INTER·FLUVE, INC.
FISHERIES, HYDROLOGY AND RESOURCE ENHANCEMENT

FISHERIES REPORT FOR SIXTEENMILE CREEK, SPANISH CREEK, AND CHERRY CREEK ON THE TURNER PROPERTIES, GALLATIN AND MADISON COUNTIES, MONTANA

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August 6, 1990

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INTRODUCTION

Surveys of the fish populations in Sixteenmile Creek, Spanish Creek, and Cherry Creek were conducted during March and April 1990. The purpose of these surveys was to determine the general characteristics of the fish population in order to assess the effects of habitat enhancement on the fish population and to gather information pertaining to management of the fisheries. The following is a summary of these results.

STUDY AREAS

Sixteenmile Creek

Fish populations were surveyed on two sections of Sixteenmile Creek. The sections are listed below in order from upstream to downstream.

Treatment Section (Pack River upstream section)

Dates of survey: 7, 22 March 1990

Length=4280'

Location: SW 1/4, Sec. 5, T 4N, R 4E, Gallatin Co., Montana

This section was enhanced during the spring of1989.

Control Section (Downstream meadow section below railroad trestle)

Dates of survey: 7, 22 March 1990

Length=2300'

Location: SW 1/4, Sec. 3,T4N, R3E,.Gallatin Co., Montana

This section is not currently scheduled for enhancement.

Spanish Creek

Fish populations were surveyed on two sections of Spanish Creek. The sections are listed below in order from upstream to downstream.

Treatment Section

Dates of survey: 15, 20 March 1990

Length=911'

Location: SW 1/4, Sec. 12, T 4S, R 4E,Gallatin Co., Montana

This section was enhanced during April and May 1990 following this electrofishing survey.

Control Section

Dates of survey: 13, 16 March 1990

Length=880'

Location: NE 1/4, Sec. 13, T 4S, R 3E, Gallatin Co., Montana

This section is not currently scheduled for enhancement.

Cherry Creek

A total of five sections were surveyed; two in the upstream (Butler) section, and three in the downstream (Wiley) section. The sections are listed below in order from upstream to downstream.

Butler Treatment Section

Dates of survey: 17, 23 April 1990

Length=500'

Location: SE 1/4, Sec. 23, T 3S, R 2E, Madison Co., Montana

This section was enhanced during July 1990.

Butler Control Section

Dates of survey: 17, 23 April 1990

Length=750'

Location: NE 1/4, Sec. 23, T 3S, R 2E, Madison Co., Montana

This section has not been enhanced.

Wiley Section 1

Date of survey: 28 March 1990

Length=500'

Location: SW 1/4, Sec. 10, T 3S, R 2E, Madison Co., Montana

This section is scheduled for enhancement during summer 1990.

Wiley Section 2

Date of survey: 28 March 1990

Length=500'

Location: NW 1/4, Sec. 9, T 3S, R 2E, Madison Co., Montana

This section is scheduled for enhancement during summer 1990.

Wiley Section 3

Date of survey: 29 March 1990

Length=500'

Location: NW 1/4, Sec. 5, T 3S, R 2E, Madison Co., Montana

This section is not currently scheduled for enhancement.

METHODS

Fish were captured using a "Leach Box" electrofishing unit (Dr. Harley Leach, Department of Electrical Engineering, Montana State University) set on direct current (DC) at an output of 500-900 watts. Electrofishing equipment (generator, Leach Box, live cars, etc) was conveyed in an 11'2" plastic boat equipped with an attached cathode and a mobile anode, except on Spanish Creek where operations were shore-based due to shallow water.

Captured trout were weighed and measured, and scale samples were taken for age determinations. The presence and general abundance of non-trout fish species was noted. From this information species composition, size/age structure, mean total lengths and weights, and condition factors of the trout populations were determined. Condition factors were calculated from length and weight data.

Fish population estimates for trout species by age class were obtained by use of a modified Petersen mark-recapture technique (Seber 1973) on Sixteenmile Creek, Spanish Creek, and the two upstream (Butler) sections of Cherry Creek where high stream discharge prevented the use of block nets. Due to the lower discharge in the three downstream (Wiley) sections of Cherry Creek, two-pass removal estimates (Seber 1973) were completed. Estimates of fish biomass were obtained by multiplying population estimates by mean weights of each species. Caution should be exercised when drawing conclusions from these estimates since they contain a certain degree of statistical variance. For example, estimates of population density (number of fish per mile) should be considered significantly different only if their confidence intervals do not overlap.

A brief caveat is appropriate at this point. Interpretation of the results of this study and any discussion of limiting habitat conditions should be treated as conjectural due to innate variability of biological systems. Moreover, a difference in population density between the two study sections may have been merely a result of seasonal migration rather than specific habitat conditions. For the purposes of this study, we will assume that capture biases and migration effects were negligible. The only way to determine with any certainty the cause and effect relationships between fish and habitat is through detailed study over several seasons, if not years. However, results of the survey described below will provide a practical approach for fishery assessment.

older) were found in the control section, while four (I,II,III, IV and older) were found in the treatment section. Three age classes (I,II, III and older) of brook trout were found in both sections (Table 2).

Mean total length of brown trout was higher than rainbow or brook trout in both sections, and mean lengths of all species were higher in the control section than in the treatment section (Table 2, Figure 17). Correspondingly, mean weights followed the same pattern (Table 2, Figure 18). Mean condition factors of all fish were near 1.0, except for brook trout in the treatment section (mean condition factor=0.81, Table 2, Figure 19).

Petersen mark-recapture population estimates were calculated for trout species in both sections (Table 2, Figure 20). Rainbow trout numbers and biomass (Table 2, Figure 21) were significantly higher than those of either brook or brown trout in both sections, and brook trout numbers and biomass were also significantly higher than, but closer to, those of brown trout in both sections. The treatment section had over twice as many rainbow trout as the control section, primarily due to the greater abundance of age I fish. The treatment section also had slightly fewer brook trout than the control section, and brown trout numbers were not significantly different between the two sections.

Cherry Creek Butler Reach

Only rainbow and brook trout were present in the Butler reach of Cherry Creek, although several rainbow trout showed signs of hybridization with cutthroat trout (Oncorhynchus clarki). A waterfall located downstream of the Butler section in Cherry Creek Canyon presumably serves as an effective fish block preventing the establishment of other fish species such as mottled sculpin, suckers, or brown trout. Rainbow trout were aged to age class IV and older, while brook trout were aged to age class III and older (Figures 7-10). Fish were quite small; mean total lengths and weights were similar for both sections and both species, about six inches and 0.15 pounds (Table 3, Figures 17 and 18). Condition factors for rainbow trout averaged around 1.00, brook trout condition factors averaged around 0.90 (Table 3, Figure 19).

The Butler section of Cherry Creek supports very high numbers and biomass of small rainbow and brook trout. For example, the Butler control section contained 6836±169 rainbow trout/mile, which was significantly higher than the estimates for the other species and sections (Table 3, Figures 20 and 21)). Numbers and biomass of rainbow and brook trout in the Treatment Section and Control Section brook trout were not significantly different from each other.

Cherry Creek Wiley Reach

In this reach of Cherry Creek, which is below the waterfall, seven fish species were captured: rainbow, brown, and brook trout, mountain whitefish, mottled sculpin, longnose sucker (Catostomus catostomus), and white sucker (Catostomus commersoni). No suckers were captured in Section 1, and brook trout and mountain whitefish were present in low numbers in all three sections. Histograms of rainbow and brown trout captured are presented in Figures 11-16. Mean total lengths and weights of brown trout were greater than rainbow trout except in Section 3 where the higher mean was more due to the paucity of small rather than the abundance of large rainbow trout (Table 4, Figure 15). Condition factors were generally near 1.0 in Sections 2 and 3, and somewhat lower in Section 1 (Table 4, Figure 19). The condition factor of 0.52 for age I rainbow trout in Section 3 is likely due to a combination of two factors. First, only one fish in this age group was captured and second, is is often difficult to obtain accurate weights of small fish due to limitations of the top-loading scale.

Precision of two-pass removal population estimates (LeCren 1973) is dependent on capturing sufficient numbers of all age classes of the population on the first pass (i.e. first pass captures should be at least ≥50% of second pass captures). However, in some instances this did not

occur. For example, for Section 1 rainbow trout, the precision of estimates for age classes II-IV and older was adequate, however the precision of the estimate for age I was poor (Table 4). This is due to the numbers of fish of this age class captured on the first and second passes (pass 1, n=17, pass 2, n=12). In retrospect, precision could have been improved by performing a third pass, or marking and releasing all fish and returning to complete a Petersen estimate. As a result of this poor precision, differences between population estimates by species and section are mostly nonsignificant. However, since effort and technique among the three sections was roughly equal, an index of relative abundance based on total fish captured allows some conclusions to be drawn from these data. Populations of rainbow and brown trout in Section 1 and 2 are similar, with brown trout being 2.4-4.3 times more abundant than rainbow trout. Section 3 clearly has fewer fish, with an overall trout population of about half that of the upper two sections. Again, brown trout were more than twice as abundant as rainbow trout. Brook trout were rare in all three sections.

LITERATURE CITED

Seber, G. A. F. 1973. The estimation of animal abundance and related parameters. Hafner Press, New York, N.Y. 506 p.

Table 1. Summary of data for Sixteenmile Creek (numbers following ± are 95% confidence intervals).

