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STREAM FISHERIES INVESTIGATIONS

JOB PROGRESS REPORT

PROJECT F-51-R

by

R. Barry Nehring, Wildlife Researcher

Richard Anderson, Wildlife Researcher

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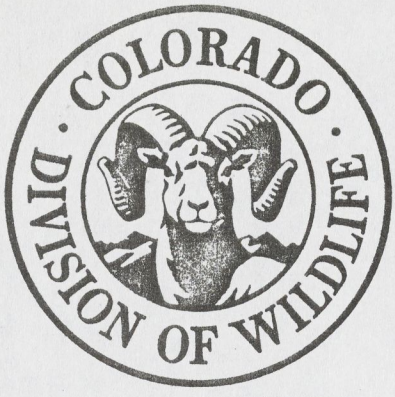

Jack R. Grieb, Director

Federal Aid in Fish and Wildlife Restoration

F-51-R

Colorado Division of Wildlife

Fish Research Section

Ft. Collins, Colorado

June 1981

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JOB PROGRESS REPORT

State Colorado

Project No. F-51-R-6 Name: Stream Fisheries Investigations

Job 1 Title: Taylor River Flow Investigations

Job 3 Title: Special Regulations Evaluations

Inclusive dates: May 1, 1980 - April 30, 1981

INTRODUCTION

Background

This project began in 1973 as the "Upper Gunnison River Investigations." In 1975, the title was changed to "Stream Fishery Investigations" (F-51-R). At that time the project included Job 1, "Taylor River Flow Investigations" and Job 2, "Influence of Artificial Stream Flow Alterations on Trout Populations." Job 1 involved studies done from 1973-1975 to determine the status of the fishery under the existing Taylor River flow regime and has been reported on by Burkhard (1977). In 1976, the flow regime was changed to conform to a pattern specified by Burkhard. Following 3 years of this pattern, the fishery was to be reexamined to determine if any significant changes had taken place.

In 1979, this study was reactivated with Job 1 continued, Job 2 discontinued and a new Job 3, "Special Regulations Evaluations," added. Job objectives for the current segment are specified below. In the following sections of the report, the jobs are not specifically differentiated. Methods were generally the same for both jobs. Results and Discussion are given alphabetically on a river by river basis.

Job 1. Taylor River Flow Investigations

On Burkhard's recommendation, a pattern of reduced fall flows, augmented winter flows was instituted on January 1, 1976, and maintained over the next 3 years. It was hoped that this pattern would enhance spawning success and increase recruitment of brown trout in the river. As was planned, the study was reactivated in May 1979, with the objective: To determine the effects of a changed flow regime on the brown trout population of the Taylor River. Segment objectives were:

1. To characterize the present population of brown trout in the Taylor River with respect to density; to size and age composition; and to growth, mortality and recruitment rates.

2. To determine if any significant changes have occurred in the above population parameters since 1973-1975.

The study area included five sampling stations located along the Taylor River in Gunnison County from its confluence with the East River at Almont upstream to Taylor Park Dam, a distance of 32 km.

Job 3. Special Regulations Evaluations

Special regulations trout fisheries have existed in Colorado for at least 2 decades. They have proliferated in form and number in the past 10 years as the public demand for a more diverse fishing experience has increased. However, except for Klein's (1974) evaluation of the size restriction on the Cache la Poudre River rainbow fishery, special regulations stream fisheries have not been intensively evaluated in Colorado. Consequently, this job was initiated in May 1979, with the objective: To determine the impact of special fishing regulations on the sport fishery in some Colorado trout streams. Segment objectives were:

1. Determine the effects of special regulations on trout population parameters in selected sections of 11 Colorado trout streams.

2. Determine the effects of special regulations on fisherman use and catch on the Fryingpan, South Platte and Arkansas Rivers.

3. Determine the degree of acceptance of special regulations by fishermen and their satisfaction with the fishery on the Fryingpan, South Platte and Arkansas Rivers.

4. Compare the results from experimental and control stream sections by species as well as between different study streams and make recommendations for further study and management implementation of results.

5. Work with regional management personnel to evaluate the need for similar investigations to be incorporated into the study in future years.

Pertinent data for the study streams are given in Table 1.

Table 1. Study stream location, important species and fishing regulations.

Stream name	County	Important species	Harvest restrictions	Terminal tackle
Arkansas	Chaffee/ Fremont	Brown	Catch & Release 2 fish bag over 16 in.	Flies & Lures
Cache la Poudre	Larimer	Brown, Rainbow	None	Flies & Lures
Cochetopa	Saguache	Brook, Brown Rainbow	Catch & Release	Flies only
Conejos	Conejos	Brown, Brook	None	Flies only
Conejos, Lake Fork	Conejos	Rio Grande Cutthroat	Catch & Release	Flies only
Fryingpan	Eagle	Brown, Brook, Rainbow	Catch & Release	Flies only
Los Pinos	Saguache	Brook, Brown	Catch & Release	Flies only
Middle Fork S. Platte	Park	Brown	Catch & Release Between 8 in. & 16 in. 8 fish bag with only two 16 in. and over	Flies only
N. Platte	Jackson	Brown, Rainbow	None	Flies & Lures
Roaring Fork	Pitkin	Rainbow, Brown	Catch & Release over 12 in.	Flies only
S. Platte	Douglas/ Jefferson	Brown, Rainbow	Catch & Release	Flies & Lures

METHODS AND MATERIALS

The methodologies and techniques used in fish population sampling, population estimation, biomass estimation, age and growth analyses, mortality estimates, creel censuses, and angler preference surveys have all been outlined previously (Nehring 1980), with the following exceptions described below.

Mortality estimates were not done for the 1979 field season because only 1 year's data was available. With the completion of the 1980 field season, 2 years of age and growth data were available for mortality rate determinations. Age and growth data from scale sample analyses were combined with the population data to construct life tables for all important species on all study streams where 2 years of data were available. Additionally, all of Burkhard's (1977) age, growth, and population estimates from the Taylor River for 1974-75 were reworked and life tables were constructed.

A new method of electroshocking was employed on the Arkansas River, the largest river sampled in the 1980-81 segment. A working trip was made to Montana in September 1980 to observe the electroshocking techniques of the Montana Fish and Game Department biologists on the Madison and Yellowstone Rivers. The techniques observed on the Madison River proved ideally suited to the Arkansas River. The necessary equipment was constructed and the technique employed on the Arkansas River between Salida and Parkdale for 3 weeks in the winter of 1980-81.

The method requires a three- or four-man crew, a flat bottomboat, two 10-ft dipnets a large live box in the boat, standard electroshocking equipment and a "mobile" electrode. The mobile electrode (positive DC voltage) is thrown up to 50 ft away from the boat and quickly retrieved hand-over-hand back to the boat. Trout attracted by the positive electrical field are usually drawn up to the boat by the electrode for netting.

RESULTS AND DISCUSSION

Fish Populations

Except where specifically noted below, all population and biomass estimates were completed on trout over 10 cm total length. Additionally, all study streams will be presented alphabetically in this section, except for those streams investigated as additional study areas under Objective 5 of Job 3. This objective states:

> "Work with regional management personnel to evaluate the need for similar investigations to be incorporated into the study in future years."

These areas, (Colorado, Eagle and St. Vrain Rivers) will be presented at the end of the Results and Discussion section in alphabetical order.

Arkansas River

The Arkansas River is one of the state's major drainages and provides an excellent trout fishery over much of its course. In 1977, stocking of catchable rainbow trout was discontinued in the Arkansas River from Salida to Parkdale. Creel data revealed no apparent decline in catch rates without stocking and indicated the wild brown trout (Salmo trutta) population was sufficient to maintain the fishery in this portion of the river.

Special regulations were implemented on the Arkansas River on January 1, 1981. The regulation places a 16-inch minimum size limit on trout, with a two fish per day limit on two short sections of the river. One section is near the town of Salida, and the other is near Fernleaf Gulch. It is hoped that this regulation will reduce exploitation rates of the wild stock and spawners.

In the winter of 1980-81, four stations on the Arkansas River were established and electrofished in an effort to obtain population data prior to any influences due to the special regulations. Both catch and release areas were sampled in March 1981 along with a control area located immediately downstream of the village of Coaldale. A private stretch of the river was electrofished just upstream of Texas Creek (Tezak construction property) in December 1980. Population estimates are presented in Appendix I, Table I-1.

The Salida and the Tezak stations had the greatest population estimates for trout $\geq$ 15 cm, 5,483 and 5,454 trout, respectively. Population estimates for Coaldale (4,131 trout) and Loma Linda (3,976) were significantly less (p. 0.10) than the other two stations. The higher trout standing crops of the Tezak station is explainable by the fact that angling mortality should not be as high there as on the public waters. Brown trout $\geq$ 23 cm were 42% (104 trout/ha) and 28% (69 trout/ha) more numerous at the Tezak station than on the Loma Linda and Coaldale stations, respectively. Population estimates ranging from 249 to 383 trout/ha indicate the Arkansas River has a much lower trout density than other large rivers of the state such as the South Platte (1,300 trout/ha), Roaring Fork River (950 trout/ha), Fryingpan River (633 trout/ha), Poudre River (600 trout/ha) and Taylor River (1,800 trout/ha) (see tables in Appendix I).

Length frequency histograms are presented in Appendix II for the trout collected from the four stations. It is noteworthy that no trout were collected from the Arkansas over 43 cm (17 in.) and very few were in the 36 to 40 cm (14 to 16 in.) size range. The length distribution of trout in the lower three stations reveal that size structure of the trout population in the Arkansas River between Coaldale and Texas Creek is nearly uniform (see Appendix II). The Salida station deviated from the other three in that the 1978 year-class was the dominant age group.

Peaks in the length frequency distribution correspond to the back-calculated length at time of annulus formation for age groups 1 and 2 (Table III-1, Appendix III). The mean lengths for Age 1 and 2 trout (24.3 cm and 31 cm) reveal extraordinarily rapid growth. Growth is probably maximized because of the ideal temperature regime of the river, and the low trout population density (below carrying capacity). Length frequency distribution of trout in the Salida station indicated annual growth in this area is about 1.5 to 2 cm less than the lower stations. Examination of trout scales also revealed that very few trout were of the 1977 year-class or older.

The lack of trout over 16 in. and in age group III and above suggest that possibly a severe fish-kill occurred on the Arkansas River in 1977 from just below Salida and on downstream. A fish-kill was reported in the Arkansas River downstream of Salida. However, the extent of the kill or the sources of the toxicant were not determined. If most large trout were removed at that time, it is possible that new recruits since then have not had sufficient time to grow to 40 cm.

Creel census information was gathered in the summer months of 1980 from June through September. Two study sections were established on the Arkansas River. The upper station extended from Coaldale downstream to Fernleaf Gulch, a distance of 12.9 km. This area included the town of Cotopaxi, numerous private lots and the special regulation area. Public fishing in the section is limited to 9.3 km of river. The lower study area, from Texas Creek downstream to Parkdale (21.1 km), contained no closed stretches with one BLM campground.

In the upper study area, there was an estimated 284 hr/ha (1,040 hr/km) of fishing effort between June 2 and September 30, 1980 (Table V-1, Appendix V). In the lower study area, 181 hr/ha (664 hr/km) of pressure for the same time period was estimated. Fishing pressure on the Arkansas River may be ranked as moderate when compared to other large rivers in the state. Marshall (1973) reported pressures on the Poudre River ranging from 1,191 hr/km in the "wild trout water" to 2,640 hr/km in stocked sections in 1971. In 1979 the South Platte was subjected to 4,600 hr/ha near Deckers and the Fryingpan River had up to 968 hr/ha.

Total values for catch-per-man-hour (CPMH) (including throwbacks) on the Arkansas River was 0.696 on the upper and 0.488 on the lower study areas. These values compare favorably with catch rates determined in previous years on the Arkansas River when it was stocked with catchable rainbows (Salmo gairdneri) (Table 2). The most comparable catch statistic for wild trout caught in an area without stocking is on the Poudre River "wild trout water" where total CPMH (brown and rainbow trout) was 0.471 in 1971 and 0.431 in 1972 with a flies and lures only regulation.

Harvest estimates for the four creel census months in the upper study area was 114 trout/ha (45/ac) and 54 trout/ha (22/ac) in the lower study area. Assuming that trout under 9 inches in length are generally too small for

most anglers to keep, this rate of harvest represents a removal by angling of approximately 38% of the brown trout standing crop $\geq$ 23 cm in length in the upper study area. Annual exploitation rates may approach 50% since fishing conditions on the Arkansas River are good for most of the year. Exploitation rates of this magnitude especially on a young population, may be a major factor in causing the low trout density in the Arkansas River and may preclude the accumulation of trout in the larger and older groups.

Table 2. Creel census data for Arkansas River.

Section	Year	Number of fisherman checked	CPMH	Species	(%)
Salida to Parkdale	1974	161	0.353	Rainbow	55
				Brown	45
	1975	192	0.485	Rainbow	21
				Brown	79
	1976	228	0.577	Rainbow	57
				Brown	42
	1977	208	0.370	Rainbow	3
				Brown	96

Cache la Poudre River

Special regulations were first implemented on the Cache la Poudre River in 1963. This came in the form of two "wild trout management" areas in which stocking was eliminated, tackle was restricted to flies and lures only and a 12-inch minimum size on rainbow in possession. The size limit was removed in 1969. The lower wild trout water (LWTW) is located near the mouth of Poudre Canyon, 15 km west of Fort Collins. The upper wild trout water (UWTW) is about 80 km west of Fort Collins, near the town of Rustic, Colorado.

Two investigations near the UWTW concerning the effects of the wild trout regulations on fisherman use and the trout populations have been completed. Klein (1974) established four sampling stations, two within the UWTW and two control stations within 5 km above and below the UWTW. The wild trout station of Marshall (1973) corresponded to the lower study area of Klein, but Marshall's control area was situated in the heavily fished campground at Kelly Flats, 15 km downstream of the UWTW.

The sampling stations in 1980 were selected to approximate those of Klein and Marshall. Stations were electrofished at Klein's upper control, lower control, lower study area (Marshall's UWTW), and at the Kelly Flats Campground. An additional station was electrofished at Indian Meadows, about halfway between Kelly Flats and the UWTW. Population number and biomass estimates are given in Table I-2, Appendix I. Brown trout comprised approximately 75% of the trout in the upper control, but were near a 50:50 ratio with rainbow at the other stations, except Indian Meadows where they comprised 25% of the population. Trout density and biomass estimates fell within the ranges reported by Klein (1974) and Marshall (1973). Densities were from 301 (upper control) to 673 (Kelly Flats) fish/ha in 1980. Biomass ranged from 48.4 kg/ha in the lower study area to 76.4 kg/ha in the lower control.

In 1980, the density and biomass was significantly less ($P \leq .05$) in the lower study area (UWTW station) than in either the lower control or campground stations (Table 3). However, this was not the case in earlier years. Marshall (1973) found no significant differences between the campground and UWTW stations in wild trout density or biomass in 1971 or 1972. Klein (1974) reported comparable numbers of trout in the lower study and lower control stations in the fall of 1962 and 1970, but larger numbers in the UWTW in the fall of 1963 (Table 3).

Comparisons of density and creel census data (available for 1962, 1963, 1964, 1967, 1971 and 1972) suggest a relationship between standing crop in the fall and mortality of trout due to fishing over the year. For example, Marshall (1973) found no statistical difference in the harvest between the UWTW (194 and 262 trout/ha, 1971 and 1972, respectively) and the campground station (270 and 243 trout/ha). In 1962, Klein (1974) reported nearly equal trout harvest in the lower study and lower control stations. By the fall of 1963, when trout density dramatically increased in the lower study area (UWTW) harvest dropped off by 80%. The decline in harvest was attributed to the initiation of the new regulation which excluded bait fishing and the keeping of rainbow trout under 12 inches. Creel census data is not available for 1970, but since the size limit was not in effect at that time, it is likely that harvest rates in the UWTW had increased to levels observed in 1962.

The fact that trout densities were lower in the UWTW in 1980 than in both the lower control and campground stations may suggest harvest rates have increased faster there than in the other two areas. An increase in the harvest could be accounted for by an increase in popularity of the area or in the skill of anglers in the UWTW. Marshall (1973) found that use of the UWTW for fishing in 1972 was relatively low, compared to another section of river of equal length normally stocked but not directly influenced by campgrounds. Also a decrease in tourism, experienced in 1980, may have reduced traffic to the campground areas of the Poudre River. However, since no creel census was made in 1980, the relationship between trout population levles and harvest rates can not be determined. Similar electrofishing results in 1981 would tend to confirm a heavier harvest per unit of area in the UWTW.

Table 3. Population estimates of trout for the Cache la Poudre River from fall samples.

Station/year	Brown trout no. /ha	Brown trout kg /ha	Brown trout %	Rainbow trout no. /ha	Rainbow trout kg /ha	Rainbow trout %	Total trout no. /ha	Total trout kg /ha
Big Bend Campground								
1962[a]	368	35.0	74	130	12.2	26	498	47.2
1963[a]	487	53.3	79	130	12.0	21	617	65.3
1980	227	41.3	75	74	10.2	25	301	51.5
Lower Study Area (UWTW)								
1962[a]	204	27.3	51	195	27.8	49	399	54.3
1963[a]	316	37.9	47	355	45.7	53	671	83.6
1964[a]	296	29.1	44	380	35.9	56	676	65.0
1970[a]	197	30.6	51	185	27.5	49	382	58.1
1971[b]	230	41.3	44	292	44.6	56	522	85.9
1972[b]	264	40.9	52	242	38.6	48	506	79.5
1980	133	18.4	36	231	30.4	64	364	48.8
Lower Control Area								
1962[a]	155	20.2	34	304	36.1	66	459	56.3
1963[a]	196	24.3	44	248	29.9	56	444	54.2
1970[a]	115	16.1	34	226	28.1	66	341	44.2
1980	221	35.7	43	288	40.7	57	509	76.4
Kelly Flats Campground								
1971[b]	277	43.4	48	297	34.4	52	574	77.8
1972[b]	271	33.3	48	294	39.3	52	565	72.6
1980	291	23.4	43	381	39.9	57	672	70.9
Indian Meadows								
1980	160	23.4	27	445	51.8	73	615	75.2

[a]Date from Klein (1974) converted to metric.
[b]Data from Marshall (1973).

