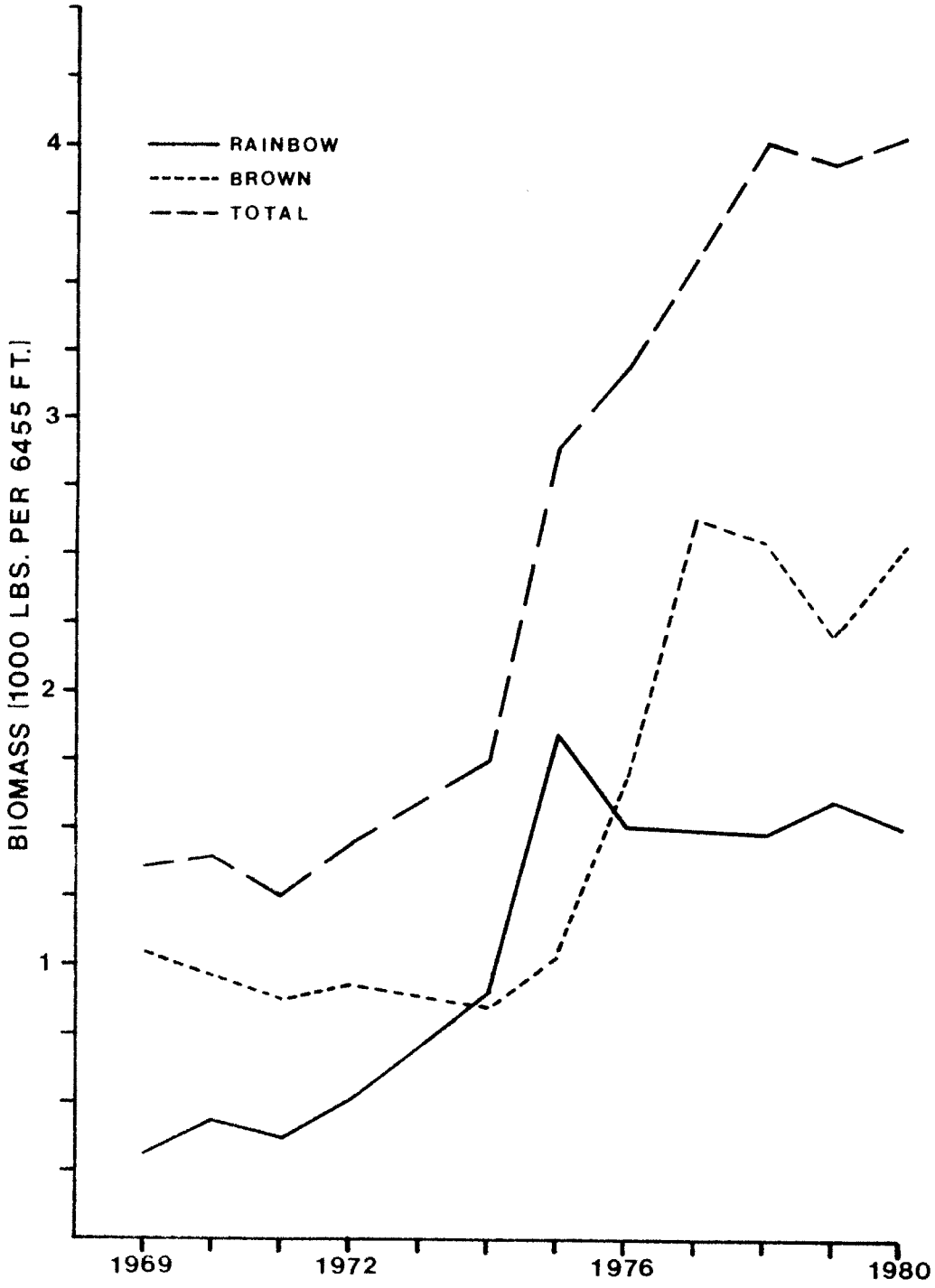

Figure 4. Estimated fall biomass of rainbow trout, spring biomass of brown trout and combined winter biomass in the Hildreth section (6,455 ft.) of the Beaverhead River, 1968-69 through 1979-80.

biomass. The dramatic increase resulted from a strong 1977 rainbow year class. As the 1977 year class is reduced by mortality, total rainbow biomass should decline.

Although creel census information for the Beaverhead is lacking, previous experience has shown that angling mortality may affect rainbow trout to a greater degree than brown trout (Vincent 1969a, 1969b, 1970). Differential angling mortality is probably due to habitat preferences of the two species. Brown trout are usually closely associated with overhanging cover (willows), while rainbow trout are more likely to utilize mid-stream habitats. Thus in streams such as the Beaverhead that offer plentiful overhanging cover, brown trout are generally more difficult for the angler to catch than rainbow trout.

As a stream approaches carrying capacity, preferred brown trout habitat probably becomes saturated and more brown trout are forced to utilize mid-stream habitats. Brown trout in mid-stream are more likely to be caught than those under overhanging willows, but less likely to be caught than rainbow trout. Consequently, in a stream at carrying capacity, brown trout probably enjoy a significant competitive advantage over rainbow trout. Over the long term, the trout population of the stream may tilt heavily toward brown trout. Species specific regulations that encourage brown trout harvest while limiting rainbow trout harvest should prevent the trend towards monospecificity. If recent trends in the Beaverhead River persist, reevaluation of regulations may be necessary.

RECOMMENDATIONS

This project should be continued. Studies of effects of flows and population density on recruitment and production should continue. Status of the highly valued Beaverhead trophy fishery should be closely monitored.

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