AGE CLASS (years)	NUMBER (fish/mile)	MEAN TL (inches)	MEAN WT. (lbs.)	BIOMASS (lbs./mile)	CONDITION FACTOR
Sixteenmile Creek Treatment Section rainbow trout					
I	33±11	4.2	0.03	1.1	0.98
II	21±6	8.9	0.30	5.3	1.00
III	21±2	11.5	0.60	12.5	1.04
IVand older	37±5	15.3	1.30	46.6	0.98
TOTALS	112 ± 14	11.1	0.57	65.5	1.00
Sixteenmile Creek Treatment Section brown trout					
I	6±0	4.9	0.04	0.3	0.93
II	32±6	10.1	0.40	11.8	0.96
III	40±2	14.5	1.10	41.1	0.95
IVand older	51±1	17.2	1.60	78.2	0.85
TOTALS	127±6	14.5	0.75	131.4	0.90
Sixteenmile Creek Control Section rainbow trout					
I	5±0	4.8	0.03	0.13	0.62
II	21±9	8.7	0.20	4.2	0.82
III and older	16±9	13.6	0.97	15.6	0.93
TOTALS	41±14	9.8	0.45	19.9	0.82
Sixteenmile Creek Control Section brown trout					
I	44±14	5.1	0.04	1.5	0.68
II	16±0	9.8	0.35	5.7	0.96
III and older	25±14	14.5	1.12	28.2	1.00
TOTALS	37±8	9.0	0.37	35.4	0.85

Table 2. Summary of data for Spanish Creek (numbers following ± are 95% confidence intervals).

AGE (years)	NUMBER (fish/mile)	MEAN TL (inches)	MEAN WT. (lbs.)	BIOMASS (lbs./mile)	CONDITION FACTOR
Spanish Creek Control Section rainbow trout					
I	504±102	3.6	0.02	11.3	1.09
II	396±24	5.7	0.07	29.3	1.11
III	294±12	8.4	0.22	65.6	1.05
IVand older	36±24	12.6	0.60	32.4	0.83
TOTALS	1248±114	6.7	0.12	138.6	1.07
Spanish Creek Control Section brown trout					
I	6±6	3.9	0.02	0.13	1.03
II	48±30	6.7	0.10	4.9	1.00
III and older	60±12	12.5	0.70	40.7	0.98
TOTALS	114±30	10.0	0.40	45.8	0.99
Spanish Creek Control Section brook trout					
I	150±24	5.3	0.06	9.1	1.11
II	108±12	6.4	0.09	9.8	0.94
III and older	42±18	8.3	0.21	8.6	0.96
TOTALS	300±30	6.2	0.08	27.4	1.02
Spanish Creek Treatment Section rainbow trout					
I	2220±220	2.7	0.01	17.6	1.03
II	620±29	5.4	0.06	35.3	0.96
III	179±12	7.6	0.16	28.1	0.96
IVand older	122±12	11.3	0.49	59.1	0.90
TOTALS	3141±220	5.9	0.10	140.2	0.97
Spanish Creek Treatment Section brown trout					
I	23±12	3.9	0.02	0.42	0.96
II	12±0	6.0	0.07	0.81	0.88
III	17±6	9.5	0.36	12.8	1.06
IVand older	23±23	13.4	0.86	10.0	0.96
TOTALS	81±17	8.3	0.21	24.1	0.99
Spanish Creek Treatment Section brook trout					
I	81±35	3.6	0.01	1.1	0.85
II	75±12	5.1	0.07	5.1	0.78
III and older	6±6	9.2	0.26	1.5	0.98
TOTALS	162±41	5.4	0.05	6.3	0.81

Table 3. Summary of data for Cherry Creek Butler Section (numbers following ± are 95% confidence intervals).

AGE (years)	NUMBER (fish/mile)	MEAN TL (inches)	MEAN WT. (lbs.)	BIOMASS (lbs./mile)	CONDITION FACTOR
Cherry Creek Butler Treatment Section rainbow trout					
I	686±84	3.1	0.01	10.0	1.31
II	845±116	5.9	0.08	68.0	0.99
III	771±32	8.6	0.23	176.0	0.99
IVand older	148±32	9.9	0.28	41.4	0.75
TOTALS	2450±148	6.8	0.13	253.6	1.04
Cherry Creek Butler Treatment Section brook trout					
I	845±63	4.1	0.02	18.7	0.80
II	1521±63	6.8	0.11	163.6	0.91
III and older	232±32	8.7	0.21	47.0	0.86
TOTALS	2598±95	6.3	0.10	229.2	0.87
Cherry Creek Butler Control Section rainbow trout					
I	3867±148	3.1	0.01	39.6	1.01
II	1288±70	5.6	0.06	82.4	0.96
III	1225±28	8.4	0.21	267.7	1.01
IVand older	486±28	10.5	0.41	203.6	0.99
TOTALS	6836±169	6.4	0.15	593.4	1.00
Cherry Creek Butler Control Section brook trout					
I	753±28	4.0	0.02	15.0	0.81
II	1316±28	6.9	0.11	149.6	0.93
III and older	471±14	8.7	0.22	104.8	0.92
TOTALS	2534±42	6.5	0.11	269.4	0.89

Table 4. Summary of data for Cherry Creek Wiley Section (numbers following ± are 95% confidence intervals).

AGE (years)	NUMBER (fish/mile)	MEAN TL (inches)	MEAN WT. (lbs.)	BIOMASS (lbs./mile)	CONDITION FACTOR
Cherry Creek Wiley Section 1 rainbow trout					
I	612±908	3.3	0.01	6.8	0.82
II	84±11	7.6	0.15	13.1	0.86
III	63±21	10.9	0.37	24.1	0.80
IVand older	74±0	13.3	0.82	60.4	0.96
TOTALS	834±940	6.3	0.19	104.4	0.84
Cherry Creek Wiley Section 1 brown trout					
I	676±148	4.1	0.02	13.9	0.80
II	95±0	5.5	0.05	4.9	0.80
III	253±623	8.8	0.24	62.8	0.97
IVand older	486±21	12.2	0.60	289.5	0.91
TOTALS	1510±802	7.7	0.26	371.0	0.86
Cherry Creek Wiley Section 2 rainbow trout					
I	275±21	3.3	0.01	3.7	0.98
II	63±0	7.1	0.13	8.5	0.95
III	169±655	11.8	0.60	100.1	0.99
IVand older	21±0	13.9	0.84	17.7	0.87
TOTALS	528±676	5.9	0.17	130.0	0.97
Cherry Creek Wiley Section 2 brown trout					
I	950±32	3.9	0.02	20.0	0.92
II	148±11	6.3	0.09	13.9	0.94
III	253±222	9.8	0.34	87.5	0.98
IVand older	718±560	12.4	0.66	467.6	0.93
TOTALS	2069±824	7.0	0.23	589.1	0.93
Cherry Creek Wiley Section 3 rainbow trout					
I	11±0	3.6	0.01	0.1	0.52
II	211±42	8.6	0.23	49.0	0.96
III and older	≥42	10.5	0.30	12.5	0.67
TOTALS	222±45	8.7	0.23	48.8	0.90
Cherry Creek Wiley Section 3 brown trout					
I	348±137	4.0	0.03	9.4	1.10
II	84±106	6.2	0.10	8.0	1.01
III	180±11	9.8	0.34	61.4	0.97
IVand older	137±21	12.5	0.67	95.4	0.92
TOTALS	760±264	7.5	0.25	174.3	1.02

Figure 1. Length-frequency histogram of rainbow trout captured by electrofishing in the Treatment Section, Sixteenmile Creek. Estimated age classes are indicated by the shaded bars.

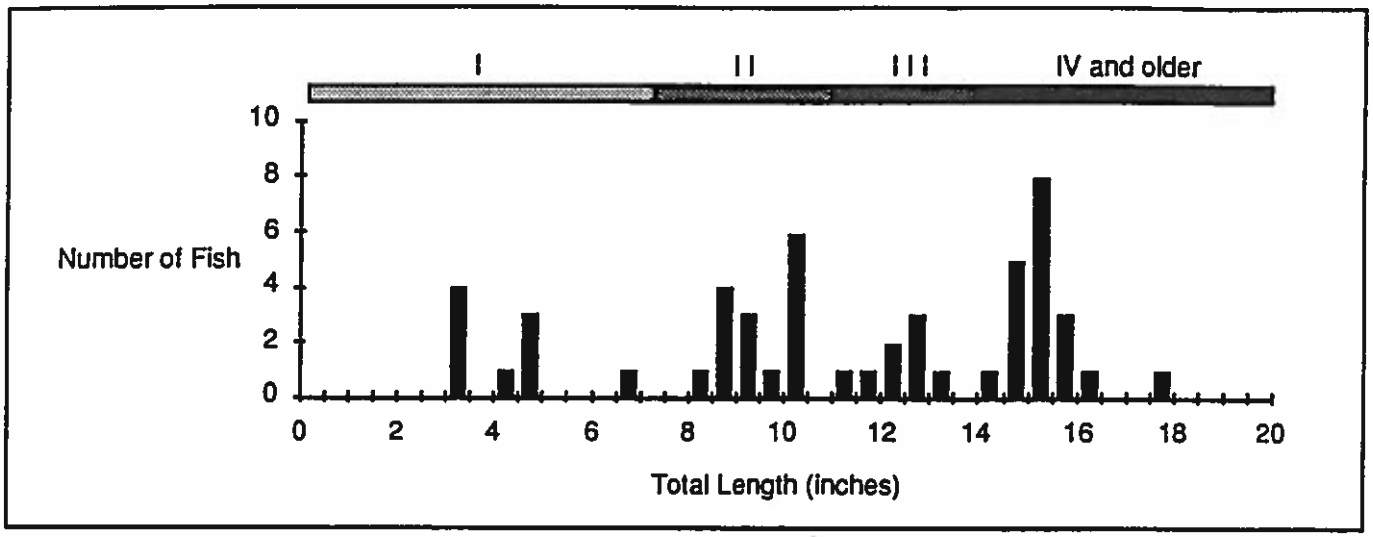


Figure 2. Length-frequency histogram of brown trout captured by electrofishing in the Treatment Section, Sixteenmile Creek. Estimated age classes are indicated by the shaded bars.