Length frequency histograms for brown and rainbow trout are presented in Appendix II. Size structure appears to be fairly uniform between the stations. Mean lengths of brown and rainbow trout ($\geq$ 14 cm) captured in 1980 were largest in the upper control area and smallest in Kelly Flats Campground (Table 4). The mean size of trout in 1980 was less in the lower study area (UWTW) and Kelly Flats than determined by Marshall (1973) in 1971 and 1972 for those areas (Table 4). In contrast, mean lengths for the lower control and upper control were above those found by Klein (1974) (Table 4).

Age and growth data for trout sampled in 1980 are presented in Table III-1 of Appendix III. Back-calculated length data was very similar between stations in 1980. Klein (1974) found essentially identical growth rates for trout of the lower study and lower control in 1967, 1969 and 1970 (Table 5). The growth rate of wild rainbow trout in the Poudre River in 1980, which closely paralleled those reported by Klein (1974), is much slower than those of other streams included in this study. The cold temperatures characteristic of the Poudre River have been related to a slow growth rate (Klein 1974). Scale analysis of brown trout, however, indicated in 1980 that they grew faster than rainbows and brown populations of earlier years (Table 5).

The remaining two stations sampled were associated with the wild trout management unit within the lower canyon (LWTW). The study site was located near the upper terminus of the LWTW and a control station was sampled about 500 m upstream, outside the LWTW. Brown trout comprised 95% of the trout in the LWTW and 92% in the control area (Table I-2 in Appendix I). Estimates for trout density and biomass appeared to be greater in the LWTW than in the control station, but did not differ significantly. Densities, but not biomass, were significantly greater in both the LWTW and control stations than found above in the five upper stations.

The length frequency histograms for the lower two stations, presented in Appendix II, indicated very few trout larger than 30 cm in this portion of the river. Mean size of 19.1 cm for the LWTW and control was 4.0 cm less than the average of the mean size of brown trout in the five upper stations. The size structure of browns in this area is indicative of a stunted population or one that is receiving extremely heavy fishing pressure. The latter probably reflects the true situation. Scales were not taken from trout at these two stations, but mean length of age 0 (10.3 cm) determined by length frequency analysis, shows a slightly faster growth at this age in the lower Poudre than in the upper UWTW.

Length-weight regressions for brown and rainbow trout from the Poudre River are contained in Table IV-1 of Appendix IV.

Table 4. Mean lengths of brown and rainbow trout collected in October samples from the Cache la Poudre River 1971, 1972 and 1980 for trout ≥ 14 cm, otherwise ≥ 15.2 cm.

Station	Year	Brown trout		Rainbow trout	
		no.	mean length	no.	mean length
Big Bend Campground	1962[a]	76	20.3	54	20.3
	1963[a]	91	21.0	73	20.3
	1980	51	25.9	19	23.4
Lower Study Area (UWTW)	1962[a]	61	23.4	61	23.4
	1963[a]	75	22.3	46	22.6
	1964[a]	74	20.8	70	20.1
	1967[a]	74	22.8	65	24.4
	1969[a]	55	24.6	74	25.4
	1970[a]	55	24.6	57	23.9
	1971[b]	235	24.7	341	23.1
	1972[b]	252	23.7	345	23.8
	1980	36	22.9	68	22.4
Lower Control Area	1962[a]	48	23.9	83	22.1
	1963[a]	44	22.3	96	21.8
	1967[a]	74	21.3	114	21.1
	1969[a]	100	23.1	150	24.1
	1970[a]	79	23.6	165	22.1
	1980	56	24.3	71	23.2
Kelly Flats Campground	1971[b]	481	23.7	587	21.7
	1972[b]	488	22.4	582	22.3
	1980	84	21.0	117	20.3
Indian Meadows	1980	41	24.3	122	21.0

[a]Data from Klein (1974) converted to metric.
[b]Data from Marshall (1973).

Table 5. Mean length of trout at time of capture in fall samples from the Cache la Poudre River.

Month and year	Age classes						
	0	I	II	III	IV	V	VI
			Rainbow trout				
April 1963	6.4	13.0					
October 1967		15.5	21.0	24.1	26.8	27.7	
April 1969		13.7	20.8	25.4	27.9	32.0	
April 1970	6.8	17.0	21.5	25.9	28.5	31.7	
October 1970		15.2	20.5	25.0	27.7	31.5	
October 1980	7.8	14.7	20.9	24.2	27.3	30.5	
			Brown Trout				
April 1963	7.8	13.5					
October 1967		16.6	22.5	25.0	28.2		
April 1969		16.0	22.3	25.4	28.7		
April 1970	8.9	16.0	22.2	25.2	20.0		
October 1970		16.7	21.8	25.1	28.0	28.3	32.6
October 1980	9.5	16.9	24.1	28.3	34.6		

Cochetopa, Los Pinos and Archuleta Creeks - Coleman Easement

Although large fluctuations in the numbers and biomass of trout in Los Pinos Creek (1,300 - 3,100/ha) have been observed over the past 3 years, species composition remains unchanged. Brook trout (Salvelinus fontinalis) comprise 95% or more of the population with brown trout comprising the remainder. Previous findings (Nehring 1980) have been substantiated by the data collected during the 1980 field season. Recruitment is limited by the low-gradient silt-laden condition of the stream, primarily induced by heavy cattle grazing. Low fishing pressure and catch and release angling are the primary reasons for maintaining this excellent small stream trout fishery. The author and his son caught and released more than 50 nice brook trout on the Los Pinos during a few hours of angling in the summer of 1980. Standard bag limits on the Los Pinos would probably result in rapid decimation of the fishery. Population estimates and biomass data are presented in Table I-3 of Appendix I. Length-frequency histograms for the 1980 field season are presented in Appendix II.

Population numbers and densities for both brown and brook trout have fluctuated widely in Archuleta Creek over the past 3 years. Brook trout made up slightly more than 50% of the trout population in 1978 and more than 90% in 1979 and 1980 while the brown trout component has been steadily decreasing in both real numbers and percentages. Brook reproduction and recruitment appears excellent and the fish are in robust condition. Population estimates and biomass data for 1980 are presented in Table I-3 (Appendix I) and length-frequency histograms are presented in Appendix II.

On Cochetopa Creek, the trout population more than doubled in density between 1979 and 1980 with more than a 300% increase in brown trout numbers and a 60% increase in rainbow numbers. The average size of trout has also improved with more trout over 30 cm total length. Recruitment appears to be limited by inadequate spawning gravel, high water velocities, lack of nursery areas, and siltation of the stream due to overgrazing and irrigation return. Without restriction of fisherman harvest (through catch and release angling), Cochetopa Creek would be quickly overexploited. The lower control section (statewide angling regulations of 8 trout/day) is a classic example of an overexploited stream. Here, the density is 75% lower and the biomass is 82% below that of the catch and release area despite the stocking of more than 14,000 catchable rainbow. Wild brown trout are six to ten times more numerous and the biomass is eight times greater in the catch and release area. Population estimates, densities and biomass estimates for the various sections of Cochetopa Creek are presented in Table I-3 (Appendix I) and length-frequency histograms are found in Appendix II.

Mortality estimates and life tables were not calculated for any of these three streams as the primary species in Los Pinos and Archuleta Creeks is brook trout and few of the brook survive beyond the third year of life. Sample sizes of brown trout in the Cochetopa Creek were too small to allow for accurate age-class determination and life table calculation.

Conejos River

Comparison of the density and biomass estimates for the Conejos River in 1980 (Table I-4, Appendix I) with those from 1978 and 1979 (Nehring 1980) reveal a remarkable stability in the brown trout population at all three sampling stations. Trends observed in 1978 and 1979 were reconfirmed in 1980, i.e., the Spectacle Lake, Broyles Bridge and Hamilton - T-Bone stations maintained their relationship in having the highest, intermediate and lowest brown trout density, respectively.

Also reiterated in 1980 was the fact that stocking of catchable rainbows does not appear to have a negative impact on wild brown stocks. The Spectacle Lake and Broyles Bridge stations have consistently supported the better brown trout populations (1976-1980) despite heavy infusions of catchable size rainbows. Conversely, the Hamilton - T-Bone section, a flies only stretch which is not stocked with catchable rainbow, has consistently had the lowest wild brown trout population.

Table 6 below compares the number of rainbow stocked by year (1976-1980) with the number of rainbow remaining at the sample stations each fall after the fishing season is over. The fishing season on the Conejos River runs from about Memorial Day through Labor Day. Fifty to 80% of the fishermen are nonresidents. Once school starts and the summer vacation season is over, fishing pressure drops off to near nothing.

Table 6. Comparison of catchable rainbow stocking rates versus number of rainbow sampled (N/ha) in September-October 1976-1980.

Statistic	Year				
	1976	1977	1978	1979	1980
Number stocked	37,500	40,300	50,300	44,800	54,300
Broyles Bridge	61	--	157	40	123
Spectacle Lake	68	--	121	34	229

These data indicate a clear direct relationship between the number of rainbow trout stocked each year and the number remaining each fall after the fishing season. Klein (1974) indicated overwinter survival of hatchery rainbow in the Cache la Poudre River to be negligible. The same indications have been found by other investigators (Norwin Smith and William Weiler, personal communication) as well as the authors. The Spectacle Lake station (U.S.F.S. campground) and Broyles Bridge stations are two of the most readily accessible public fishing areas and probably receive the heaviest fishing pressure on the river, and yet large numbers of catchable rainbow remained at these stations in 1978 and 1980, the 2 years when catchable stocking rates exceeded 50,000 rainbow. It would seem that a residual rainbow population of 50-100 rainbow trout/acre (1980 estimates at Broyles Bridge and Spectacle Lake) are probably excessive and that some cutback in the stocking rate might be warranted. That action was taken in 1979 after similar findings in the fall of 1978. The action was apparently successful as residual catchable rainbow numbers in the fall of 1979 were reduced 70-75% from the 1978 levels. It appears that a stocking rate of 35,000-45,000 catchable rainbow is enough to satiate the stream under present levels of fishing pressure. Anything above 45,000 catchables appears to be a wasted investment since overwinter survival is probably poor.

Life tables constructed for the three stations on the Conejos (Tables III-3, Appendix III) indicate total mortality rates on subcatchable size (less than 20 cm) stocks range from 0 to 50%. However, once the year-class reaches catchable size, total mortality rates are in the 50-90% range. This would tend to indicate that either fishing mortality is not compensated by decreases in natural mortality, or fishing mortality is great enough to result in 50-90% reductions in stocks above the minimum acceptable size (about 20 cm or 8 in.). The latter is probably the case as brown trout stock densities in the Conejos River are among the lowest of any of the streams in this study.

Length-frequency histograms for brown trout at the Conejos River stations are presented in Appendix II.

Conejos River - Lake Fork

The Lake Fork of the Conejos River supports a rapidly expanding population of Rio Grande cutthroat trout (Salmo clarki virginalis). For details on the study area, the reader is referred to last year's progress report (Nehring 1980). Precise population estimates were completed on the 1978 and 1979 age-classes, both the result of natural reproduction since the stream was chemically reclaimed and restocked in 1977 (see Table I-5, Appendix I). At the time of the survey (in early August), the 1980 year-class was just emerging from the gravel. This was somewhat of an enigmatic as no adults of spawning size or age were taken at any of the survey stations. Apparently either all spawners had died of natural mortality or they had retreated to other areas of the stream or downstream to Rock Lake.

This population should continue under close scrutiny of either research or management personnel as large scale mining operations are about to begin in the Lake Fork drainage and an access road for mining operations has already been constructed up the valley, crossing the stream in several places. These operations could have a negative impact on the trout population.

No age and growth analyses or mortality tables were done for the Lake Fork of the Conejos River as most of the fish are known to be from the 1978 and 1979 year-classes. Trout in the 1979 year-class ranged from 7 to 14 cm in total length with the mode at 9-10 cm. The 1978 year-class trout ranged from 15-23 cm with a mode at 19 cm. Only 9 cutthroat out of a total of 469 taken exceeded 23 cm and were believed to be from the original stocking in 1977. No trout over 28 cm were taken.

Fryingpan River

Population estimates, density (no./ha) and biomass (kg/ha) estimates for all six stations on the Fryingpan River are presented in Table I-6 in Appendix I. Comparison of these data with those from the fall of 1979 (Nehring 1980) indicate some changes have occurred in the population in the last year (Table I-7, Appendix I).

Brown and brook trout population estimates changed very little at Stations 2 and 3 in the catch and release area. Rainbow population estimates at all three stations in the catch and release area increased slightly. Conversely, both brown and rainbow populations decreased between the fall of 1979 and 1980 at all three stations outside the catch and release area. These trends will be monitored throughout the 1981-82 project segment.

Creel census data collected in 1980 indicates fishing effort increased between 8% and 33% over 1979. The 33% increase came in the catch and release area. Creel catch (trout kept) dropped 38.2, 36.2 and 21.2% in Sections 1, 2 and 3 (standard regulations areas), respectively, between 1979 and 1980. Rainbow creel catch (rainbow kept) decreased 43.2, 25.5 and 45.7% in Sections 1, 2 and 3, respectively, between 1979 and 1980. Brown catch and brown creel catch increased in two of the three sections between 1979 and 1980. These data strongly indicate fishing pressure is making heavy inroads on both the brown and rainbow trout populations outside the catch and release area. Rainbow CPMH decreased between 19% and 36% in all three standard regulations areas between 1979 and 1980, another indication of decreasing rainbow populations. Brown CPMH increased in two of the three standard regulations sections indicating that brown trout can make up for some of the loss of the rainbow; however, rainbow CPMH is still two to three times higher than brown CPMH in the standard regulations sections despite the fact that brown trout comprised 63% and 78% of the total trout population at Sections 2 and 3, respectively.

In the catch and release area, catch increased 30% in 1980 over 1979 despite a 33% increase in fishing pressure as well. Rainbow, brown and brook trout catch increased 3%, 65% and 94%, respectively, in the catch and release area in 1980. For a section by section summary of creel census statistics in 1980, refer to Table 7 below. Detailed creel census statistics for individual sections are presented in Tables V-2, V-3, V-4 and V-5 of Appendix V.

Table 7. Fryingpan River creel census summary for summer (May - October) 1980.

Statistic	8 trout/day creel limit			Catch & release
	Section 1	Section 2	Section 3	Section 4
Total hours	3,991	7,530	6,486	9,548
Total catch	2,295	3,110	4,131	10,786
Total CPMH	0.575	0.413	0.637	1.130
Creel catch	1,272	2,013	1,698	--
Creel CPMH	0.319	0.267	0.262	--
Rainbow catch	1,727	1,917	2,615	6,140
Rainbow creeled	1,110	1,318	1,110	--
Brown catch	484	1,147	1,483	2,272
Brown creeled	126	688	575	--
Rainbow CPMH	0.433	0.255	0.403	0.643
Brown CPMH	0.121	0.152	0.229	0.238
Brook catch	--	--	--	1,884
Brook CPMH	--	--	--	0.197
Catch >15 in.	91	169	132	1,279

The catch and release section of the Fryingpan River is about 4 km long, and the 8 trout/day bag limit area is 19 km long. Despite the large disparity in stream distance and surface area between the two sections, more total trout were caught in the catch and release area than in the remaining 19 km of stream. Almost as many rainbows were taken in the catch and release area as in the 8 trout/day bag area, and almost 1,900 brook were caught in the catch and release area compared to less than 100 in the remaining stream. Total CPMH averaged 1.13 in the catch and release area compared to CPMH rates of 0.575, 0.413 and 0.637 in the three standard regulations sections. In the 19 km--8 trout/day bag area, a total of 392 trout in excess of 381 mm (15 in.) total length were estimated caught in 1980. In contrast, an estimated 1,279 trout over 381 mm were taken (and released) in the 4 km catch and release section.

Clearly, catch and release angling offers some benefits to the fishing public that apparently cannot be produced under normal harvest regulations. Despite the highest fishing pressure, average CPMH doubled, total catch was greater and three times as many trout in excess of 381 mm (15 in.) were taken in the catch and release section of stream with only one-fifth of the total surface area of the standard regulations section.

Five creel surveys have been conducted on the Fryingpan River between 1972 and 1980. The results of these studies are summarized in Table 8 below, again emphasizing the point that catch and release angling has virtually doubled the fisherman catch rate.

Table 8. Comparison of total CPMH statistics for the Fryingpan River between sections and years.

Months - year	8 trout/day bag area			Catch & release since 1979
	Section 1	Section 2	Section 3	Section 4
July-September 1972	0.337[1]	--	--	--
July-September 1973	0.413[1]	--	--	--
July-September 1978	0.740	0.60	0.86	0.55
May-September 1979	0.720	0.59	0.55	1.16
May-October 1980	0.570	0.41	0.64	1.13

[1]All sections combined.

Length-frequency histograms for rainbow and brown trout on the Fryingpan River for the spring and fall of 1980 are presented in Appendix II. These histograms indicate that both rainbow and brown trout populations outside the catch and release area are composed of an increasing percentage of smaller younger trout. Conversely, in the catch and release area, larger and older trout are being retained in the population. Again, this reinforces the hypothesis that fishing pressure can have detrimental effects on catchable (20 cm and larger) size trout stocks in the Fryingpan River.

Life tables for rainbow, brown and brook trout in the Fryingpan River are presented in Tables III-4, III-5 and III-6 in Appendix III. These data indicate that far greater numbers of trout in the older age groups exist in the catch and release area than in the 8 trout/day bag limit area. If we stratify the data by species and regulation for each year-class, the numbers can be summarized and compared as presented in Table 9, below.

Table 9. Comparison of numbers of rainbow and brown trout (no./ha) by year-class and regulation type in the Fryingpan River, fall 1980.

	Rainbow		Brown	
Year-class	8 trout/day	catch & release	8 trout/day	catch & release
1979	100	51	109	93
1978	109	64	145	280
1977	64	90	80	272
1976	22	63	18	73
1975	8	41	0	4
1974	0	19	0	0

While some discrepancies occur in the life tables, i.e., increases in year-class size over time, the author feels these are primarily a function of lower electroshocking efficiency on smaller young trout and/or movement of fish into or out of the sampling areas between samples. Close examination of these tables indicates that total annual mortality rates for trout over 3 years of age is usually 50% or greater. In younger age-classes (1 to 3 year olds) the annual mortality rates decrease somewhat. As a age-class approaches 6 and 7 years of age, total annual mortality approaches 100%.

Nehring (1980) pointed out that the percentage of rainbow trout at the Ruedi Dam station had been decreasing through the decade of the 1970's and the brown trout percentage had been increasing. Examination of the data for the Taylor Creek station indicated a similar trend between 1970 and 1980. These trends are presented in Figures IV-1 and IV-2 of Appendix IV. Nehring (ibid.) also referred to the probability that the best location in the Fryingpan River for rainbow trout spawning, incubation and nursery areas was in the Seven Castles reach, a section of river about 2-2.5 km long, about 15 km (9 mi.) below Ruedi Dam. A plot of the rainbow population data in the fall of 1979 and 1980 (Fig. IV-3) in miles upstream and downstream of the Seven Castles area indicates quite graphically that the percent rainbow in the population decreases with increasing distance upstream of the Seven Castles area. Below the Seven Castles spawning area the percentage of rainbow trout in the population increases dramatically. This information supports the hypothesis that (1) the Seven Castles area is a primary source of rainbow trout recruitment in the Fryingpan, (2) that the area downstream from Seven Castles probably receives significant rainbow trout recruitment from that area, and (3) rainbow trout recruits from the Seven Castles spawning area do not move very far upstream against the current.

A comparison of the size distribution between population and harvest for rainbow trout and brown trout in the catch and release and 8 trout/day bag areas is presented in Figures IV-4 and IV-5 in Appendix IV. All four sets of histograms indicate fishing pressure is the greatest on trout 9-12 inches (229-305 mm) in length and larger. The histograms also indicate fishermen catch more trout of both species in excess of 12 inches (305 mm) in the catch and release area than they do in the 8 trout/day bag limit sections.

Concern has been expressed over possible detrimental impacts on trout growth due to reduced water temperatures in the Fryingpan River below Ruedi Reservoir (Finnell 1972). Temperature data collected by the U. S. Fish and Wildlife Service in 1963 and 1971 and reported by Finnell (ibid.) is compared with temperature data collected as a part of this project in 1980 (Table 10). Quite clearly, Ruedi Reservoir has had a severe impact on the thermal regime of the Fryingpan River downstream from the reservoir. It is hard to believe that a -15 F drop in temperature at the damsite and a -9 F drop at the town of Basalt, 23 km downstream from the reservoir, has not had a depressing effect on the trout growth rate. Unfortunately, no age and growth data was collected on the trout populations in the study area prior to the construction of Ruedi Reservoir (Burkhard 1966, 1967). However, a study completed in September of 1969 (Clary 1969) did include age and growth analysis of rainbow trout and brown trout from the Fryingpan River below Ruedi Dam. Ruedi Reservoir began filling in May 1967; thus, age and growth data on trout in their second, third and fourth summer of life collected in 1969 should reflect growth rates prior to the filling of the reservoir. Clary's data is summarized, compared with that collected by Finnell (1972, 1978) and Nehring (1980) and presented in Table 11, below. No apparent decrease in the growth rate can be detected from the 1969 data. Even though Clary's brown trout data was inadequate for a good comparison, it was sufficient to indicate the impact on brown trout growth rates was negligible.

Table 10. Mean monthly water temperature data (F) from the Fryingpan River.

Month	Ruedi Damsite			Basalt		
	1963	1971	1980	1963	1971	1980
July	59.0	44.8	41.9	60.2		51.8
August	58.3	49.1	43.2	59.8		50.9
September	57.0	45.6	44.2	58.3		48.2
Average	58.1	46.5	43.1	59.4		50.3

Table 11. Back-calculated lengths (mm) of rainbow and brown trout by age and years from the Fryingpan River (1969-1979).

Year	Back-calculated lengths at various ages					Source
	I	II	III	IV	V	
			Rainbow			
1969	60	151	248	318	--	Clary, 1969
1970	76	165	264	320	386	Finnell, 1972
1977	82	148	222	305	381	Finnell, 1978
1978	92	181	254	317	--	Nehring, 1980
1979	82	168	247	305	348	Nehring, 1980
			Browns			
1970	81	168	244	318	371	
1977	84	149	217	279	--	
1978	86	171	245	312	--	
1979	80	163	232	277	--	

Elliott (1975a, 1975b, 1976) has conducted intense studies on the growth rate of brown trout fed on maximum and reduced rations over a wide range of temperatures. He found that (1) optimum temperature for growth, i.e., that temperature which produces the largest weight gain per unit of good intake, decreases from 13 C at maximum ration to 4 C at a ration size just above a maintenance diet, and (2) that as size and age increases trout growth rates decrease, thereby minimizing the impacts of optimum temperatures for growth. Elliott's findings indicate that wild brown trout have an innate physiological ability to minimize the impacts of both colder temperature and reduced ration size on growth. This may help explain why no apparent measurable decreases in trout growth rate has been observed in Fryingpan River trout below Ruedi Reservoir since reservoir operations began. In addition, colder summertime water temperatures may be compensated by warmer wintertime water temperatures as alluded to by Finnell (1972) and Nehring (1980).

North Platte River

The North Platte River within Routt National Forest, from the Colorado-Wyoming state line upstream 6.4 km, has been restricted to artificial flies and lures only fishing since 1973. Stocking was also terminated on the North Platte in this area. Float fishing is popular on this stretch of the river, as vehicle access points are limited to the upper forest boundary. In August 1980, two stations were sampled within the area on the North Platte. These included a station on the Ginger Quill Ranch, a short private owned piece, and one about 1 km downstream of the Ginger Quill on the national forest. A third station was electrofished at Six-Mile Gap campground in Wyoming about 6 km downstream of the state line. Since Wyoming does not restrict the type of tackle used, the Six-Mile Gap station was to serve as a "control" area.

Electrofishing revealed that trout densities were low at all three North Platte stations (Table I-8, Appendix I). Even when using the maximum value allowed by the 95% C.I., trout density estimates ranged from 150 to 288 trout/ha for the two stations in Colorado. Trout were found to be about equally abundant at Six-Mile Gap. The most apparent difference between the Colorado and Wyoming station was related to species relative abundance. Brown trout comprise 68% of the trout population for the two Colorado stations, but rainbow were the dominant trout (69%) in the Wyoming station. It is likely that the rainbow of Six-Mile Gap were naturally produced since this area has not been stocked in recent years (personal communication Bob McDowell, Wyoming Game and Fish).

The length frequency distribution for brown trout for the two Colorado stations is very similar to that of the state leases on the North Platte further upstream (Appendix II).

Back-calculated length data for trout are given in Appendix III, Table III-2.

North Platte (North Park) Tributary Leases

In the North Park region of Colorado, the Division of Wildlife has acquired ten stream leases and easements that provide the public with access to 62 km of trout stream fishing. All stream sections leased by the DOW are managed as "wild trout waters," in which there is no stocking and fishing is restricted to flies and lures only. Locations of North Park leases are described by Smith (1980) in the July-August 1980 issue of Colorado Outdoors.

A total of 20 stations were electrofished in North Park in August 1980. For purposes of this report, stations will be combined into three major groups: state wildlife areas (state fishing leases) on the North Platte River [Peterson, Manville, Verner, Brownlee-2, Wilford and Trick (North Park Angus)]; state wildlife areas on the Michigan River (Murphy, Brownlee-1, and Brownlee-2); and stations occurring on the tributary streams of Norris Creek, Roaring Fork Creek, North Fork of the North Platte and the Illinois River (Irvin and Manville Wildlife Areas, Richard Ranch and Arapaho National Wildlife Refuge, respectively). Results of electrofishing for each station are presented in Table I-9 of Appendix I.

Many physical and biological properties of the North Platte River on the public fishing leases were in the poor category. The most serious habitat degradation was the direct result of riparian vegetation removal caused by excessive livestock grazing. Exposed and eroding streambanks has resulted in sedimentation loads that have produced a monotonous substrate composed of nearly 100% sand and silt. Also undercut banks and pools that provide cover for trout are rare. Habitat problems are further exacerbated by dewatering for irrigation in the summer months.

Western white suckers (Catostomus commersoni) was the most common species collected in the North Platte River stations. Density estimates for both white and longnose suckers (C. catostomus) ranged from 80/ac at the Peterson lease to 6/ac on the Wilford property. The number of brown trout collected ranged from zero at the Trick Wildlife Area to seven on the Manville Lease (one electrofishing pass). The single rainbow trout collected was taken from the Wilford Lease station.

Angling mortality is probably not an important density regulator in trout populations of the North Platte River on the state leases. Fisherman use information for the Peterson Wildlife Area obtained in the summer of 1980 showed that this lease received an estimated 208 ± 185 hr of pressure over 4.3 km of stream.

Part of the problem for the depleted state of the trout population in the North Park has been attributed to the extremely severe winter of 1977 (Mr. Brownlee, personal communication). We believe that the high winter mortality of 1977 has not allowed the population to recover. An effort to increase standing crop of trout will be made by Regional personnel through stocking fingerling brown trout in the North Platte leases in the spring of 1981.

Back-calculated length data for trout are given in Appendix III, Table III-2

The length frequency distributions of all trout taken from the North Platte Leases are presented in Appendix II. The histograms, which do not have peaks that typically represent the 0 and I age groups, suggest that recruitment has been generally unsuccessful in this segment of the North Platte River in 1978 and 1979.

Back-calculated length data for brown trout are presented in Appendix III, Table III-2.

The Michigan River and its tributary Owl Creek, on the Murphy and Brownlee-1 Leases contained a fish community composed of brown trout, western white suckers, longnose suckers, creek chub (Semotilus atromaculatus) and longnose dace (Rhinichthys cataractae). Brown trout was the dominant species in the Michigan River, Murphy Lease (MR-M) and Owl Creek--Brownlee-1 Lease (OC-B1), comprising 51% and 53% of the fish from those two stations, respectively. Suckers made up 70% of the population in the Michigan River--Brownlee-1 Lease (MR-B1) and 61% in the Owl Creek--Murphy Lease (OC-M). Trout density on the MR-M Lease of 315 trout/ha, was greater than those found on the MR-B1 Lease (180 trout/ha), OC-M Lease (196 trout/ha) and OC-B1 Lease (180 trout/ha).

Brownlee-3 is the other state lease on the Michigan River. Angling records compiled by the Michigan River Trout Club (presently Brownlee-3) indicate that this section of the river has provided good trout fishing in previous years. However, in 1980 only 15 brown trout,about 10.8 trout/acre, were collected in two stations electrofished on this lease. Suckers, even though five times more numerous than trout in the Brownlee-3 Station, were also considerably less abundant than downstream on the Brownlee-1 and Murphy Leases.

Length frequency distributions for brown trout collected from the Michigan River are presented in Appendix II. The histogram for trout from the Murphy and Brownlee-1 Leases combined (4 stations) show a respectable number of (13%) of trout $\geq$ 30 cm in length. Length frequency histogram for trout from Brownlee-3 reveal very few trout in the young age groups were collected.

Growth rates, determined by back-calculations of length at annulus formation (Table III-2, Appendix III), were similar for fish taken from the Michigan River and for those of other North Park streams. However, it appears that substantial differences in growth rate occur for trout of different year-classes. Generally growth rates of brown trout were slower in the North Park streams than found in other streams examined in this study.

Values for trout density and biomass for the tributary streams of Norris Creek, Roaring Fork Creek and North Fork were intermediate to those found on the Michigan River and the North Platte leases. Two stations were sampled on Norris Creek (Irvin Lease). The low number of trout collected there (40 trout/ha upper station and 105 trout/ha lower station) may have been a reflection of fishing harvest, since the habitat appeared to be able to support a much larger trout population.

Two stations were also electrofished on Roaring Fork Creek. The upper station, on the Irvin Lease, was characterized by extensive riffle areas and few holding pools for trout. Brown and brook trout were numerous (336 and 114 trout/ha, respectively) in this station, but only six trout were larger than 30 cm (12 in.). The reverse was the case in the lower station of the Roaring Fork Creek (Manville Lease). Large pools in this segment of the stream contained several trout over 30 cm, but numbers of trout (99/ha) were only one-fourth of the upper station. Pressure counts and creel census data were obtained for the Roaring Fork Creek (Manville Wildlife Area) from June to September 1980. The relatively light amount of fishing pressure, 926 ± 568 hours (95% C.I.), on this lease most likely helped precipitate a fairly high total catch rate of 0.66 trout/hr. Creel catch was estimated at 337 trout ± 333 (95% C.L).

A section of the North Fork of the North Platte was electrofished on the Richards Ranch. Since this river was on private property, it did not have any restrictions for tackle and, in this respect, it served as a control station. Although the North Fork had nearly a 50:50 pool, riffle ratio, results of electrofishing were similar to the other North Park streams.

The last station was on the Illinois River on the Arapahoe National Wildlife Refuge. This area is open to public fishing and has no restrictions on tackle. This station had few trout, (99/ha) but white suckers, longnose suckers and creek chub were numerous. The largest brown trout collected in North Park (21.5 in.) came from this station.

Length frequency distributions of trout collected from tributary streams are presented in Appendix II.

Roaring Fork River

The Roaring Fork River has been subject to various types of special regulations management since 1961, when a catch and release regulation on all trout under 12 inches went into effect. For details on the history of the regulations in effect and the exact study area, the reader is referred to Table 1 in the Methods and Materials section and last year's progress report (Nehring 1980). Population estimates, density and biomass estimates for the 1980 field season are presented in Table I-10 of Appendix I. Data on numbers of trout/ha/yr are summarized below in Table 12 for the Aspen Institute Station where some sort of catch and release regulation has been in effect since 1961.

Table 12. Trout population estimates (no./ha) at the Aspen Institute Station of the Roaring Fork River.

Year	Rainbow	Brown	Brook	Total trout
		Catch and release under 12 in.		
1970	625	168	--	793
1973	721	89	79	889
$\bar{x}$	673	128	--	841
		Catch and release over 12 in.		
1977	743	235	42	1,020
1978	454	225	35	716
1979	837	341	72	1,233
1980	539	272	45	860
$\bar{x}$	643	268	49	957

These data support the conclusion reached last year (Nehring 1980), i.e., there has been no significant change in the population density, size, or age structure under either set of catch and release regulations. Clary (1969) found the population in the catch and release area to be 93% rainbow and 7% brown. This seems to indicate that no significant changes have occurred in the population as far as species composition is concerned since 1969. However, with an 8-yr time lapse between the imposition of special regulations (1961) and the first good evaluation (1969), any changes in the population size, age structure, and species composition would have long since been manifested by the time Clary's study was done. Weberg (1954) indicated the subcatchable size trout population in the Roaring Fork River was extremely low; although he gave no indication of the location of his sampling.

Length-frequency histograms for the 1980 data from the Roaring Fork (Appendix II) show no changes in population size structure for either rainbow or brown, including Clary's studies (1969).

Despite all the indications listed above, I feel the catch and release regulation on the 5 km section of the Roaring Fork River is having a positive effect in maintaining the rainbow component in the fish population. At the Aspen Institute (catch and release area) station the population has consistently been from 60 to 90% rainbow since 1969 (Clary 1969, Sealing unpublished data, Finnell 1972, Nehring 1980). Conversely, in the standard regulations area below the catch and release section, the population has

been evenly split between rainbow and brown with overall trout densities much lower. In the upper standard regulations area (above catch and release area) brown trout comprise 70 to 80% of the population. Without the catch and release regulation, the rainbow component of the population would decrease as has occurred on the Fryingpan and South Platte Rivers where standard statewide angling regulations have been in effect.

The life tables for the rainbow and brown trout (Table III-7, Appendix III) support the contention that the catch and release regulation is helping to maintain the rainbow component of the population. In the fall of 1980, there were still large numbers of the 1976 and 1977 rainbow year-classes in the population at the Aspen Institute Station. After rainbow trout are into their fourth and fifth summers of life, old age begins to significantly reduce year-class size. While total mortality for the 1977 and 1978 year-classes of rainbows at the Aspen Institute Station ranged from zero to 32%, total mortality on the 1976 and 1975 rainbow year-classes were 68 and 76%, respectively. Total mortality on brown trout for the 1977, 1976 and 1975 year-classes at the Aspen Institute were 20, 5 and 42%, respectively, perhaps indicating brown trout live longer than rainbow.

South Platte River

Population estimates, density (no./ha) and biomass (kg/ha) estimates are presented in Tables I-11 and I-12 of Appendix I. Comparison of the data from the spring and fall 1980 sampling periods with data from the fall of 1979 (Nehring 1980) indicates both trout density and biomass estimates have been remarkably stable throughout the study period. The stability has been greater in the catch and release area where density and biomass estimates have been the highest. Although not included in this report, spring 1981 population estimates completed in late March--early April 1981 indicate that this stability has been maintained through the winter of 1980-81, despite water flow reductions to 0.2 m^3/sec (7 ft^3/sec) for almost 2 months. Biomass estimates in the catch and release area are still in the 600-800kg/ha (543-712 lb/ac) range.

Length-frequency histograms for spring and fall 1980 rainbow and brown trout populations are presented in Appendix II. The histograms indicate the status quo is still still being maintained, i.e., the catch and release areas still support trout populations comprised predominately of trout in the 30-40 cm (12-16 in.) size range. In contrast, the 8 trout/day bag areas contain trout populations comprised predominately in the 15-25 cm (6-9 in.) size categories. Very few trout over 30 cm (12 in.) occur in the 8 trout/day bag areas.