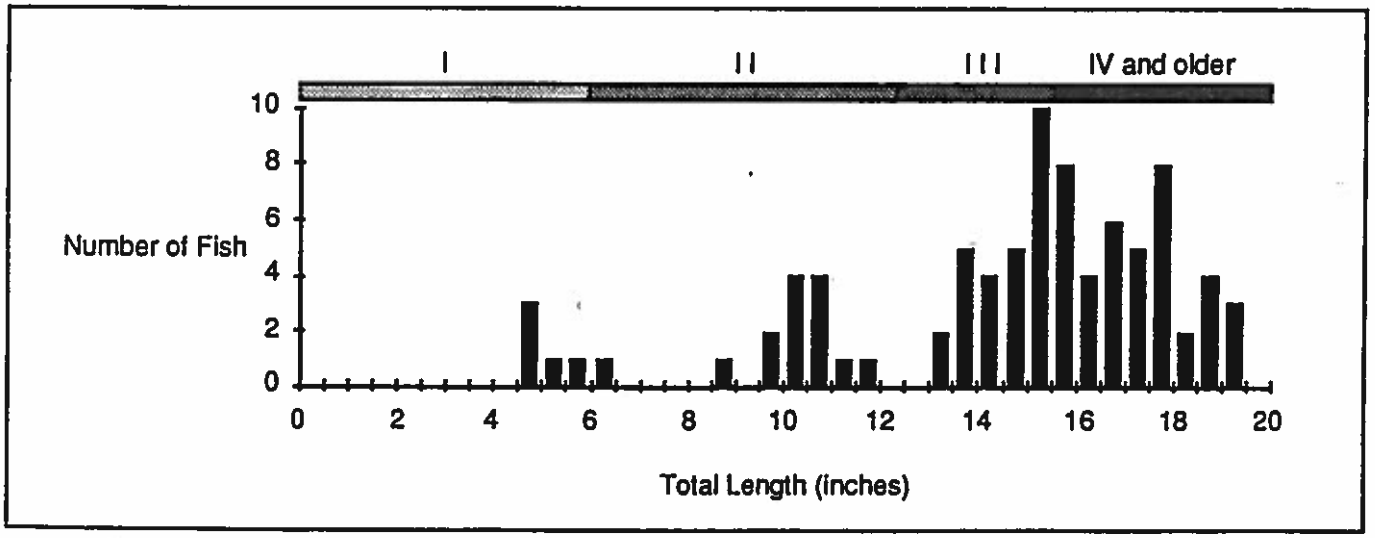


Figure 3. Length-frequency histogram of rainbow trout captured by electrofishing in the Control Section, Sixteenmile Creek. Estimated age classes are indicated by the shaded bars.

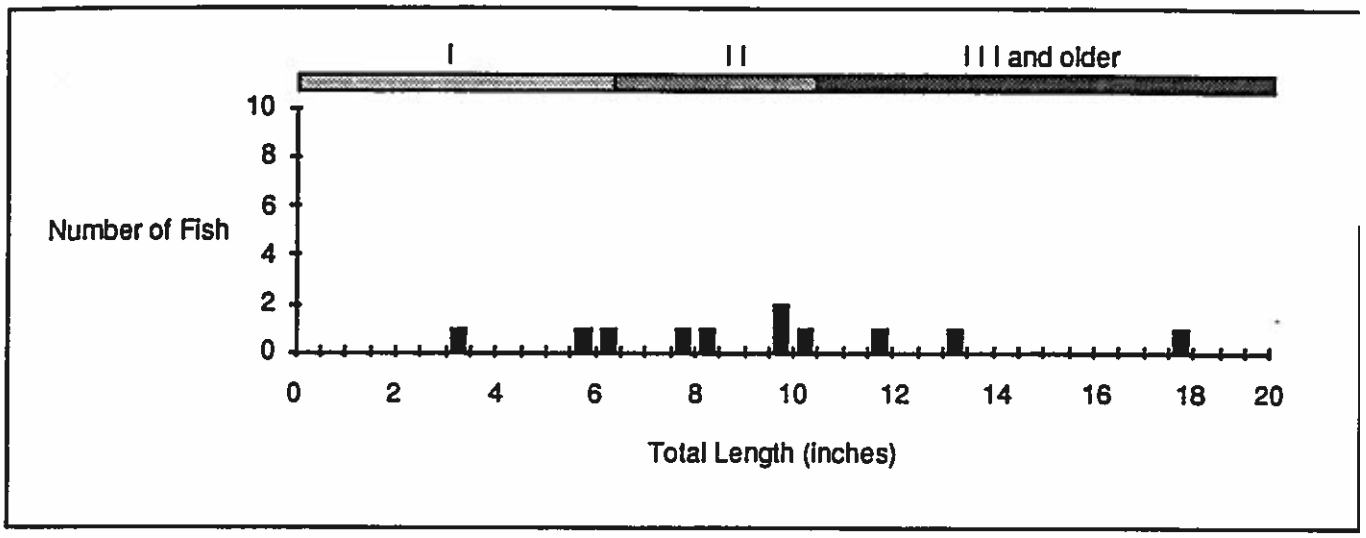


Figure 4. Length-frequency histogram of brown trout captured by electrofishing in the Control Section, Sixteenmile Creek. Estimated age classes are indicated by the shaded bars.

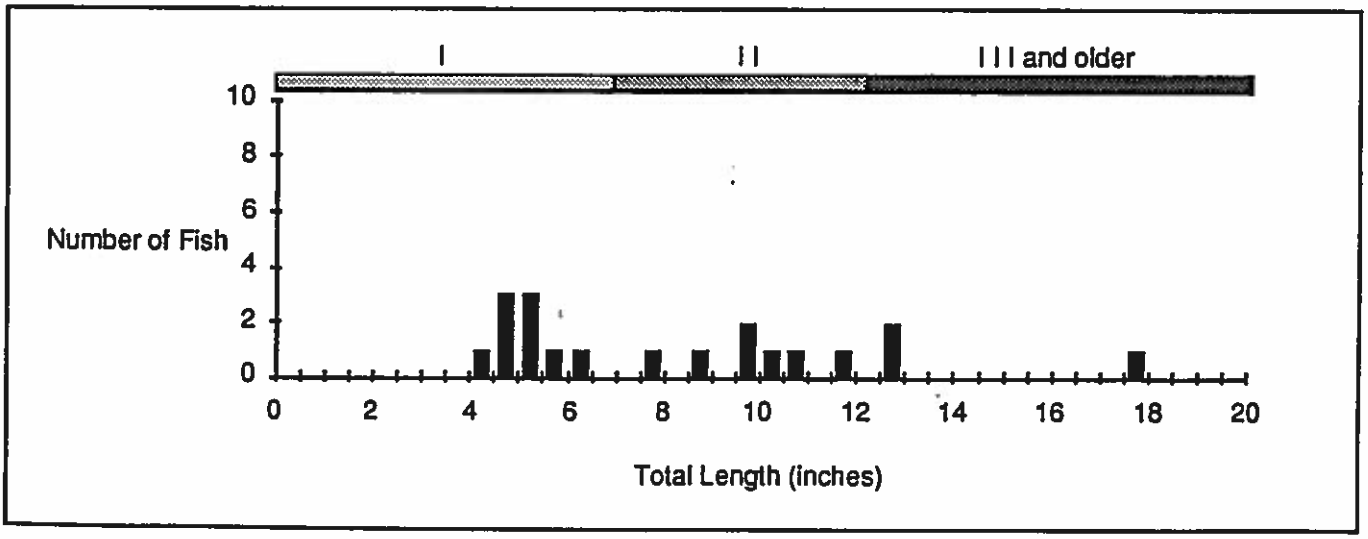


Figure 5. Length-frequency histograms of rainbow, brown, and brook trout captured by electrofishing in the Control Section, Spanish Creek. Estimated age classes are indicated by the shaded bars.