Length frequency histograms of the trout population versus harvest distribution for both the catch/release and catch/keep areas are found in Figures IV-6 and IV-7 in Appendix IV. These histograms indicate fishing pressure is greatest on those segments of the trout population in excess of 23 cm (9 in.), as was the case on the Fryingpan River.

Life tables (Tables III-8, III-9) for rainbow and brown trout at all sample stations on the South Platte have been constructed from length-frequency and age and growth data and are presented in Appendix III. The data indicate that more rainbow and brown trout in the older age classes are retained in the population in the catch and release areas, a phenomenon already demonstrated on the Fryingpan River. The tendency is most pronounced in the rainbow population data for the 1975, 1976 and 1977 year-classes. Conversely, the younger year-classes (1978 and 1979) predominate in the 8 trout/day bag areas.

Creel census data collected in 1980 indicates fishing pressure and fisherman success (CPMH) was basically unchanged from 1979. However, close scrutiny of the data reveals some interesting points and trends. Total hours, total catch and total CPMH for the South Platte by regulation type over the summer and autumn of 1980 is presented in Table 13 below. For detailed creel census statistics see Tables V-6 and V-7 in Appendix V.

Table 13. South Platte total fishing pressure, total harvest and total success rates for 1980.

Month 1980	8 trout/day area			Catch & release area		
	hours	catch	CPMH	hours	catch	CPMH
May	8,277	4,672	0.564	6,102	3,272	0.536
June	9,575	5,117	0.534	4,072	3,101	0.762
July	8,362	3,095	0.370	4,597	5,612	1.220
August	6,191	3,272	0.529	5,399	5,896	1.090
September	4,189	4,321	1.030	5,576	7,690	1.380
October	2,025	3,663	1.810	7,650	5,804	2.190
Totals	38,619	24,140	0.625	28,396	31,375	1.105

As was the case in 1979, the catch and release section provided consistently better fishing in 1980, despite the fact that the 8 trout/day bag area is stocked at a rate of 2,000 catchable rainbow trout/mile (1,240/km) from April through Labor Day weekend each year. Continuation of the creel census through the month of October 1980 allowed us to evaluate the impact of stocking, if any, on the rainbow harvest and catch rate. The data in Table 14 very clearly demonstrate that without heavy rainbow stocking under an 8 trout/day bag limit, that rainbow trout would not exist in the South Platte River outside the catch and release area. Rainbow, especially hatchery catchables, are rapidly removed from the stream trout population

under even moderate fishing pressure. But at the fishing pressure levels observed on the South Platte (2,000 hrs/ac from May through October) removal of the rainbow trout component of the population is almost instantaneous. A marked rainbow trout plant made as a part of this project in July 1980 indicated 75% of 1,000 marked fish were removed within 5 days after stocking. The rejection rate on rainbow

$$\text{Rejection rate} = \left(\frac{\text{total catch-creel catch}}{\text{total catch}} \times 100\%\right)$$

was only 22.5%; however, without the stocking of 1,240 catchable/km, the rejection rate would be much higher. The brown trout fishery is supported totally by natural reproduction. Rejection rate on the brown trout was 57.9% in 1980 in the 8 trout/day bag area. In 1979, the rejection rate on browns was 53.2%.

Table 14. Rainbow trout harvest and catch rate in the South Platte River 1980.

Month 1980	8 trout/day area			Catch & release area		
	hours	catch	CPMH	hours	catch	CPMH
May	8,277	1,361	0.164	6,102	2,347	0.385
June	9,575	2,820	0.295	4,072	2,722	0.668
July	8,362	1,608	0.192	4,597	3,864	0.841
August	6,191	1,323	0.214	5,399	4,316	0.799
September	4,189	730	0.174	5,576	5,295	0.950
October	2,025	88	0.435	2,650	4,252	1.605
Total	38,619	7,930	0.205	28,396	22,796	0.803

In 1980 an estimated 4,230 trout were caught in the 5 km catch and release section that exceeded 381 mm (15 in.) compared to an estimated catch of 108 trout that size in the 5 km 8 trout/day bag area. The data in Table 15 reveals the stark contrast in the size distribution of the harvest between the two types of regulation areas.

Table 15. South Platte River fisherman creel census evaluation--1980 size of catch composition by percent.

Size range	Catch and release		Standard regulations	
	rainbow	brown	rainbow	brown
< 12 in. (30.5 cm)	26.8	46.8	93.7	92.2
> 12 in. (30.5 cm)	73.2	53.2	6.3	7.8

Nehring (1980) hypothesized that fisherman success (average CPMH) on brown trout was strongly correlated with average winter flows (November through February) which control brown trout spawning and incubation success. Data presented in last year's progress report indicated that at some flow level above 1.42 m^3/sec (50 ft^3/sec) brown CPMH began to level off; however, at flow levels below 1.42 m^3/sec the brown CPMH statistic falls precipitously. The implication was that brown trout age group size was directly tied to spawning and incubation flows. The problem with correlating fisherman success (CPMH) with spawning and incubation flows was that it took 2 years between the time an age group was spawned and when it had reached catchable size and manifested itself in fisherman success. After 2 full years of collecting trout population and age and growth data, we have the data base that is adequate to correlate year-class strength (without the 2-year lag) with mean daily discharge levels during the spawning and incubation period. Figure IV-8 (Appendix IV) indicates that a strong correlation does exist between mean daily discharge during rainbow and brown spawning and incubation period and age-class strength for both species. When year-class strength is plotted against mean daily discharge for both species, it is readily apparent that one line will fit both sets of data points for both species, as shown in Figure IV-9, Appendix IV. An inflection point in the curve occurs at about 2.83 m^3/sec (100 ft^3/sec). Although we do not have cross section and flow data to support this apparent relationship, yet we hypothesize that 2.83 m^3/sec (100 ft^3/sec) is the flow level below which wetted perimeter across critical riffles, spawning and incubation areas begins to decrease rapidly. The collection of cross section and flow data

on the South Platte study area in 1981 will allow us to evaluate this apparent relationship between flow level and year-class strength. If we can substantiate the relationship through computer evaluation of spawning and incubation habitat versus flow with the IFG3 and IFG4 computer models, the importance for application of this relationship to other streams across the state is enormous. We may at last have a real tool for documenting the relationships between trout populations and water flows and truly incorporate this into water development projects.

Middle Fork of the South Platte

Population estimates, density (numbers/ha), and biomass estimates (kg/ha) for the 1980 field season on the Middle Fork of the South Platte River are presented in Table I-13 of Appendix I. Two additional stations were electroshocked in 1980, giving a total of five stations. Comparison of the population estimates (for trout over 12 cm) from the fall of 1980 with those from the fall of 1979 indicates little change in population densities between years. Population densities are very healthy (1,000 brown trout/ha or more) and standing crop estimates are high (100-200 kg/ha).

However, the population size and age structure is heavily skewed toward the smaller fish (<20 cm) and younger age classes. The length-frequency histograms in Appendix II illustrate this point, indicating a severely overexploited population. Creel census information collected by SE Regional biologists in 1980 supports this hypothesis. The brown CPMH was 2.49 for the period June-October 1980. In the 11 km of stream on the Tomahawk Wildlife Area more than 18,000 browns were caught between June and October of 1980, but more than 14,000 were released for a 78% rejection rate. Numerous studies done on various bodies of water in Colorado have shown that trout less than 20 cm are of an unacceptable size to the average fisherman.

Total mortality rates for the 1976, 1977 and 1978 year-classes, with two exceptions, are in the 50-90% range, again supporting the hypothesis that anglers are probably making heavy inroads on the catchable size stocks (trout over 20 cm). Life tables for the Middle Fork of the South Platte are found in Table II-10 of Appendix III.

A catch and release slot limit on all trout between 8 inches and 16 inches has been implemented on the lower half of the Middle Fork of the South Platte on the Tomahawk Wildlife Area for 1981. The catch and release area runs from the bridge just below the U.S.G.S. gaging station downstream to the lower boundary of the Tomahawk Wildlife Area. It is hoped that this regulation will allow catchable size stocks to remain in the population and grow to a larger size. Growth rates on brown trout in this population are fast enough that observable changes may be found by the fall of 1981, and certainly by the fall of 1982.

Taylor River

This project, formerly entitled "Upper Gunnison River Investigations," was discontinued after 1975, and reactivated in 1979 under the same Federal Aid designation F-51-R. The history and description of the project area, methods used and results of the investigation up through 1975 has been published previously (Burkhard 1977).

The objective of the project has been to determine the effects of a changed flow regime on the brown trout population of the Taylor River. Burkhard (1977) felt that if flow manipulation could enhance spawning success, it would probably manifest itself through changes in the population size, age structure, or individual growth rate. Up until 1975, the flow regime during the fall spawning period had been as high as 17 m^3/sec and then dropped down as low as 0.56 m^3/sec during the mid winter incubation period. Commencing in the fall of 1976, agreements were reached with the Bureau of Reclamation, Uncompahgre Valley Water Users Association and the Upper Gunnison Water Conservancy District, to stablize flows in the Taylor River below Taylor Park Reservoir prior to the onset of spawning activity of the Taylor River brown trout population. These stabilized flows were then maintained with little variation throughout the spawning and incubation period (October - April).

After allowing 3 years for stabilization of the trout population under the new flow regime, population estimates were completed in the fall of 1979 and 1980 in the same reaches of the Taylor River that were sampled in 1974 and 1975. While Burkhard (1977) sampled during both the spring and fall of 1974 and 1975, our schedule called for electroshocking in the fall of 1979 and 1980 only. Results of the 1979 and 1980 electroshocking are compared with the results from the fall of 1974 and 1975 in Table 16 below. For detailed information on brown trout numbers, densities and biomass by station, see Table I-14 in Appendix I.

Table 16. Taylor River brown trout population estimations from October 1974, 1975, 1979 and 1980. (Estimates in no./km.)

Sample station	1974	1975	1979	1980
Almont	1,775	1,482	2,975	2,823
Elsinore Cattle Co.	2,156	1,866	2,460	2,531
One-Mile Campground	2,384	1,839	3,641	3,741
Perkin Sams	1,817	1,974	2,825	3,575

A statistical evaluation of all possible pairings of the data is presented in Table 17.

Table 17. Statistical evaluation of brown trout populations in the Taylor River from October 1974, 1975, 1979 and 1980.

Years tested	df	t.95	Calculated t value
1974 vs 1975	3	2.353	1.662 n s d
1974 vs 1979	3	2.353	-4.296 **
1974 vs 1980	3	2.353	-3.886 **
1975 vs 1979	3	2.353	-4.242 II**
1975 vs 1980	3	2.353	-5.224 ***
1979 vs 1980	3	2.353	-0.9897 n s d

n s d = No significant difference
** Level of significance between 0.975 and 0.99
*** Level of significance between 0.99 and 0.995

The increases observed in the Taylor River brown trout population in 1979 and 1980 are quite pronounced. Whether these statistically significant increases are biologically significant and truly the result of the stabilized fall - winter flow regime implemented in 1976 remains to be proven. Most of the increase observed in 1979 and 1980 can be attributed to the 1977 and 1978 year-classes, both benefectors of the stabilized winter flow regime. Conversely, the populations evaluated in 1974 and 1975 were recruits of the 1971, 1972 and 1973 year-classes, which might have been depressed by the erratic discharge patterns during the winter months when those year-classes were incubating in the gravel.

However, the record low and near record low run-off levels in the Gunnison River Basin of 1977 and 1978 may be the primary factor in the large increases in the Taylor River brown trout population observed in 1979 and 1980. Drummond (1966) found a negative correlation between cutthroat trout recruitment and water discharge. Other investigators have also found that a strong relationship exists between water levels and fish reproduction (McKernan et al. 1950, Bulkey and Benson 1962, Brett 1951, Johnson 1956, Vernon 1958, Wickett 1958, Gagmark and Bakkala 1960). We have found a similar correlation between brown trout recruitment and discharge levels in the South Fork of the Rio Grande (see Figs. IV-10 and IV-11 of Appendix IV). Observations concerning lack of rainbow trout recruitment

on the South Platte River below Cheesman Reservoir and high flow releases support the hypothesis that abnormally high spring runoff can have disastrous impacts on the survival and recruitment of young-of-the-year trout. Population evaluations of the Taylor River brown trout should continue through the fall of 1982 in order to more clearly discern the relationship between trout population densities and annual discharge patterns. With 2 dry years (1977 and 1978) followed by 2 wet years (1979 and 1980) by the fall of 1982, it should be possible to clearly demonstrate the impact of the enhanced fall winter flow regime in effect since 1976.

Using population and age/growth data from the 1974-75 and 1979-80 study periods, life tables have been constructed for the Taylor River brown trout population spanning a decade (1969-1979). For details, see Table III-11 in Appendix III. These data indicate that during both sampling periods (1974-75 and 1979-80) there has always been an increase in the numbers of brown trout for a given age-class in the Taylor River between the second and third year of life. These increases have been as low as 25% (possible random sampling variation) but most often ranging between 100% and 500%. We have not observed this phenomenon in sampling other stream brown trout populations in Colorado. This tends to support the probability of high levels of recruitment from the major side tributaries of the Taylor River between Taylor Park Dam and the town of Almont. Four major tributaries (Spring, Beaver, Crystal and Lottis Creeks) empty into the Taylor River, each supporting thriving brown trout populations. The life tables do not demonstrate a large increase in total mortality of brown trout once they reach catchable size, as was demonstrated on the Conejos River. However, the influence of water flows, severe differences in water years, recruitment from the side tributaries, and varying levels of recruitment between years probably all combine to mask the real impact of fishing mortality. Fishing pressure may also be somewhat less on the Taylor River compared to the Conejos River.

Tagging and finclipping studies by Burkhard never indicated even minor movements of adult brown trout from the Taylor River into the side tributaries or vice versa. However, most of the trout Burkhard tagged or finclipped were 200 mm in length or larger. This phenomenon of augmentation of year-classes between the second and third year of life comes from brown trout ranging from 130 mm to 150 mm in length according to our age and growth data which are considerably smaller than the fish tagged and/or finclipped by Burkhard. Thus, augmentation of the Taylor River brown trout population through recruitment from side tributaries is probably quite real and has been going on for many years and should not bias the findings in 1979 and 1980.

We again collected trout at several stations with jaw tags in October 1980 that had been tagged by Burkhard and Sherman in 1974. Those trout were 3, 4 and 5 years old when tagged at that time; thus, these fish are now in the ninth, tenth and eleventh year of life. Klein (1974) documented similar ages and growth rates on tagged trout in the Cache la Poudre River. Those

trout had not reached 30 cm total length at 11 years of age, a condition identical to the brown trout of the Taylor River. Both streams are coldwater streams where ambient water temperatures rarely exceed 10-11 C.

Length-frequency histograms for the brown trout collected at all five stations on the Taylor River are presented in Appendix II. While differences in size distribution between stations are not great; nonetheless, the trout on Perkin Sams property are clearly larger than in the other three study areas farther downstream. This is probably the result of less fishing pressure (closed to the public) and reduced harvest of brown trout.

Colorado River

Objective 5 under Job 3 for Federal Aid Research Project Segment F-51-R-6 states, "Work with regional management personnel to evaluate the need for similar investigations to be incorporated in the study in future years." Electroshocking of the Colorado River has been ongoing since October 1979 under this segment objective. Our findings in the spring and fall of 1980 concerning population estimates, density (no./ha) and biomass (kg/ha) estimates reconfirmed what we observed in the fall of 1979. Population densities are very low, generally in the 100-200 trout/ha range, biomass estimates are moderate (100-120 kg/ha), and the average size of trout is quite large. Population statistics on density and biomass are presented in Table I-15 of Appendix I and length-frequency histograms are found in Appendix II.

The length-frequency histograms for both the spring and fall of 1980 indicate that when harvest is limited as is the case on the Con Ritschards and Thompson Ranches large numbers of trout from 35-50 cm (14-20 in.) can be maintained in the population. However, on public stretches of the Colorado River where there is no limit on harvest except for the standard 8 trout/day bag limit, the length-frequency distribution is skewed towards the smaller size classes indicating fishing pressure and harvest is having a depressing effect on the trout population. This is especially apparent in the length-frequency histogram for the fall of 1980 at the State Ranch, a section of stream owned by the Colorado Division of Wildlife

Eagle River

Work on this river was also accomplished under Job 3 (Objective 5) as previously stated. We electroshocked three stations on the Eagle River in the spring and fall of 1980. Data on population estimates, density (no./ha) and biomass estimates (kg/ha) for this river are presented in Tables I-16 and I-17 of Appendix I. These data indicate the population is quite low and in need of protection. A slot limit, i.e., a catch and release on all trout between 10 and 14 inches (25.4-35.6 cm) was implemented on a 2.4 km section of the Eagle River for the 1981-82 fishing seasons to evaluate the impact of special regulations on this trout population.

Length-frequency histograms for some of the electroshocking stations on the Eagle River from both spring and fall 1980 are presented in Appendix II. These histograms indicate brown trout are between 25 cm and 30 cm long at the end of their third summer of life which is an excellent growth rate. Through the use of special regulations, it should be possible to retain more trout in the 25-35 cm size classes.

Table III-12 of Appendix III contains the life tables for Eagle River brown and rainbow trout.

St. Vrain River

On January 1, 1981, catch and release angling by artificial flies and lures only was put into effect on the St. Vrain River from its confluence with the South St. Vrain at Lyons downstream to U. S. Highway 36 bridge. The catch and release area is (1.3 mi.) in length.

Four electroshocking stations were set up in the fall of 1980. Two control stations were sampled, one upstream (City Park) and one downstream (Martin Marietta) of the catch and release area. The Lyons Gaging Station represented habitat typically found in the catch and release area. The Ideal Concrete Station was sampled because it possessed the best habitat of the area. Population data is presented in Table I-18 in Appendix I.

Brown trout made up from 98.2% to 100% of the trout population of the four stations sampled in 1980. The 14 rainbow trout collected from three stations were probably relics of the summer's stocking program. No rainbows were found at the Martin Marietta Station.

The better quality habitat at the Ideal Concrete Station was reflected in the larger population size/ha (58%) and biomass/ha (71%) as compared to the Lyon Gaging Station. Density and biomass estimates of the Lyons Station (1,139 trout/ha and 85.9 kg/ha) were 18% and 21% higher, respectively, in the fall of 1980 than those reported by Sherwood et al. (1980) from samples made in that area in April 1980.

Length-frequency histograms for brown trout of the St. Vrain are shown in Appendix II. Size structure was very similar between all four stations. Of 1,081 trout collected in the fall of 1980, only three were $\geq$ 31 cm (12 in.) and all were from the Ideal Concrete Station. Length-frequency distributions of brown trout from the St. Vrain in April 1980 (compiled by Sherwood et al. 1980) were very similar to those for the fall collections.

Back-calculated lengths of brown trout at time of annulus formation (Table III-1, Appendix III) indicate a fairly rapid growth rate in the St. Vrain River. However, scale analysis revealed that there were very few age 3+ trout (< 1%) present in the population. It is not known if age 3+ brown trout are normally rare in the St. Vrain or if this is a situation unique to the 1980 population. Possible explanations include recruitment failure in 1977, mortality of older trout due to angling, heavy

fungal infections, or winter kill associated with very low stream flows. If fishing mortality is a major factor, then an improvement in size and age structure of the brown trout population of the St. Vrain can be expected in the catch and release area in the next few years.

Length-weight regressions for brown trout are presented in Table IV-1 of Appendix IV.

Evaluation of Methods

Seven different topics were addressed under this heading during the 1979-80 segment (Nehring 1980). Since most methods remained the same during the 1980-81 segment, there is little reason for a detailed analyses again. Accordingly, only those techniques and methods used for the first time in the 1980-81 segment or expanded upon in the current segment will be discussed.

These techniques or methodologies are as follows:

1. Mobile Electrode Boat Electroshocking
2. Dual Fisherman Attitude Survey
3. Dual Creel Census Methods
4. Differentiation of Wild and Hatchery Catchable Size Rainbow Trout by Scale Growth Patterns

Mobile Electrode Boat Electroshocking

On a work trip to Montana, Barry Nehring observed the boat shocking techniques employed by the Montana Game and Fish Department on large rivers such as the Madison and Yellowstone. The "mobile electrode method" employed by Mr. Richard Vincent on the Madison River (Montana Federal Aid Project F-9-R) seemed to hold the most promise for application on Colorado's larger trout streams. Accordingly, a mobile electrode was constructed in November 1980, tested on the Gunnison River in December 1980 and subsequently, was used on the Arkansas River population estimations in December 1980 and March 1981.

The system, which employs one throwable electrode (carrying positive DC voltage) on a 15 m (50 ft) tether, worked very well on the Arkansas River. We were able to collect up to 700 trout per day in one pass down 4-5 km of the Arkansas River. Two or three marking runs were made followed by a fourth recapture run. Trout were marked with a different mark each day on the caudal fin so each day's marks and recaptures could be recognized. This system allowed us to do at least two different population estimates each day subsequent to the first marking run. We used both the simple Peterson and the Schnabel methods in calculating our population estimates. Two to three marking runs and a final recapture run game 95% confidence intervals of ± 10% to ± 20% of the mean.

Fisherman Attitude Survey

During the 1979-80 segment, a fisherman attitude survey was conducted on the Fryingpan River to determine fisherman acceptance and approval of the catch and release regulation (Nehring 1980). Approval rate for the regulation was over 90% on the entire river, irregardless of the river section fished (catch and release or 8 trout/day bag area) or type of equipment (bait, flies, or lures) in use at the time of contact. However, some question remained concerning the reliability of the information obtained from a personal interview. To evalute this question, we set up a dual attitude survey for the 1980-81 segment.

The dual attitude survey consisted of personal interviews and a postcard questionnaire. In the personal interview, the interviewee was questioned as to whether he was in favor of a catch and release regulation, opposed to it, or held no opinion on the subject for the river in question. The mail-back postcard questionnaire also asked the same question. The dual system was applied on eight different sections of three rivers. These rivers were (1) the Arkansas (two sections), (2) the South Platte (two sections) and (3) the Fryingpan (four sections). A comparison of the results is presented in Table 18 below.

As can be seen from the data, the approval rate was some higher with the personal interview method than it was with the voluntary mail-back postcard method. We suspected that this might be the case. There are several plausible explanations for the difference in response between methods. We know that in the personal interview about 20-25% of the people contacted are not familiar with the concept of catch and release on the stream in question. If the interviewee is unfamiliar with the regulation, he is given a brief explanation of the concept of catch and release and the philosophy behind it. After the explanation he (she) is asked his (her) opinion again. It is reasonable to assume that the responses would be in the same proportion as it is among those respondents who need no explanation. We know from the postcard mail-back survey that the positive response is 75%. Thus, if 75% of the 20-25% of the respondents initially contacted and unaware of the catch and release concept respond positively, that would add an additional 15% to 19% to the positive respondents, thereby boosting the positive response percentage up to 90-95%. This is right in the range observed with the personal interview method.

A second possibility for the higher positive response is that the interviewee feels a conscious or unconscious need or pressure to respond in a positive manner even if he (she) doesn't really feel that way. In contrast, with the postcard questionnaire, there is no personal contact, the respondent's anonymity is preserved, and he would probably feel no inhibition to respond in a negative manner.

Table 18. Summary of Fishermen Attitudes concerning catch and release areas on the Arkansas, Fryingpan and South Platte Rivers.

Stream name	River section	Mailback postcard questionnaire						Personal interview survey					
		approve		oppose		no opinion		approve		oppose		no opinion	
		N	%	N	%	N	%	N	%	N	%	N	%
Arkansas R.[a]	upper	129	74.1	24	13.8	21	12.1	776	91.8	19	2.3	50	5.9
Arkansas R.[b]	lower	212	73.3	45	15.6	32	11.1	1,322	94.1	27	1.9	56	4.0
Arkansas R.	combined	341	73.7	69	14.9	53	11.4	2,098	93.2	46	2.1	106	4.7
Fryingpan R.[b]	1	22	64.7	6	17.6	6	17.7	100	89.3	7	6.2	5	4.5
Fryingpan R.[b]	2	65	69.9	23	24.7	5	5.4	182	91.5	9	4.5	8	4.0
Fryingpan R.[b]	3	59	78.7	10	13.3	6	8.0	170	97.1	4	2.3	1	0.6
Fryingpan R.[a]	4	106	98.1	2	1.9	0	0.0	275	100.0	0	0.0	0	0.0
Fryingpan R.	combined	252	81.3	41	13.2	17	5.5	727	95.5	20	2.6	14	1.9
S. Platte R.[a]	upper	226	88.6	19	7.5	10	3.9	94	98.9	0	0.0	1	1.1
S. Platte R.[b]	lower	80	48.8	54	32.9	30	18.3	107	66.0	26	16.1	29	17.9
S. Platte	combined	306	73.0	73	17.4	40	9.6	201	78.2	26	10.0	20	11.7
Grand Total		899	75.4	183	15.4	110	9.2	3,026	92.6	92	2.8	150	4.6

[a]Present or proposed catch and release area.

[b]Standard regulations 8 trout/day bag area.

Although the postcard questionnaire percentage of positive respondents was 17% lower than the personal interview survey, it is nonetheless remarkable that more than three-fourths of all respondents were in favor of catch and release angling. This would seem to indicate the fishing public is more than willing to accept very restrictive angling regulations to enhance their opportunity to catch larger trout.

Dual Creel Survey Methods

During the 1979 angling season we first used the mail-back postcard questionnaire to gather creel survey information. The data gathered by that method was compared against the count/interview system of Neuhold and Lu (1957). There was no statistical difference in the mean estimates between the two systems (Nehring 1980). The dual creel survey method was expanded to eight sections on three rivers referred to above in the section of the report on the fisherman attitude survey.

The detailed results of the two creel survey methods are compared by section of stream between methods and are presented in Tables V-1 through V-7 in Appendix V. On the two sections of the Arkansas River surveyed, the estimates for five different parameters using the mail-back postcard system were not significantly different for the estimates derived using the count/interview system. On six sections of the South Platte and Fryingpan rivers where both methods were used, 45 comparisons of mean and total statistics were made. In only one instance was the estimate using the postcard method outside the 95% confidence interval calculated using the count/interview system. In many cases, the postcard mean statistics were within the standard errors calculated with the count/interview system. From this evaluation, we believe the mail-back postcard creel survey method to be as reliable as the count/interview system and plan to use the postcard method exclusively on the Fryingpan and South Platte rivers during the 1981-82 segment to gather creel survey information.

Differentiation of Wild and Hatchery Catchable Size Rainbow Trout by Scale Growth Patterns

Nehring (1980) examined the possibility of using scale growth patterns and back-calculated lengths at first annulus formation as a means of differentiating wild stream-reared rainbow stocks from hatchery-reared catchable-size rainbow stocks when they cannot be differentiated by other means. Nehring (ibid.) demonstrated statistically significant differences in back-calculated lengths at first annulus formation from separate stocks of wild rainbow and "suspected" hatchery catchables collected from the same station and stream at the same time. Wild stream-reared rainbows in Colorado rarely exceed 10 cm total length at the time of first annulus formation. In contrast, hatchery-size catchable rainbows at age I are almost always more than 15 cm total length at the time of first annulus formation.

Using the above mentioned facts and criteria as a basis of analysis, a scientific experiment was set up to evaluate the possibility of differentiating wild and catchable-size hatchery rainbows on the basis of scale growth patterns and back-calculated lengths at first annulus formation. Since this experiment required about 60 man-days of scale reading and analysis and the time and manpower was not available within the budgetary restraints of this project, the West Denver Chapter of Trout Unlimited donated $1,000.00 to have the project completed. Mr. Sherman Hebein was retained to carry out the investigation under the supervisision of Barry Nehring.

Approximately 300 scale samples from hatchery catchable-size rainbows and brood fish were collected at four different state fish hatcheries (Durango, Crystal River, Bellvue-Watson and Finger Rock) across Colorado. Also, about 300 scale samples from wild rainbow trout were collected from four trout streams (Colorado, Eagle, Fryingpan and South Platte rivers) across the State. No information appeared on the scale envelope except for a six-digit number code whereby the scale sample source could be traced to a master list once the entire analysis process was completed.

The experiment proceeded through four levels of analysis. These levels in sequential order were as follows:

1. Determination of percent regenerated scales in sample.
2. Evaluation of scale growth patterns (circuli and annuli formation).
3. Back-calculation of length at first annulus.
4. Combination of steps 2 and 3.

We hypothesized that hatchery reared catchable-size rainbows would have more scale regeneration from abrasion than would stream-reared rainbow. However, it was not possible to differentiate wild and hatchery stocks on this basis.

Examination of the scale samples on the basis of circuli growth patterns and definition of annuli was the second level of analysis. Samples with evenly spaced circuli and poor annulus definition (lack of extensive cutting over) were classified as catchable hatchery fish. Scale samples with widely spaced circuli (rapid summer growth) followed by closely packed circuli (winter growth) and good cutting over in the formation of the annuli were considered wild rainbow stocks. At this level of analysis we were successful in correctly identifying 83% of the entire sample.

At the third level of analysis back-calculated lengths at first annulus were determined on each readible scale sample. We used 12.5 cm back-calculated length as a break out point with all fish less than 12.5 cm at age I deemed wild rainbow and all fish over 12.5 cm at age I being classified as hatchery rainbows. At this level, 95% of the wild rainbow were correctly identified but only 56% of the hatchery rainbows had a back-calculated length of more than 12.5 cm. Incorrect annulus identification was a problem for trout from

two of the four rearing units. However, most of the hatchery fish incorrectly identified at the third level of analysis had been properly identified at level two purely on scale growth pattern. Combining the results of level two and level three revealed that more than 92% of the hatchery catchables were properly identified (Hebein 1981, in press). Hebein (ibid.) suggests assembling a reference collection of hatchery scales for use in studies such as this to increase the level of accuracy.

This technique has broad application and could save considerable time and manpower and cost over conventional marking techniques such as finclipping, tagging, fluorescent pigment marking and tetracycleine marking. Mark loss is nil using scale samples and the sample can easily be collected in the field during creel census with no extra equipment other than a scale envelope and pocket knife. The technique can be used to estimate mortality and survival rates on hatchery catchable plants, determine rates of return to the creel on catchable size and fingerling hatchery plants, and estimate total harvest of catchable size plants as compared to wild stocks.

RECOMMENDATIONS AND CONCLUSIONS

Fish Populations

Arkansas River

The habitat of the Arkansas River appears capable of supporting a much larger trout population than found in 1981. It has been demonstrated that in areas of catch and release fishing, rainbow trout are capable of maintaining high density levels. The establishment of a wild rainbow trout population in the Arkansas River would be practical from the standpoint of increasing total trout biomass and fishing opportunity. Such an introduction is ameliorated by the low brown trout population, reduced competition, and by making the plants in the catch and release areas, angling mortality is minimized. Maximum protection of rainbow trout could be provided by placing a minimum size limit of 16 inches or catch and release fishing for all rainbows between Salida and Royal Gorge. Since there are currently no rainbow trout in this portion of the Arkansas River, the success of a rainbow introduction would be easy to evaluate. The trout population of the Arkansas River will continue to be sampled for at least the next 3 years to evaluate the response of the browns in the two catch and release areas.

Cache la Poudre River

Results of the 1980 population estimates indicate that angling mortality may be responsible for the lower trout density in the upper wild trout water than observed in the control areas. If similar population data is found in the 1981 samples, then a creel survey study should be implemented to evaluate fisherman use and harvest in the UWTW and in the control areas. If harvest is greater in the UWTW then a reduction in the bag limit to two or four trout per day would be an effective way to maintain the standing crop throughout the summer and fall fishing season.

The flies and lures only restriction does not appear to exert any visible influence on the trout population of the lower wild trout water. The small mean size (19.4 cm) and the lack of trout over 25 cm in this area is typical of a trout population that is over exploited by angling. The implementation of a 14 inch minimum size limit or catch and release fishing on this area should greatly improve the numbers and mean size of trout.

Archuleta, Cochetopa and Los Pinos Creeks
(Coleman Wildlife Easement Area)

Archuleta Creek and Los Pinos Creek support good populations of brown and brook trout, respectively. Trout density in Cochetopa Creek was very low but is responding to catch and release angling restrictions. Spawning and incubation habitat is poor in all three streams. Adult trout habitat (overhead and instream cover) is quite poor on both Los Pinos and Archuleta Creeks. All three of these streams are quite small and easily accessible, making them prime condidates for overexploitation. In order to maintain a fishable trout population in Cochetopa and Los Pinos Creeks, a catch and release regulation is probably necessary. Archuleta Creek seems to have adequate spawning and nursery area as evidenced by the large numbers of brook and brown young-of-the-year (YOY) and could probably support a substantial harvest without an adverse impact on the population. However, this stream (on the Coleman Wildlife Easement Area) is only about 1 km long and should be left as a catch and release stream to avoid complicating the regulations.

Evaluation of these streams should be terminated after completion of the 1981-82 project segment.

Conejos River

Population densities similar to those observed in 1976, 1978 and 1979 were recorded at all sample stations on the Conejos River in 1980. We recommend this stream be dropped from the project at the completion of the 1980-81 project segment. However, regional management personnel should evaluate the effects of a joint stream improvement project by the Colorado Division of Wildlife and the U. S. Forest Service. Catchable rainbow stocking rates should be lowered or changed to augment harvest rates prior to Labor Day weekend when fishing pressure drops about 95%.

Conejos River - Lake Fork

Successful natural reproduction by transplanted Rio Grande cutthroat trout has been documented at three stations on this river. In order to permit this population to become firmly established, we recommend that catch and release angling with a flies-only terminal tackle restriction remain in effect from the Rock Lake outlet, upstream to the headwaters through 1982. We also recommend that annual evaluations be continued on the Lake Fork of the Conejos to insure that the population is firmly established with several strong age-classes present before a more liberal regulation is enacted. However, we recommend that this function be the responsibility of regional management personnel and that this stream be dropped from the project after completion of the 1981-82 segment.

Fryingpan River

Rainbow trout reproduction seems to be much better in the Seven Castles area of the Fryingpan than anywhere else on the river. Rainbow distribution and population estimates reflect this fact. Rainbow make up a progressively decreasing percentage of the population with distance upstream from the Seven Castles area. The rainbow component of the population seems to have stabilized in the catch and release section of the Fryingpan. However, rainbow stock density outside the catch/release area fell precipitously between 1979 and 1980. Fishing pressure is increasing, rainbow CPMH is decreasing and brown CPMH is increasing. All these statistics reflect excessive fishing pressure on the rainbow component of the population. Rainbow creel catch decreased from 26 to 46% in the three standard regulations sections between 1979 and 1980, again reflecting overharvest of catchable-size rainbow stocks.

Conversely, in the catch and release area, angling pressure increased 33% in 1980 over 1979. Yet rainbow, brown and brook trout catch increased 3, 65 and 94%, respectively. Total CPMH in the catch/release area was 1.13, double the rate in the standard regulations section. In the catch and release section (4 km long) an estimated 1,279 trout were caught that exceeded 381 mm (15 in.) in length, compared to only 392 trout estimated caught in that size category in the 19 km of stream under standard regulations (8 trout/day bag limit).

Life tables for rainbow, brown and brook trout indicate that greater numbers of older age-classes of trout are being retained in the catch-release section of the Fryingpan River.

We recommend that the Fryingpan River be included as a continuing study for this project when a new segment agreement is completed for the 1982-83 season.