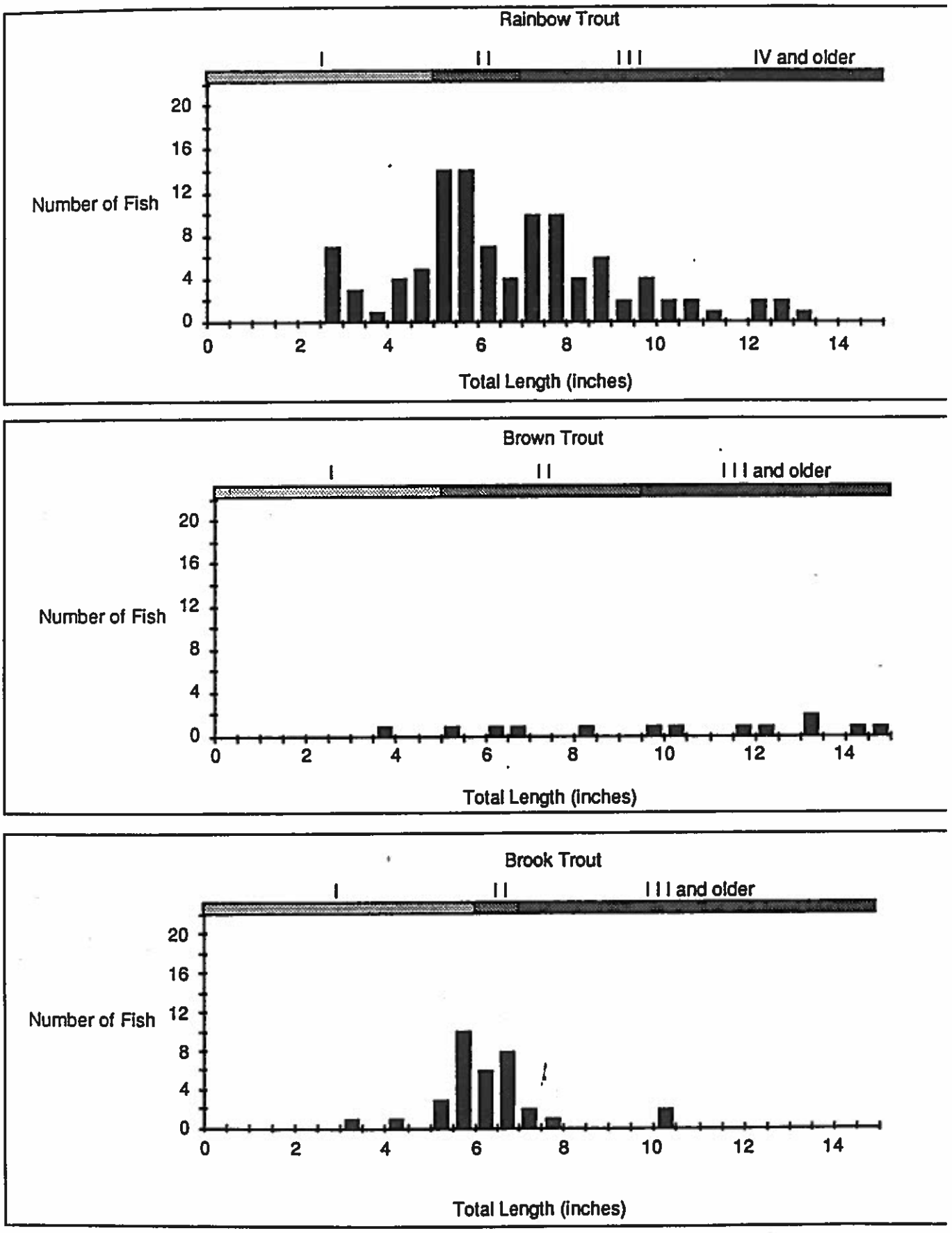
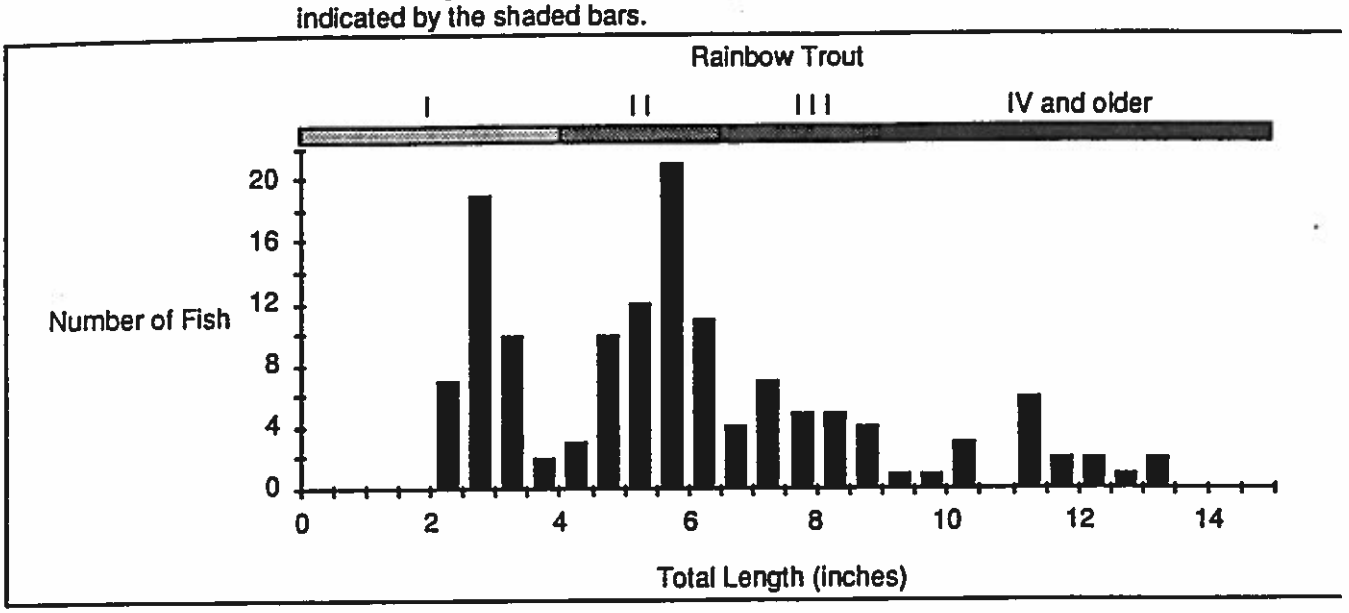
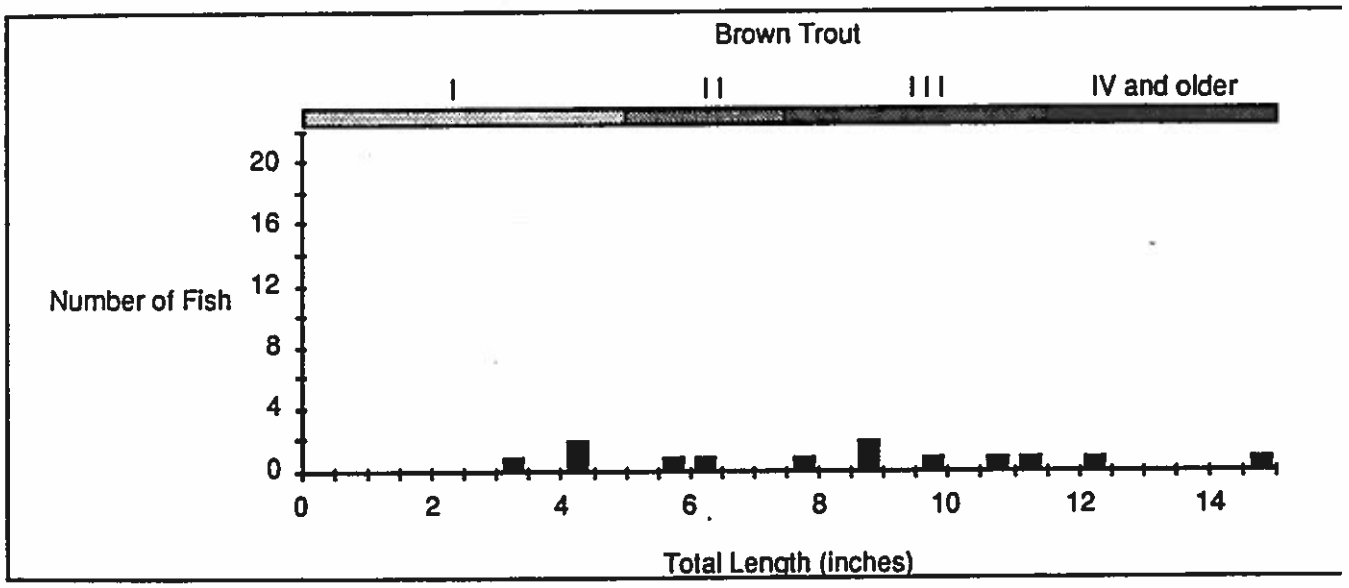


Figure 6. Length-frequency histograms of rainbow, brown, and brook trout captured by electrofishing in the Treatment Section, Spanish Creek. Estimated age classes are indicated by the shaded bars.





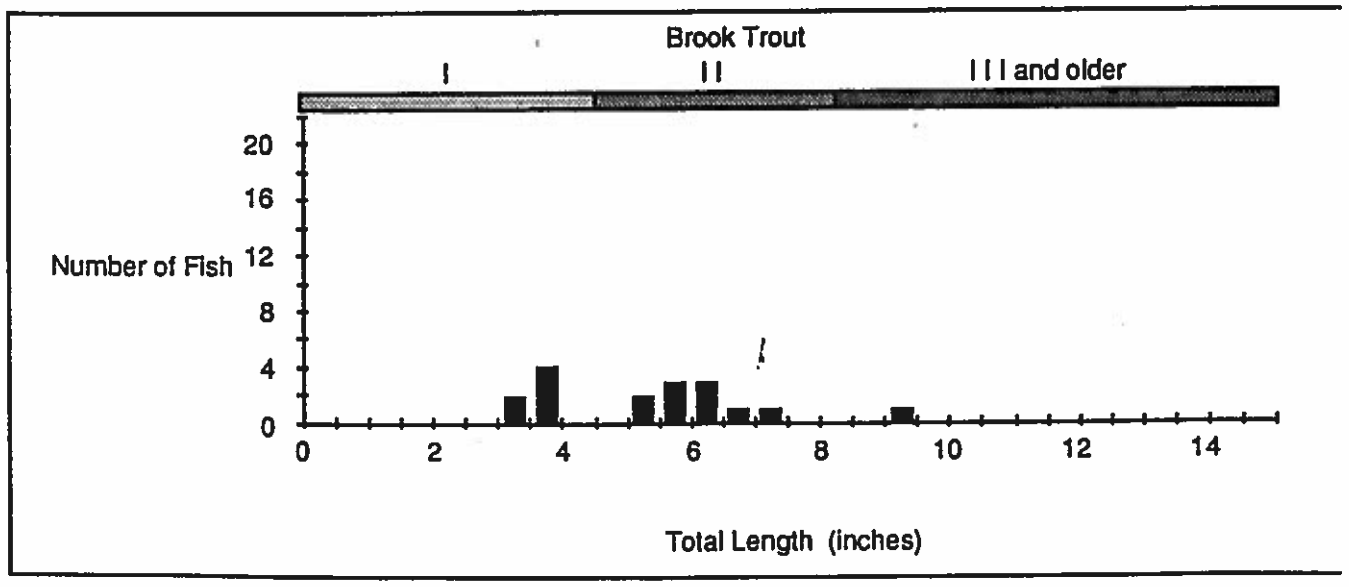


Figure 7. Length- frequency histogram of rainbow trout captured by electrofishing in the Butler Treatment Section, Cherry Creek. Estimated age classes are indicated by the shaded bars.

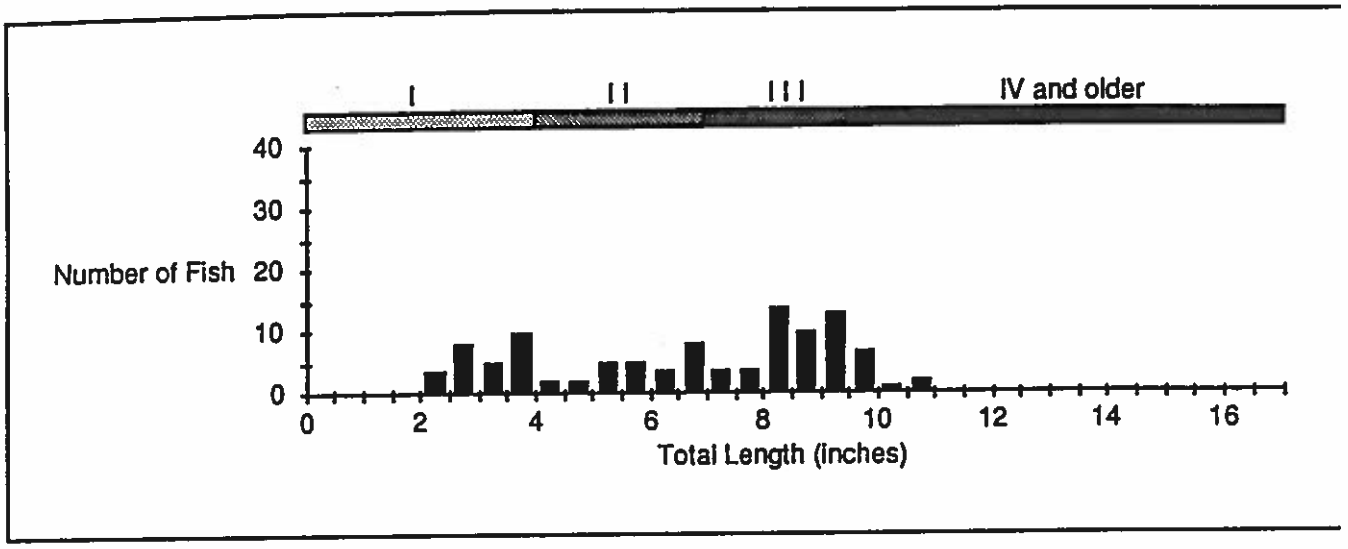


Figure 8. Length- frequency histogram of brook trout captured by electrofishing in the Butler Treatment Section, Cherry Creek. Estimated age classes are indicated by the shaded bars.

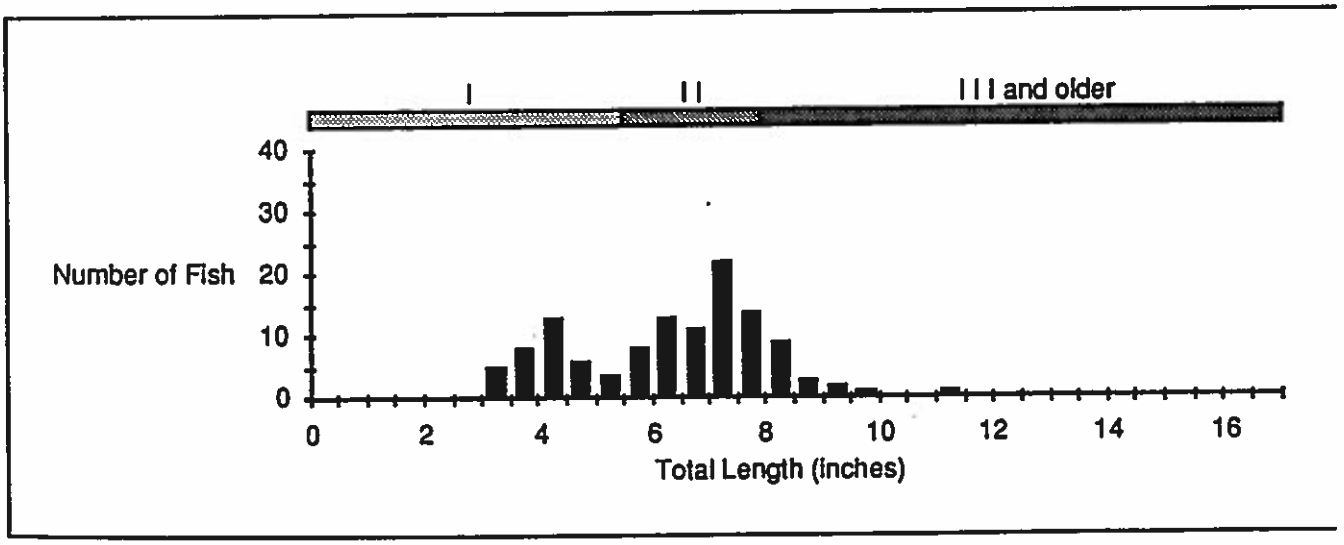


Figure 9. Length- frequency histogram of rainbow trout captured by electrofishing in the Butler Control Section, Cherry Creek. Estimated age classes are indicated by the shaded bars.

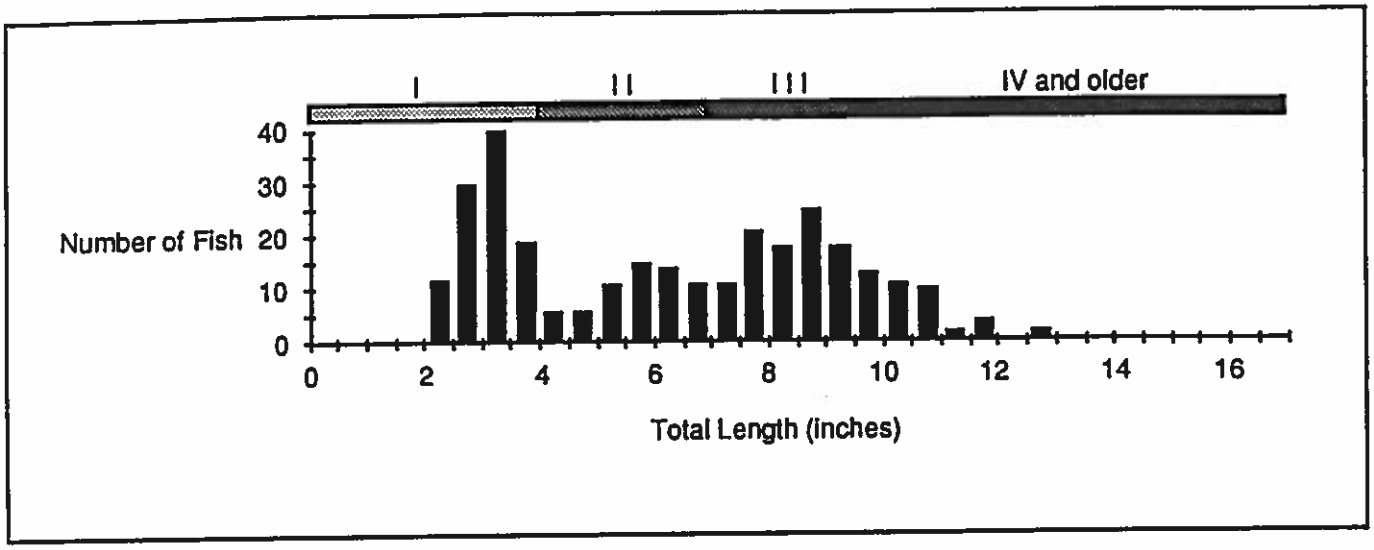


Figure 10. Length- frequency histogram of brook trout captured by electrofishing in the Butler Control Section, Cherry Creek. Estimated age classes are indicated by the shaded bars.

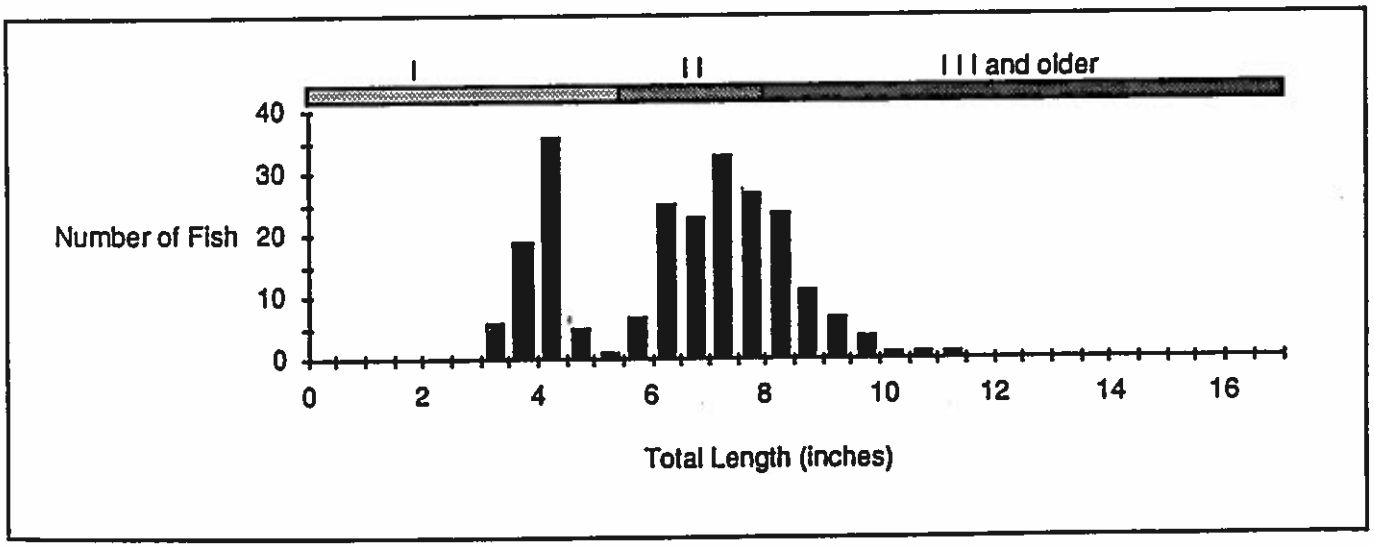


Figure 11. Length- frequency histogram of rainbow trout captured by electrofishing in Wiley Section 1, Cherry Creek. Estimated age classes are indicated by the shaded bars.