North Platte River System (North Park, Colorado)

Effective evaluation of the flies and lures only restriction on the state wildlife areas (state stream leases) of the North Park and the North Platte River was precluded by the low trout population levels of these streams. Trout were so scarce that density estimates could not be calculated in many stations. Also the lack of "control areas" (stream with public access but no tackle restrictions) and creel information hamper any statistical analysis of the special regulations effect on the fishery.

Low trout densities are most likely a result of habitat degradation caused by overgrazing, dewatering and winterkill (1977) and are, therefore, independent of angling mortality.

Since useful information pertinent to the scope of this study is unobtainable at this time, it is recommended that the North Park streams be dropped from the project.

Roaring Fork River

Catch and release angling was instituted on the Roaring Fork River in 1961 and has been in effect in some form since that time. However, the first good evaluation on the catch and release section was not completed until 1969 (Clary 1969) long after any impacts of catch/reselase angling should have been manifested in the population size and age structure. While we are reasonably confident, the catch and release regulation has maintained the high percentage (80%) of rainbows in the population in the catch/release area, we are unable to detect any differences in the impacts of catch/release angling under 12 inches versus catch/release angling over 12 inches.

Nehring (1980) recommended dropping the Roaring Fork River from the project after completion of the 1980-81 segment. That recommendation is reconfirmed here.

South Platte River - Middle Fork
(Tomahawk Wildlife Area)

Length-frequency histograms indicate (as was the case in 1979) that few brown trout in the Middle Fork of the South Platte exceed 20 cm (8 in.) total length. A regional creel census indicated a CPMH of 2.5 brown trout/hour during the summer of 1980 with a 78% rejection rate. Rejection rate can be defined by the equation:

$$\text{Rejection rate} = \left(\frac{\text{total catch} - \text{creel catch}}{\text{total catch}} \times 100\%\right)$$

All of these data indicate severe overexploitation of catchable-size stocks of brown trout. A slot limit (catch and release on all trout between 8 and 16 in.) with an eight fish bag limit has been implemented on the lower half of the Middle Fork of the South Platte on the Tomahawk Wildlife Area for the 1981-82 regulation period. This regulation should result in a larger component of catchable size (20 cm) browns in the larger and older age-classes. This phenomenon may be manifested as early as the fall of 1981 and certainly by 1982.

The evaluation of this study area is recommended for inclusion in the next project segment agreement commencing in May 1982.

South Platte River

Data collected on population estimate, density and biomass on the South Platte study area in the spring and fall of 1980 and spring 1981, reconfirmed trends observed in the population in the fall of 1979 (Nehring 1980). Biomass estimates in the catch and release area remain three to four times as high as in the 8 trout/day bag area (600-800 kg/ha versus 100-280 kg/ha, respectively). The population in the catch and release area is predominantly rainbow with most fish in the 30-40 cm size range. Numerical density is also higher in the catch and release area. In contrast, brown trout are the predominant species in the 8 trout/day bag area with very few fish exceeding 30 cm in total length.

Fishermen success (CPMH) in the catch/release area was 1.10 versus 0.63 in the 8 trout/day bag area. An estimated 4,230 trout over 381 mm (15 in.) were caught in the catch/release area compared to only 108 of that size in the 8 trout/day bag area. In the catch and release area, 73% of the rainbow and 53% of the brown caught exceeded 305 mm (12 in.) compared to only 6 and 8% of the rainbow and brown caught of that size in the 8 trout/day bag area.

We have strong indications that brown and rainbow year-class strength is directly correlated with water flow levels during the spawning and incubation period for both of these species. The indications are that flow levels below 100 cfs are detrimental to rainbow and brown recruitment if the reductions occur during the rainbow and brown spawning and incubation period.

We recommend that the South Platte be included as a study area when this project comes up for project agreement renewal in May 1982.

Taylor River

The high brown trout densities observed in the fall of 1979 were reconfirmed in the fall of 1980. Average population densities in the fall of 1980 were approximately 66% higher than fall estimates made in 1974 and 1975 (Burkhard 1977). A new water flow regime was instituted in 1976 to hopefully augment brown trout spawning and incubation success.

We recommend that the Taylor River study be continued through the fall of 1982 at least to effectively evaluate the impacts of high and low water years on brown trout population levels. Most of the population evaluated in 1979 and 1980 were recruits of the 1977 and 1978 year-classes (low water years). Conversely, the trout population to be evaluated in 1981 and 1982 will be primarily recruits of the 1979 and 1980 year-classes (high water

years). Thus, by continuing the study through 1982, we should be able to evaluate the impact of water year flow regimes on the trout population.

Colorado River

The Colorado River supports a low density predominantly rainbow population with much of the population comprised of trout in the 35-60 cm size range, especially on private sections of stream with low use and harvest. In contrast, the density of trout and size is much less in public stretches of water where fisherman use and harvest levels are much higher.

We recommend the Colorado River be included in the new project agreement up for renewal in May 1982. This river remains in serious danger of encroachment by water diversion and development projects. The trout population and environmental parameters should continue to be monitored as the Windy Gap Dam and Diversion Project enters the construction and operational phases.

Eagle River

Evaluations of the Eagle River trout population were begun during this segment. A catch and release slot limit has been imposed on a 1.5 mile (2.4 km) section on all trout between 10 and 14 inches in size. The trout population density is quite low and susceptible to rapid overexploitation by angling. Since this study area is under a restrictive regulation for the first time in 1981-82, we recommend this study be continued into the next project agreement when it comes up for renewal in May 1982.

St. Vrain River

In 1980, the potential of the St. Vrain to produce large trout appeared to be severely limited by low winter flow and the lack of suitable habitat. However, a guaranteed minimum flow of 12 cfs and the construction of stream improvement structures (by Trout Unlimited) should be highly beneficial to trout production. We recommend that we should continue to monitor the trout population of the St. Vrain River for at least 2 years in order to evaluate the impact of catch and release fishing and the effects of stream improvement structure.

Evaluation of Methods

The mobile electrode boat shocking method worked very well when used for 3 weeks on the Arkansas River between Salida and Parkdale, Colorado. It has broad application potential for effective boat shocking on Colorado's larger trout streams.

The fisherman attitude survey conducted on a total of eight sections of the Arkansas, Fryingpan and South Platte Rivers during 1980 reveals that 75-90% of all trout fishermen (almost 4,500 surveyed) support the concept of catch and release angling to enhance fishing success and increase the numbers of larger trout in the stream.

The dual creel survey (count/interview and mail-back postcard questionnaire) used on the Arkansas, South Platte and Fryingpan Rivers in 1980 revealed that the mail-back postcard questionnaire gave mean estimates for all creel survey parameters well within the 95% confidence intervals for means derived using the count/interview system of Neuhold and Lu (1957). The postcard questionnaire will be the primary method of collecting creel survey information on the South Platte and Fryingpan Rivers during 1981.

We investigated the possibility of using trout scale samples as a means of differentiating wild rainbow trout stocks from hatchery catchable-size rainbow stocks. Using back-calculated lengths at age I (< 12.5 cm for wild rainbow and > 12.5 cm for hatchery catchable size rainbow) and scale growth patterns (circuli spacing, annulus definition and variations in scale circuli growth patterns) we were able to correctly identify more than 90% of all samples, i.e., a wild stream-reared rainbow or a hatchery catchable rainbow. This technique appears to have broad application for determining survival and mortality rates of hatchery catchable stocks, total harvest and return to the creel, without the use of standard marking techniques. The savings in time, equipment and manpower could be considerable.

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APPENDIX I

Trout Population, Density and Biomass Estimated from Study Streams

Table I-1. Arkansas River standing crop and biomass estimates, March 1981.

Study section location	Study section size: length (km)	width (m)	area (ha)	Species	Population estimate: N	95% C.I.	ha/ fish
Tezak[a]	4.34	36.6	15.9	Brown			
				≥15 cm	5,483	±976	345
				≥23 cm	3,889	±719	245
				Snake River	10		
				Rainbow	10		
Loma Linda	4.34	36.6	15.9	Brown			
				≥15 cm	3,976	±736	249
				≥23 cm	2,246	±394	141
				Snake River	19		
				Rainbow	3		
Coaldale	4.18	36.6	15.3	Brown			
				≥15 cm	4,131	±693	270
				≥23 cm	2,687	±470	176
				Snake River	23		
Salida	4.02	36.6	14.7	Brown			
				≥15 cm	5,454	±865	371
				≥23 cm	4,504	±784	306
				Snake River	10		
				Rainbow	10		

[a]December 1980

Table I-2. Cache la Poudre River standing crop and biomass estimates, October 1980.

Study section Location	Study section size length (m)	width (m)	area (ha)	Species	Population estimate $\hat{N}$	95% C.I.	fish/ha	kg/ha
Big Bend	152.4	18.3	0.279	Brown	63.4	± 14.6	227	41.3
Campground				Rainbow	20.3	± 9.2	74	10.2
				Total Trout	83.3	± 14.0	299	51.5
Lower Study	152.4	18.3	0.279	Brown	37.0	± 2.7	133	18.4
5 mi. above				Rainbow	70.6	± 4.8	248	30.4
Rustic				Total Trout	106.1	± 4.9	381	48.8
Lower Control	152.4	18.3	0.279	Brown	61.6	± 9.1	221	35.7
2 mi. above				Rainbow	81.0	± 12.7	288	40.7
Rustic				Total Trout	141.8	± 15.6	508	76.4
Indian Meadow	152.4	18.3	0.279	Brown	44.5	± 6.8	160	23.4
1 mi. below				Rainbow	139.4	± 14.5	482	51.8
Rustic				Total Trout	183.9	± 15.8	641	72.2
Kelly Flat	152.4	18.3	0.279	Brown	81.0	± 12.5	291	31.0
Campground				Rainbow	121.3	± 28.3	435	39.9
				Total Trout	200.6	± 27.8	719	70.9
Lower W.T.	152.4	19.8	0.302	Brown	298.6	± 84.9	989	77.6
control above				Rainbow	16.2	± 9.4	54	4.4
Greely Diversion				Total Trout	307.6	± 79.9	1,019	82.0
Lower W.T. study	152.4	19.8	0.302	Brown	392.3	±114.2	1,299	103.0
below Greely				Rainbow	--	--	--	1.6
Diversion				Total Trout	410.9	±118.2	1,361	105.5

Table I-3. Cochetopa, Archuleta and Los Pinos Creeks population and biomass estimates, August 1980.

Study section Location	Study section area length (m)	width (m)	area (ha)	Species	Population estimate $\hat{N}$	95% C.I.	fish/ha	kg/ha
Archuleta Creek - Coleman Easement, catch & release	305	5.5	0.168	Brook	512	± 7	3,047	123.50
				Brown	44	± 1	262	41.20
				Rainbow	1	--	6	--
				Total Trout	557	± 7	3,315	164.70
Cochetopa Creek - (1 mi. above culvert) Coleman Easement, catch & release	305	6.7	0.204	Brown	120	± 5	588	61.70
				Brook	13	± 6	64	4.30
				Rainbow	34	± 6	167	24.60
				Total Trout	165	± 8	809	90.60
Cochetopa Creek - (at culvert) Coleman Easement, catch & release	152	6.7	0.102	Brown	34	±38	333	59.20
				Brook	33	±63	324	22.10
				Total Trout	66	--	647	81.30
Cochetopa Creek - lower control, open fishing	152	8.8	0.134	Brown	8	±10	60	7.48
				Rainbow	20	±12	149	8.59
				Suckers	6	± 2	45	--
				Total Trout	28	±15	209	16.07
Los Pinos Creek - Coleman Easement, catch & release	305	4.0	0.121	Brown	226	±67	1,868	181.40
				Brown	8	± 6	66	8.70
				White Suckers	26	± 9	215	--
				Total Trout	234	±65	1,934	190.10

Table I-4. Standing crop and biomass estimates from the Conejos River, September 25-26, 1980.

Study section Location	Study section size: length (m)	width (m)	area (ha)	Species	Population estimate: $\hat{N}$	95% C.I.	fish/ha	kg/ha
Broyles Bridge Section - standard regulations, catchables stocked	335	15.0	0.503	Brown	241	± 79	479	72.5
				Rainbow	62	± 64	123	13.4
				Total Trout	297	± 94	590	85.9
Hamilton-T-Bone Section - flies only, no stocking	335	18.9	0.633	Brown	177	± 51	280	46.1
				Rainbow	19	± 16	30	2.1
				Total Trout	196	± 53	310	48.2
Spectacle Lake Section - standard regulations, catchables stocked	305	10.6	0.323	Brown	374	± 96	1,158	53.8
				Brook	19	± 7	59	3.6
				Rainbow	74	± 28	229	12.5
				Total Trout	444	± 87	1,375	69.9
Fisher Gulch - standard regulations	335	9.15	0.307	Brown	563	±265	1,836	43.1
				Brook	3	--	10	1.0
				Rainbow	3	--	10	1.0
				Total Trout	537	±234	1,749	45.1

Table I-5. Lake Fork of the Conejos population estimates, August 1980.

Study section Location	Study section size: length (m)	width (m)	area (ha)	Species	Population estimate: $\hat{N}$	95% C.I.	fish/ha	kg/ha
Lake Fork of the	91.5	2.4	0.022	Cutthroat	282[a]	± 19	12,800	94.70
Conejos at Rock					38[b]	± 5	1,730	51.10
Lake Inlet				Total	320	± 19	14,530	145.80
Lake Fork - Conejos	183.0	2.9	0.053	Rio Grande	192[a]	±118	3,623	21.00
between Big & Rock				Cutthroat	81[b]	± 38	1,528	60.40
lakes				Total	267	±106	5,038	81.40
Lake Fork - Conejos	91.5	1.8	0.016	Gio Grande	9[a]	--	563	4.04
(100 m below				Cutthroat	2[b]	--	125	2.14
Big Lake)				Total	11[c]	--	688	6.18
Lake Fork - Conejos (above Big Lake)				No trout taken or observed.				

[a] 1978 year-class

[b] 1979 year-class

[c] One pass estimate

Table I-6. Fryingpan River population estimate, September 1980.

Study section Location	Study section size: length (m)	width (m)	area (ha)	Species	Population estimate: $\hat{N}$	95% C.I.	fish/ha	kg/ha
Station 1 at Gaging Station, catch & release	152	15.2	0.231	Brown	181	± 82	784	248.3
				Brook	121	± 90	524	67.6
				Rainbow	93	± 80	403	223.0
				Cutthroat	5	± 6	22	4.4
				Total Trout	424	±153	1,835	543.3
Station 2 - below Gaging Station, catch & release	305	15.2	0.464	Brown	200	± 60	431	86.5
				Brook	217	± 86	468	56.4
				Rainbow	112	± 31	241	72.6
				Total Trout	537	±115	1,157	215.5
Station 3 - Old Faithful (lower end) catch & release	320	18.9	0.605	Brown	576	±169	952	130.9
				Brook	168	±134	278	26.3
				Rainbow	208	±128	344	82.5
				Cutthroat	3	--	5	0.6
				Total Trout	952	±240	1,574	240.3
Station 4 - Upper control (Upper Terminus - standard regulations section)	366	18.6	0.681	Brown	265	±123	389	49.0
				Rainbow	33	± 62	48	8.2
				Brook	36	± 64	53	4.5
				Total Trout	388	±149	496	61.7
Station 5 - Taylor Creek, standard regulations	305	15.2	0.464	Brown	234	±102	504	77.6
				Rainbow	130	± 66	280	29.5
				Total Trout	371	±125	800	107.1
Station 6 - Big Pullout, standard regulations	213	15.2	0.324	Brown	45	± 20	139	29.9
				Rainbow	189	±145	593	94.5
				Total Trout	200	± 89	617	124.4

Table I-7. Comparison of Fryingpan population estimates and percent change between fall 1979 and spring 1980.

Study section Description	Specie	Fall 1979 N	Fall 1979 95% C.I.	Spring 80 N	Spring 80 95% C	Percent change 78/89	Fish per hectare fall 79	Fish per hectare spring 80	KGS per hectare fall 79	KGS per hectare spring 80
Station 2 - Dam	BK	264	106	130	27	-50.8	569	281	53	24
Station, catch &	BRN	216	127	117	22	-45.8	466	251	101	66
release	RBW	102	57	138	29	+35.3	220	297	88	116
	N	2	--	--	--	--	4	--	--	--
	Total	587	159	385	45	-34.4	1,265	829	242	206
Station 3 - Old	BK	75	57	38	--	-49.3	124	62	10	3
Faithful - Lower,	BRN	449	85	292	179	-35.0	742	483	104	64
catch & release	RBW	196	33	159	79	-18.9	324	263	104	99
	N	8	--	--	--	--	13	--	--	--
	Total	728	93	489	192	-32.8	1,203	808	218	166
Station 4 -	BK	18	38	13	--	-27.8	36	19	2	0.8
Upper control,	BRN	417	193	154	107	-63.1	612	225	78	28
standard regu-	RBW	237	823	63	81	-73.4	348	92	57	19
lations	Total	665	291	230	140	-65.4	977	336	137	48
Station 5 -	BRN	201	200	195	67	-35.2	724	469	75	67
Taylor Creek,	RBW	264	124	175	84	-33.7	635	422	61	59
standard regu-	Total	564	202	366	103	-35.1	1,356	891	136	126
lations										

Table I-8. North Platte River standing crop estimates, August 1980.

Study section Location	Study section size length (m)	width (m)	area (m)	Species	Population estimate N	95% C.I.	fish/ha
Ginger Quill Ranch	304	22.8	0.693	Brown	82	±46.3	118.3
				Rainbow	41	±30.0	59.2
				Total Trout	123	±75.9	177.5
				Longnose Sucker	145	± 5.0	209.2
				White Sucker	3		18.8
Picnic Station Forest Service	304	22.8	0.693	Brown	41	±36.7	59.2
				Rainbow	14	±12.4	20.2
				Total Trout	55	±48.8	79.4
				Longnose Sucker	88		127.0
				White Sucker	5		18.8
Six-Mile Gap, Wyoming[a]	304	36.5	1.109	Brown	10		26.2
				Rainbow	22		57.6
				Longnose Sucker	226		591.9
				White Sucker	7		18.3

[a]Result of one electrofishing pass.

Table I-9. North Park state fishing leases standing crop estimates, August 1980.

Study section Location	Study section size length (m)	width (m)	area (m)	Species	Population estimate N	fish/ha	kg/ha
Peterson Lease Little Grizzly Creek (Upper)	216	9.0	0.195	Brown	6	31	13.4
				White Sucker	23	118	
				Longnose Sucker	17	87	
Peterson Lease Little Grizzly Creek (Lower)	304	14.6	0.448	Brown	6	13	3.9
				White Sucker	44	98	
				Longnose Sucker	3	7	
Manville Lease[a] North Platte	243	10.7	0.259	Brown	9	35	13.6
				White Sucker	29	112	
				Longnose Sucker	14	54	
Werner Lease North Platte	152	18.3	0.278	Brown	1	4	0.4
				White Sucker	6	22	
				Longnose Sucker	6	22	
Brownlee-2 Lease North Platte	304	21.3	0.649	Brown	10	15	4.2
				White Sucker	11	17	
				Longnose Sucker	6	9	
Wilford Lease North Platte	335	18.9	0.634	Rainbow	1	2	0.2
				White Sucker	6	9	
				Longnose Sucker	3	5	
Wilford Lease Michigan River	213	11.6	0.247	Brown	5	20	4.5
				White Sucker	73	295	
				Longnose Sucker	21	85	
North Park Angus (Trick) Lease, North Platte	213	25.9	0.553	(No large fish captured)			
Murphy Lease Michigan River	213	6.1	0.130	Brown	101	777	106.1
				White Sucker	27	208	
				Longnose Sucker	60	462	
Murphy Lease Owl Creek	183	6.1	0.112	Brown	42	376	63.7
				Rainbow	1	9	
				White Sucker	104	932	
				Longnose Sucker	53	475	

Table I-9. North Park state fishing leases standing crop estimates, August 1980 - continued.

Study section Location	Study section size length (m)	width (m)	area (m)	Species	Population estimate N	fish/ha	kg/ha
Brownlee-1 Lease[a] Michigan River	213	6.1	0.130	Brown	59	453	86.4
				White Sucker	96	738	
				Longnose Sucker	83	638	
Brownlee-1 Lease Owl Creek	198	6.1	0.121	Brown	54	447	58.6
				White Sucker	24	198	
				Longnose Sucker	17	140	
Brownlee-3 Lease Michigan River (Lower)	213	14.0	0.299	Brown	8	27	5.2
				White Sucker	35	117	
				Longnose Sucker	8	27	
Brownlee-3 Lease Michigan River (Upper)	229	11.6	0.265	Brown	7	26	10.1
				White Sucker	26	98	
				Longnose Sucker	4	15	
Irvin Lease[a] Norris Creek (Upper)	304	4.6	0.139	Brown	15	107	7.8
				Longnose Sucker	11	79	
Irvin Lease[a] Norris Creek (Lower)	304	6.1	0.185	Brown	48	259	33.3
				Brook	1	5	
				White Sucker	17	92	
				Longnose Sucker	9	48	
Irvin Lease[a] Roaring Fork Creek	304	5.2	0.157	Brown	53	336	38.0
				Brook	18	114	6.0
Manville Lease Roaring Fork Creek	244	9.1	0.223	Brown	22	99	30.0
				White Sucker	3	13	
				Longnose Sucker	10	49	
Richard's Ranch[a] North Fork of the North Platte	213	9.1	0.195	Brown	8	41	3.2
				Brook	36	184	31.1
				Longnose Sucker	11	56	
Arapahoe National Wildlife Refuge Illinois River	122	6.1	0.074	Brown	11	148	
				White Sucker	73	982	
				Longnose Sucker	33	444	

[a]N represents number of fish captured from two electrofishing passes.

Table I-10. Roaring Fork River standing crop and biomass estimates, September 1980.

Study section Location	Study section size length (m)	width (m)	area (ha)	Species	Population estimate $\hat{N}$	95% C.I.	fish/ha	kg/ha
McFarlane Creek - standard regulations	183	14.6	0.267	Brown	227	±52	850	34.0
				Brook	92	±59	345	13.1
				Rainbow	4	± 5	15	1.5
				Cutthroat	1	--	4	trace
				Total Trout	316	±69	1,184	48.6
Aspen Institute - flies only, over 12 in. catch & release	305	15.2	0.464	Brown	126	±24	272	65.3
				Brook	21	±10	45	5.5
				Rainbow	250	±42	539	81.7
				Total Trout	399	±50	860	152.5

Table I-11. South Platte River standing crop and biomass estimates, October 6-10, 1980.

Study section Location	Study section size length (m)	width (m)	area (ha)	Species	Population estimate $\hat{N}$	95% C.I.	fish/ha	kg/ha
500 ft. below Cheesman Dam - closed to all fishing	183	14.0	0.256	Brown	77	± 5	301	126
				Rainbow	248	± 22	969	574
				Brook	1	--	4	trace
				Longnose Sucker	1	--	4	--
				White Sucker	0	--	--	--
				Total Trout	322	± 20	1,258	700
Upper Canyon - catch & release 1.5 mi. above Wigwam Club	183	14.0	0.256	Brown	258	± 83	1,008	192
				Rainbow	374	± 55	1,461	480
				Longnose Sucker	3	--	12	--
				Total Trout	624	± 88	2,437	672
Lower Canyon - catch & release 0.2 mi. above Wigwam Club	183	17.1	0.313	Brown	333	± 9	1,064	218
				Rainbow	384	± 11	1,227	444
				Longnose Sucker	12	± 11	38	--
				Total Trout	717	± 14	2,291	662
Deckers Bridge - standard regulations, stocked rainbow	183	17.1	0.313	Brown	545	±121	1,741	216
				Rainbow	130	± 84	415	57.9
				White Sucker	2	± --	6	--
				Total Trout	673	±143	2,150	283.9
Upper Swayback - low pressure, low harvest, no stocking	183	17.1	0.313	Brown	170	± 27	543	103
				Rainbow	85	--	272	62.2
				Longnose Sucker	3	--	10	--
				White Sucker	2	--	6	--
				Total Trout	217	± 42	693	165.2
Lower Swayback - low pressure, low harvest, no stocking	183	17.1	0.313	Brown	156	±10	498	88.3
				Rainbow	23	± 7	73	17.7
				Total Trout	179	±12	572	106.0
Scraggy View Picnic Area - standard regulations, rainbows stocked	183	17.1	0.313	Brown	241	±15	770	81.4
				Rainbow	74	± 6	236	25.2
				Longnose Sucker	10	± 1	32	--
				White Sucker	17	± 6	54	--
				Total Trout	313	±16	1,000	106.6

Table I-12. Comparison of South Platte population estimates and percent change between fall 1979 and spring 1980.

Study section Description	Specie	Fall 1979 $\hat{N}$ 95% C.I.	Spring 1980 $\hat{N}$ 95% C	Percent change 79/80	Fish per ha fall 79	Fish per ha fall 80	Kg/hectare fall 79	Kg/hectare fall 80
Upper Canyon	RBW	304 ± 15	355 ± 30	+16.8	1,427	1,667	448	506
Catch & Release	BRN	162 ± 10	148 ± 37	- 8.6	761	696	172	148
Section	Total	466 ± 18	499 ± 43	- 7.1	2,188	2,353	620	654
Lower Canyon	RBW	512 ± 25	514 ± 30	+ 0.4	1,636	1,642	530	558
Catch & Release	BRN	372 ± 12	329 ± 54	+ 0.6	1,045	1,050	254	232
Section	Total	338 ± 26	830 ± 51	- 0.8	2,674	2,654	784	790
Decker Bridge	RBW	140 --	58 ± 7	-58.6	488	201	81	37
Standard	BRN	416 ± 68	409 ± 13	- 1.7	1,449	1,426	186	181
regulations	Total	566 ± 112	467 ± 14	-17.5	1,937	1,627	267	218
Upper Swayback	RBW	72 ± 276	14 ± 4	-80.6	230	46	78	12
Ranch - catch &	BRN	217 ± 43	107 ± 22	-50.7	693	343	166	60
release	Total	256 ± 55	122 ± 22	-52.7	818	387	244	72
Lower Swayback	RBW	-- --	27 ± 46	--	--	86	--	21
Ranch - catch &	BRN	-- --	201 ± 97	--	--	641	--	125
release	Total	-- --	228 ± 106	--	--	727	--	146
Scraggy View	RBW	74 ± 4	36 ± 5	-51.4	285	138	44	22
Standard	BRN	253 ± 19	366 ± 19	+44.7	973	1,407	142	147
regulations	Total	325 ± 5	389 ± 74	+19.7	1,250	1,496	186	169

Table I-13. Middle Fork of the South Platte River standing crop and biomass estimates, September 1980.

Study section Location	Study section size length (m)	width (m)	area (ha)	Species	Population estimate $\hat{N}$	95% C.I.	fish/ha	kg/ha
Highway 9	183	6.10	0.116	Brown				
Bridge				≤ 12 cm	41	± 29	353	4.07
				> 12 cm	206	± 20	1,776	132.60
				Rainbow				
				≤ 12 cm	2	--	17	trace
				> 12 cm	4	0	34	1.34
Gaging Station	183	7.62	0.139	Brown				
Bridge				≤ 12 cm	16	± 14	115	trace
				> 12 cm	138	± 13	993	85.90
				Rainbow				
				≤ 12 cm	0	--	0	--
				> 12 cm	9	--	65	3.24
1 mile below	183	6.40	0.117	Brown				
Gaging Station				≤ 12 cm	40	± 84	342	4.30
Bridge				> 12 cm	206	± 65	1,761	212.20
				Rainbow				
				≤ 12 cm	1	--	9	trace
				> 12 cm	7	0	60	2.85
2 miles below	183	7.20	0.132	Brown				
Gaging Station				≤ 12 cm	84	± 75	636	8.05
Bridge (severe				> 12 cm	167	± 16	1,265	158.10
grazing damage				Rainbow				
bank erosion)				≤ 12 cm	2	--	15	trace
				> 12 cm	1	--	8	0.30
3 miles below	244	7.60	0.185	Brown				
Gaging Station				≤ 12 cm	97	±133	524	trace
Bridge				> 12 cm	246	± 28	1,330	174.30
				Rainbow				
				≤ 12 cm	4	--	22	trace
				> 12 cm	4	0	22	1.83

Table I-14. Taylor River population and biomass estimates, October 20-24, 1980.

Study section Location	Study section size: length (m)	width (m)	area (ha)	Species	Population estimate: $\hat{N}$	95% C.I.	fish/ha	kg/ha
Upper Sams	335	25.9	0.868	Brown	1,063	±163	1,223	220.9
				Rainbow	165	± 42	190	47.6
				SRC[a]	66	± 43	77	29.5
				Total Trout	1,280	±167	1,472	298.0
Lower Sams	183	19.8	0.362	Brown	724	±104	1,998	284.8
				Rainbow	72	± 22	198	47.2
				SRC[a]	33	± 30	91	30.2
				Total Trout	821	±106	2,265	362.2
One Mile Campground	305	20.4	0.622	Brown	1,141	±186	1,833	186.9
				Rainbow	27	± 25	44	6.3
				SRC[a]	5	± 4	7	1.5
				Total Trout	1,161	±183	1,865	194.7
Elsinore Cattle Company	305	21.3	0.650	Brown	736	±169	1,132	145.3
				Rainbow	24	± 41	37	6.9
				SRC[a]	12	± 12	17	1.8
				Total Trout	769	±171	1,183	154.0
Almont	305	26.8	0.817	Brown	854	±120	1,045	125.2
				Rainbow	154	± 47	188	22.6
				SRC[a]	60	± 38	74	5.8
				Total Trout	1,066	±133	1,304	153.6

[a]SRC = Snake River Cutthroat Trout

Table I-15. Colorado River standing crop and biomass estimates, October 13-14, 1980.

Study section Location	Study section size length (m)	width (m)	area (ha)	Species	Population estimates $\hat{N}$	95% C.I.	fish/ha	kg/ha
Con Ritschards Ranch #1[a]	183	30.0	0.549	Brown	3	--	5	1.7
				Rainbow	12	--	22	6.9
				Total Trout	15	--	27	8.6
Con Ritschards Ranch #2	183	26.0	0.476	Brown	15	±4	32	8.9
				Rainbow	99	±2	208	118.3
				Total Trout	113	±3	237	127.2
Thompson Ranch	183	19.5	0.357	Brown	21	±2	59	27.6
				Rainbow	51	±3	143	101.3
				Total Trout	72	±4	202	128.9
State Ranch	183	28.0	0.512	Brown	3	0	6	6.0
				Rainbow	46	±1	90	36.4
				Total Trout	49	±1	96	42.4
Windy Gap Ranch[a]	183	19.5	0.357	Brown	1	--	3	trace
				Rainbow	1	--	3	trace
				Longnose Sucker	403	--	1,126	--
				Bluehead Sucker	20	--	56	--
				White Sucker	13	--	36	--
				Total Trout	2	--	6	trace

[a]One electroshocking pass - population estimate calculated using a 90% efficiency estimate (actual efficiency on Con Ritschard's Ranch).

Table I-16. Eagle River standing crop and biomass estimates, March 26, 1980.

Study section	Study section size			Species	Population estimates			
	length (m)	width (m)	area (ha)		$\hat{N}$	C.I.	fish/ha	kg/ha
At Wolcott,	213	31.4	0.669	Brown	186	±71	278	62.9
Higway 6				Rainbow	36	±54	54	23.1
Maintenance Station				Total Trout	221	±67	330	86.0
Koprinikar	183	31.4	0.575	Rainbw	5	--	9	3.1
Property above				Brown	98	± 6	170	36.7
Wolcott				Total Trout	103	± 7	179	39.8
At I-70[a]	168	21.3	0.358	Rainbow	2	--	6	1.1
Overpass above				Brown	29	--	81	11.6
Wolcott				Total Trout	31	--	87	12.7

[a]Estimates based on a comparison with shocking efficiency at other stations where a complete population estimation was carried out.

Table I-17. Eagle River standing crop and biomass estimates, November 1980.

Study section Location	Study section size length (m)	width (m)	area (ha)	Species	Population estimates $\hat{N}$	95% C.I.	fish/ha	kg/ha
At Wolcott - Highway 6 Maintenance Station (above Milk Creek)	213	31.4	0.669	Brown	170	±34	254	64.1
				Rainbow	66	±65	99	25.6
				Total Trout	228	±34	341	89.7
At Dumpsite, 4 km (2.4 mi.) Eagle, Colo. (below Milk Creek)	183	19.8	0.362	Brown	27	±34	75	24.2
				Rainbow	24	±19	66	42.2
				Total Trout	55	±43	152	66.7
BLM Land[a] - special regulations section between Eagle & Wolcott	213	19.8	0.422	Brown	100	--	237	24.3
				Rainbow	100	--	237	36.1
				Total Trout	200	--	474	60.4
BLM Campground below Gypsum, Colorado	213	6.1	0.130	Brown	17	--	131	41.6
				Rainbow	2	--	15	2.5
				Total Trout	9	--	146	44.1

[a]Rough estimates based on comparison with stocking efficiency at dumpsite station.

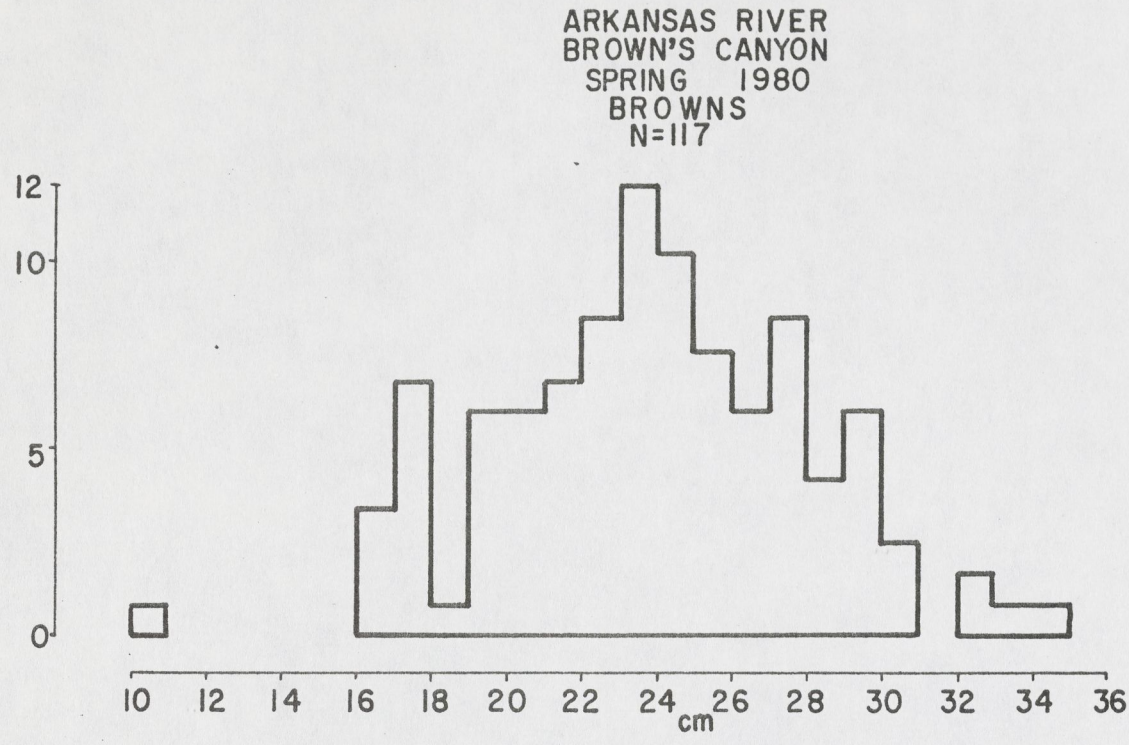
Table I-18. St. Vrain standing crop and biomass estimates, November 1980.