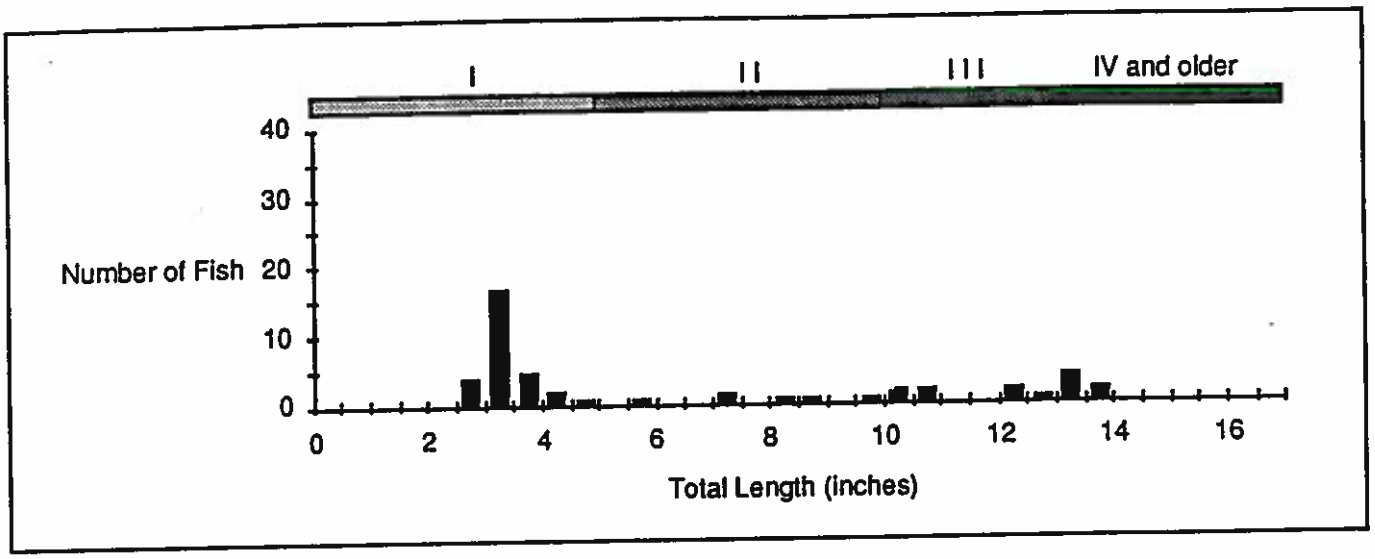


Figure 12. Length- frequency histogram of brown trout captured by electrofishing in Wiley Section 1, Cherry Creek. Estimated age classes are indicated by the shaded bars.

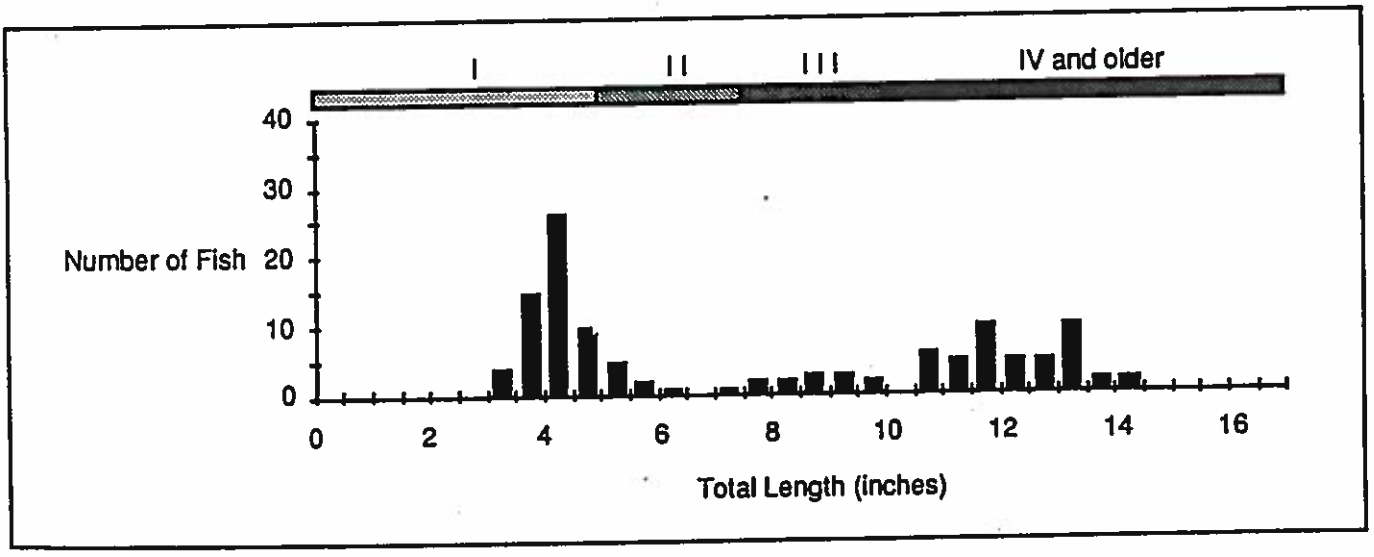


Figure 13. Length- frequency histogram of rainbow trout captured by electrofishing in Wiley Section 2, Cherry Creek. Estimated age classes are indicated by the shaded bars.

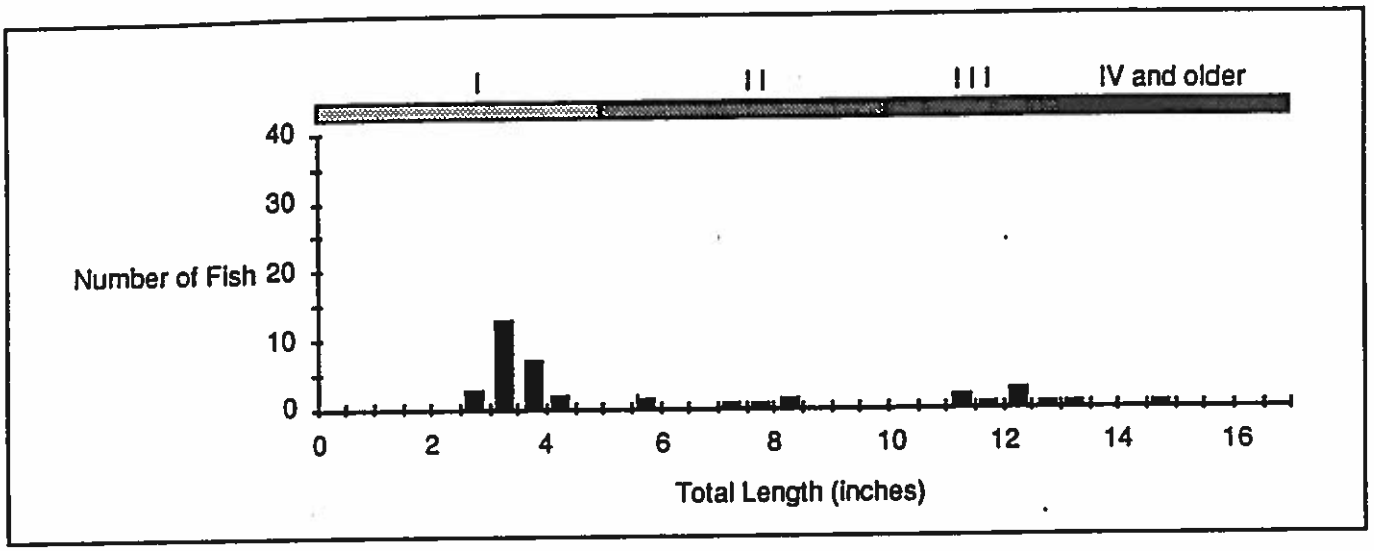


Figure 14. Length- frequency histogram of brown trout captured by electrofishing in Wiley Section 2, Cherry Creek. Estimated age classes are indicated by the shaded bars.

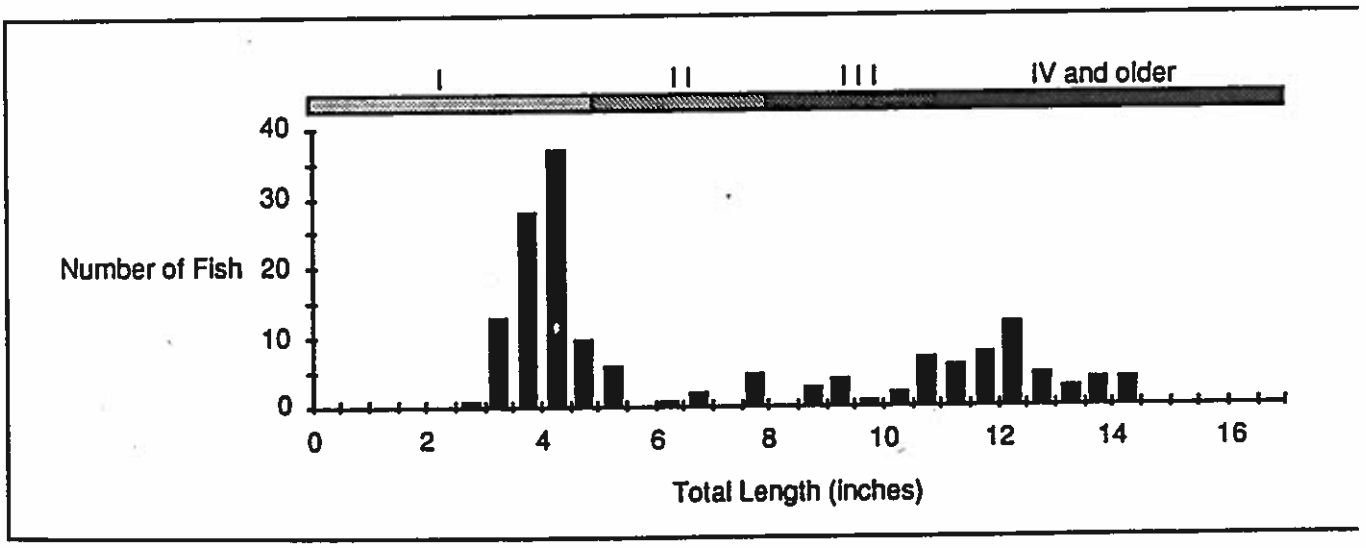


Figure 15. Length- frequency histogram of rainbow trout captured by electrofishing in Wiley Section 3, Cherry Creek. Estimated age classes are indicated by the shaded bars.

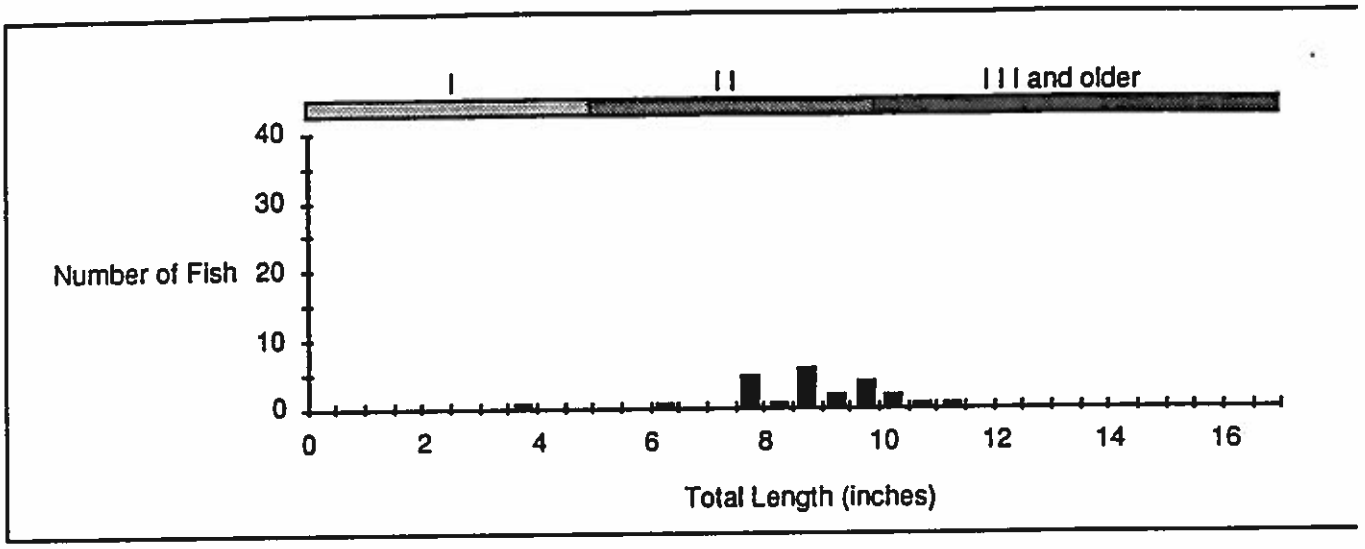


Figure 16. Length- frequency histogram of brown trout captured by electrofishing in Wiley Section 3, Cherry Creek. Estimated age classes are indicated by the shaded bars.

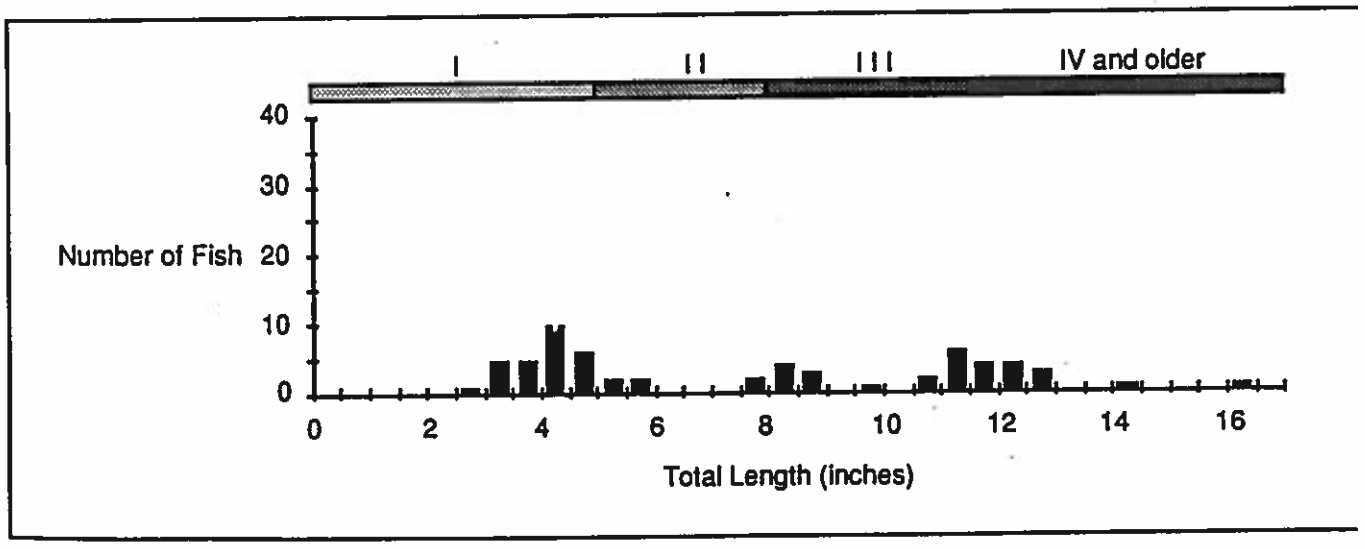


Figure 17. Mean total length (TL) of rainbow (RB), brown (LL), and brook trout (EB) captured at sites on Sixteenmile Creek, Spanish Creek, and Cherry Creek, Montana during March-April 1990.

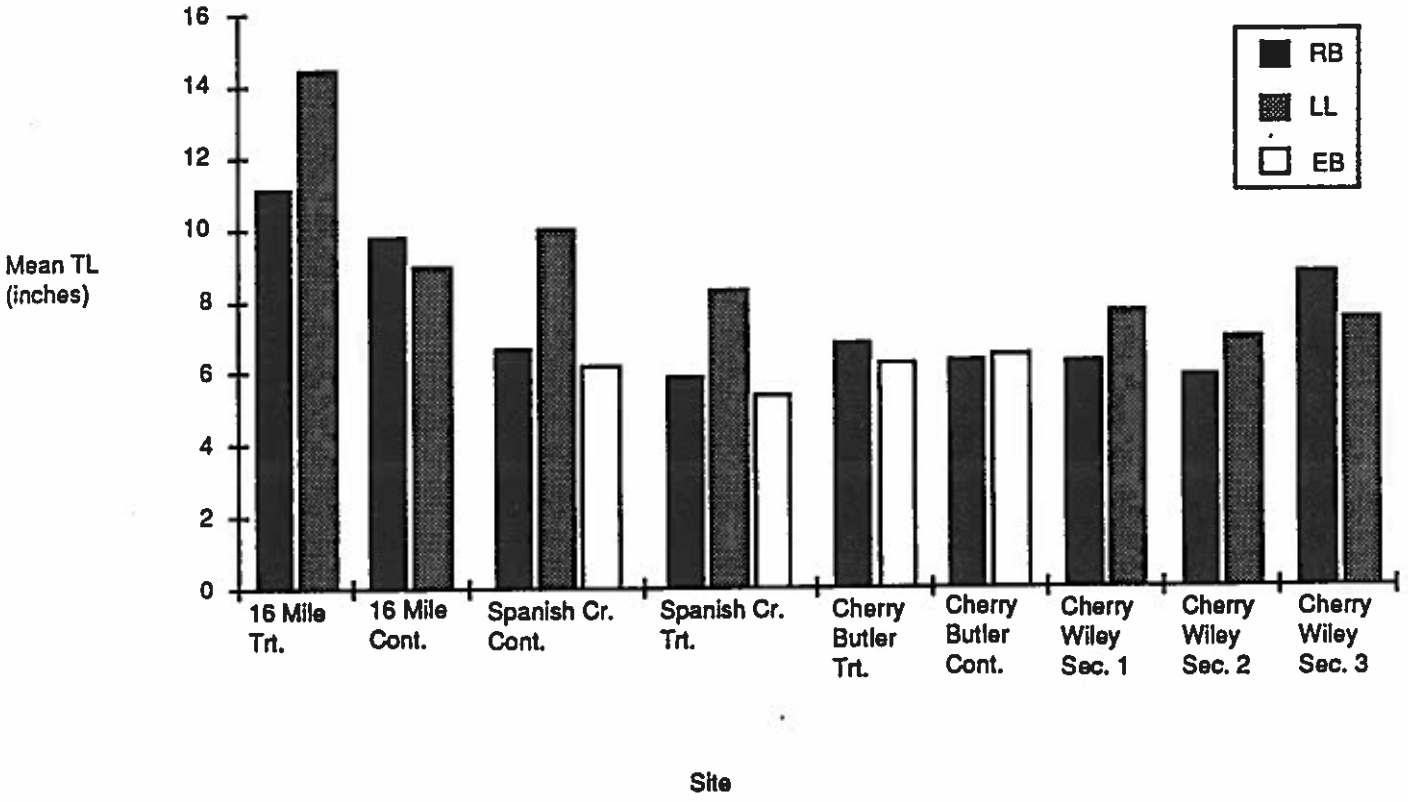


Figure 18. Mean weights of rainbow (RB), brown (LL), and brook trout (EB) captured at sites on Sixteenmile Creek, Spanish Creek, and Cherry Creek, Montana during March-April 1990.

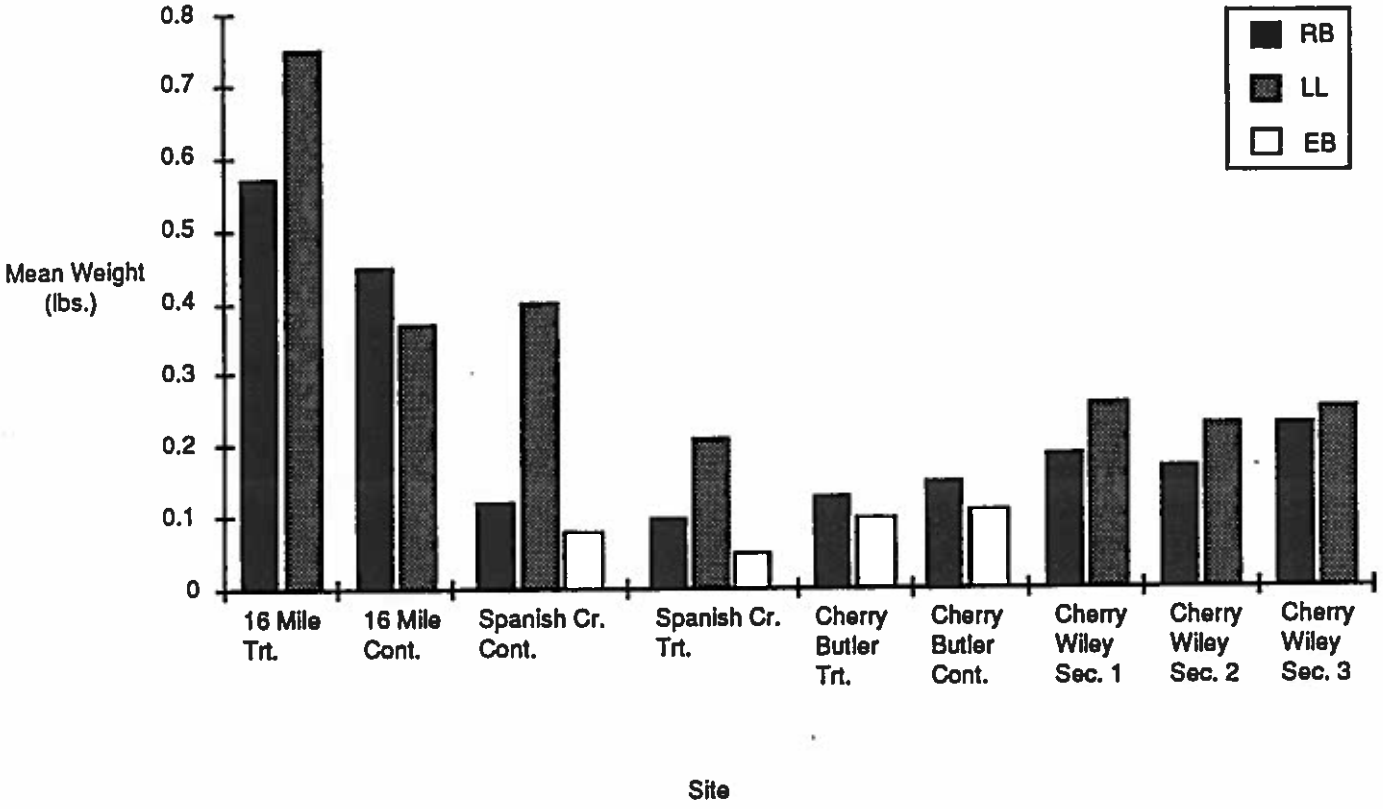


Figure 19. Mean condition factor of rainbow (RB), brown (LL), and brook trout (EB) captured at sites on Sixteenmile Creek, Spanish Creek, and Cherry Creek, Montana during March-April 1990.

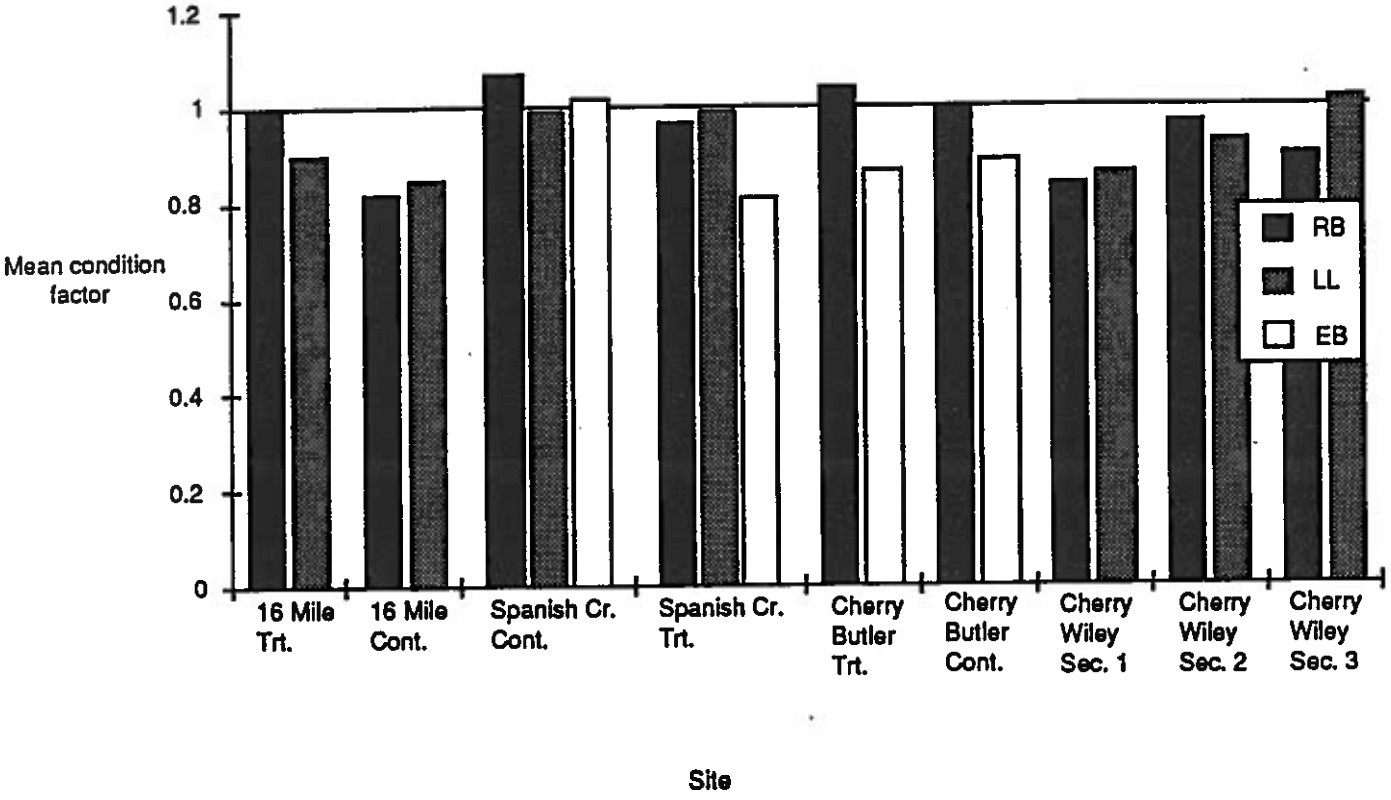


Figure 20. Population estimates for rainbow (RB), brown (LL), and brook trout (EB) at sites on Sixteenmile Creek, Spanish Creek, and Cherry Creek, Montana during March-April 1990.

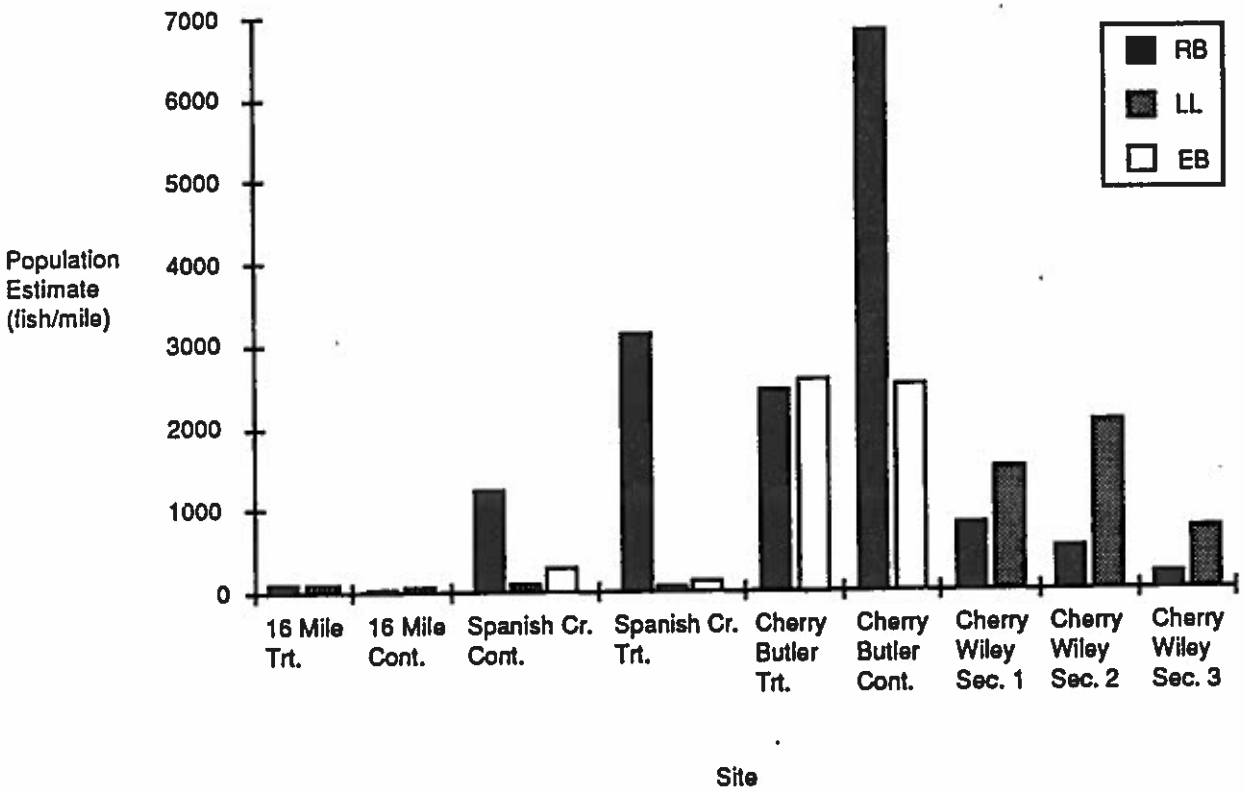


Figure 21. Biomass estimates for rainbow (RB), brown (LL), and brook trout (EB) at sites on Sixteenmile C Spanish Creek, and Cherry Creek, Montana during March-April 1990.