Study section Location	Study section size length (m)	width (m)	area (ha)	Species	Population estimate $\hat{N}$	95% C.I.	fish/ha	kg/ha
City Park, Lyons	152.4	7.6	0.116	Brown	282.5	±19.9	2,433	172.6
Lyons' Gaging Station	167.6	12.2	0.204	Brown	232.9	±12.4	1,139	85.9
Ideal Concrete, Lyons	137.2	13.7	0.188	Brown	340.5	±16.3	1,809	146.9
Martin Marrita, Lyons	157.4	7.7	0.116	Brown	69.7	± 5.2	602	51.0

APPENDIX II

Length-Frequency Histograms of Trout Populations from Study Streams[a]

[a]Histograms for study streams are presented in the order of presentation in the Results and Discussion section of the report.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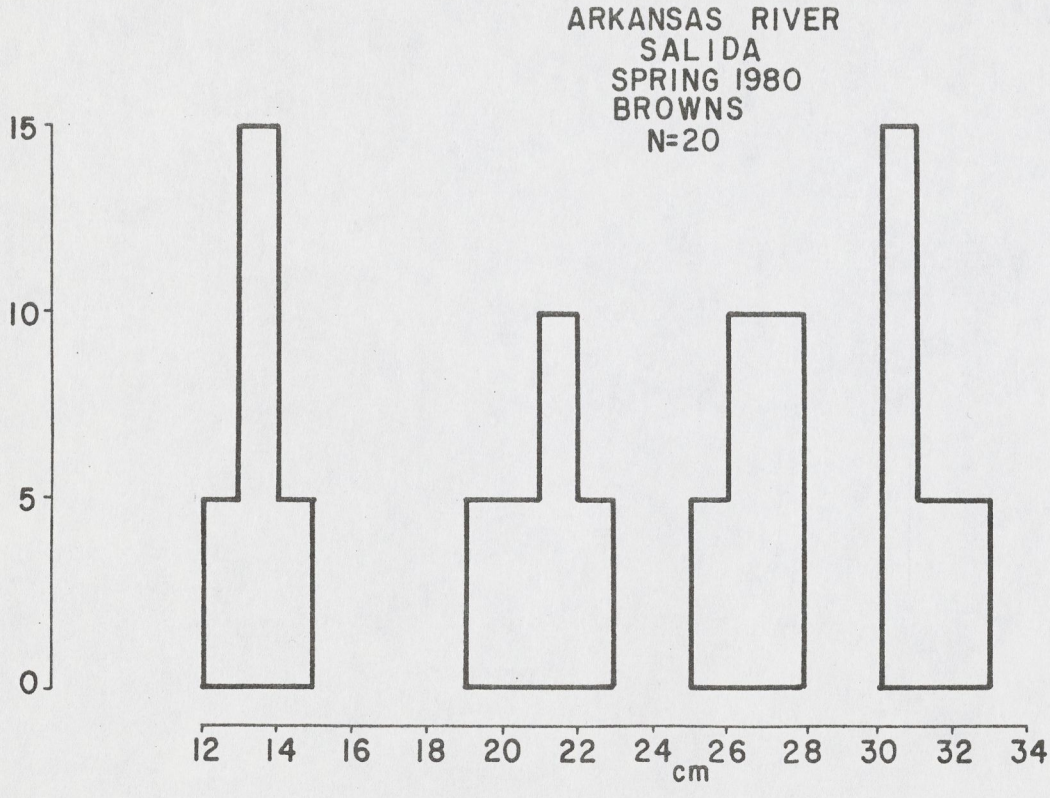
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SPRING 1980
BROWNS
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10
5
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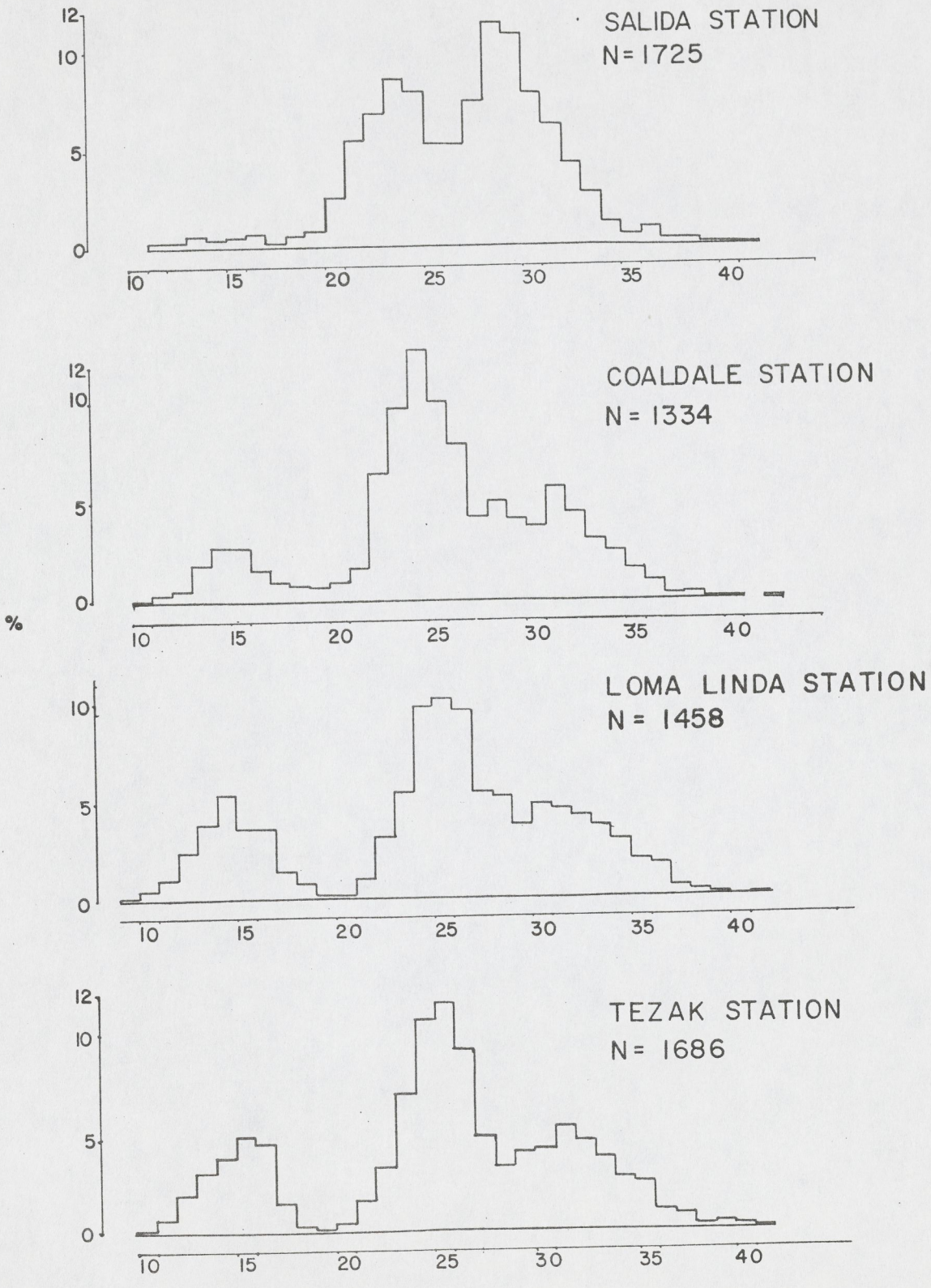
cm

ARKANSAS RIVER
WINTER 1980-1981
BROWN TROUT



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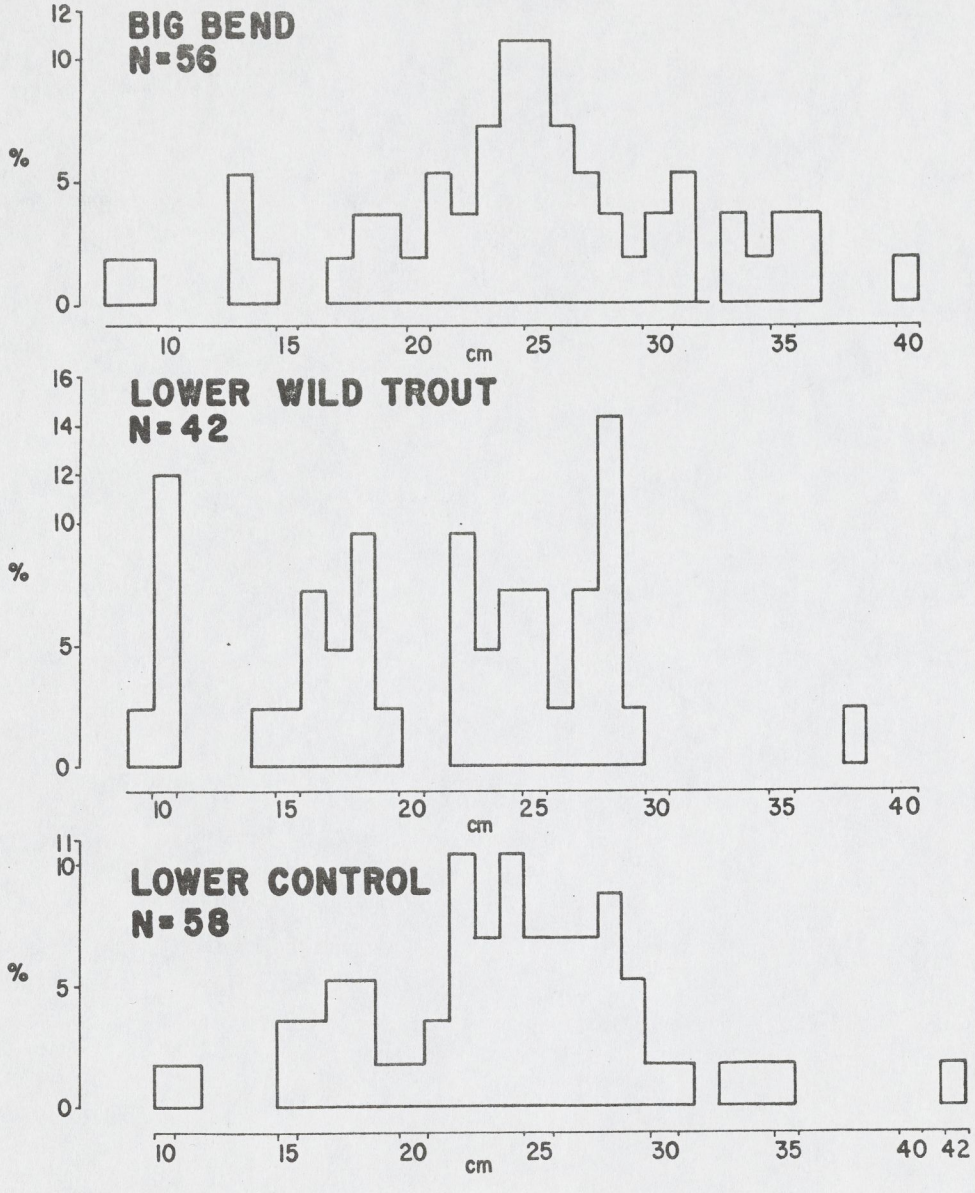
BROWNS



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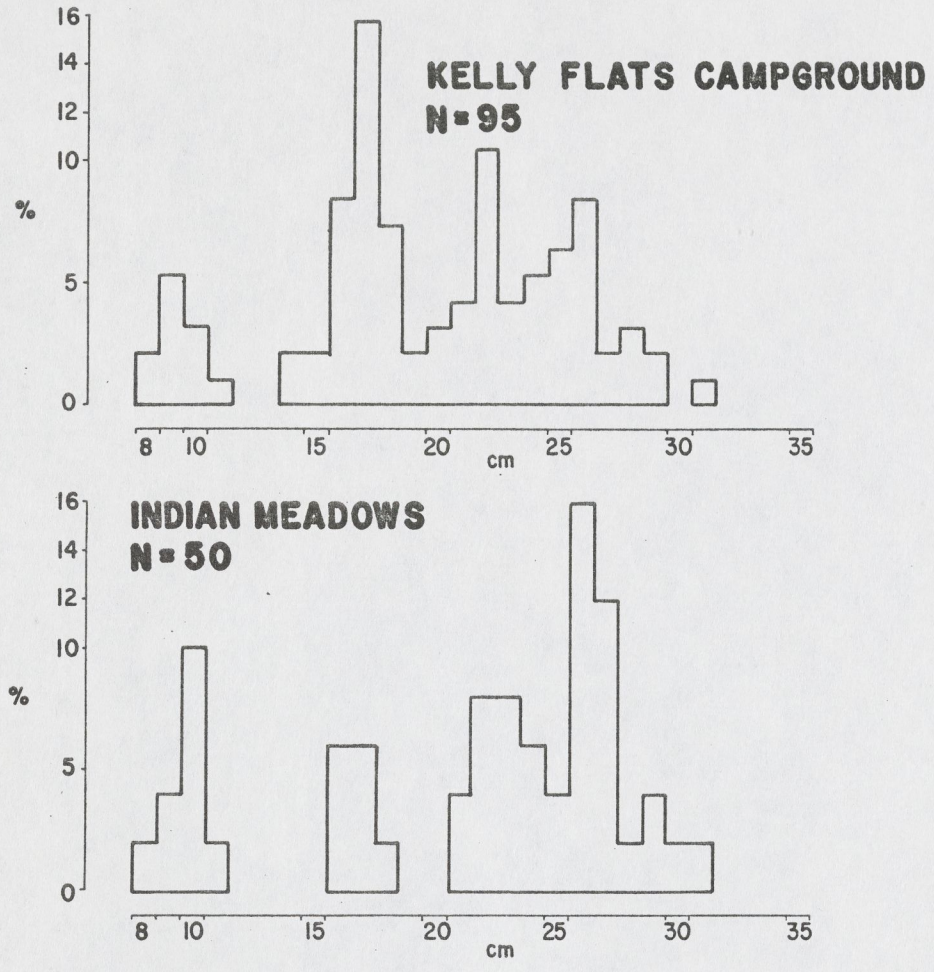

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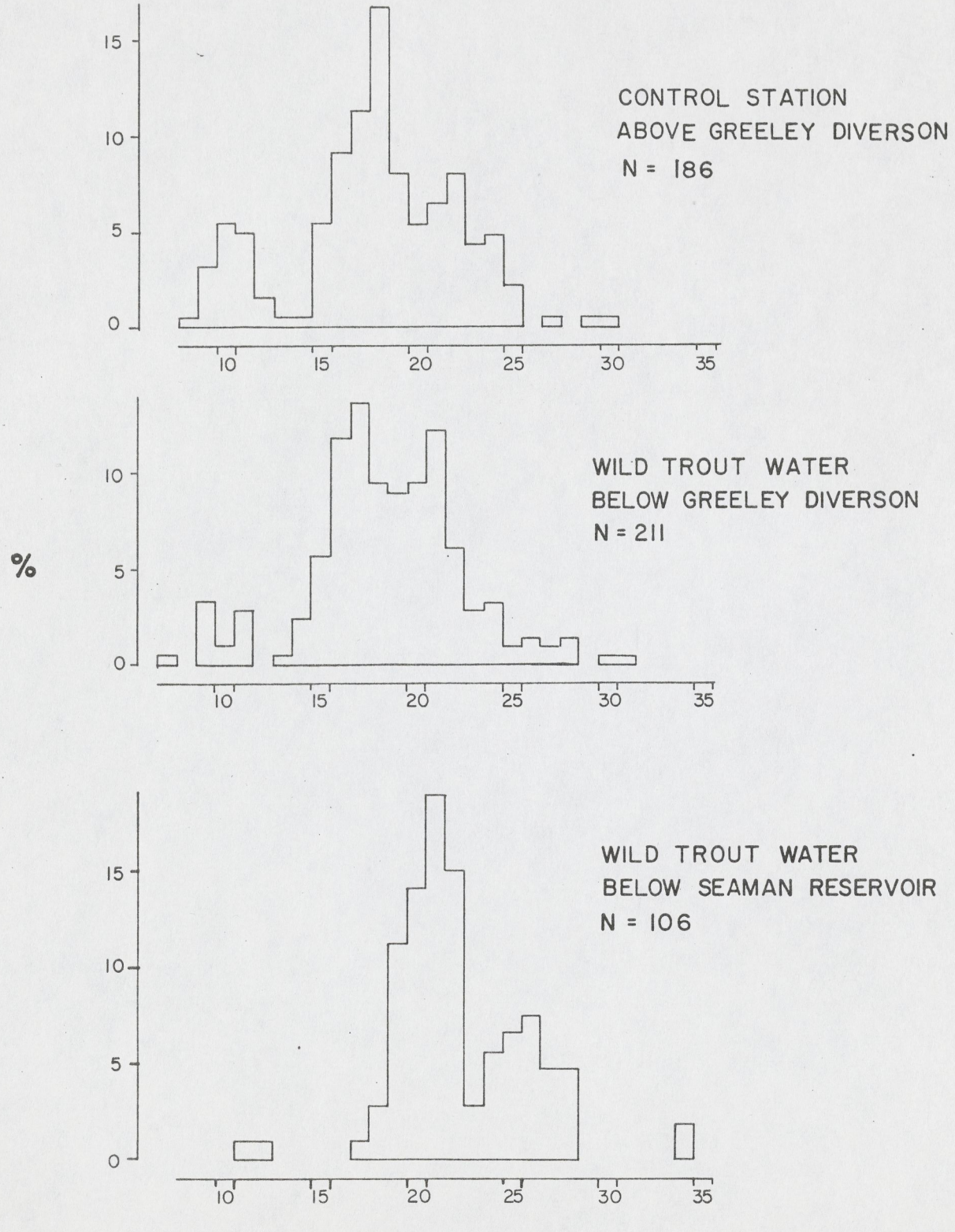
BROWN TROUT POPULATIONS



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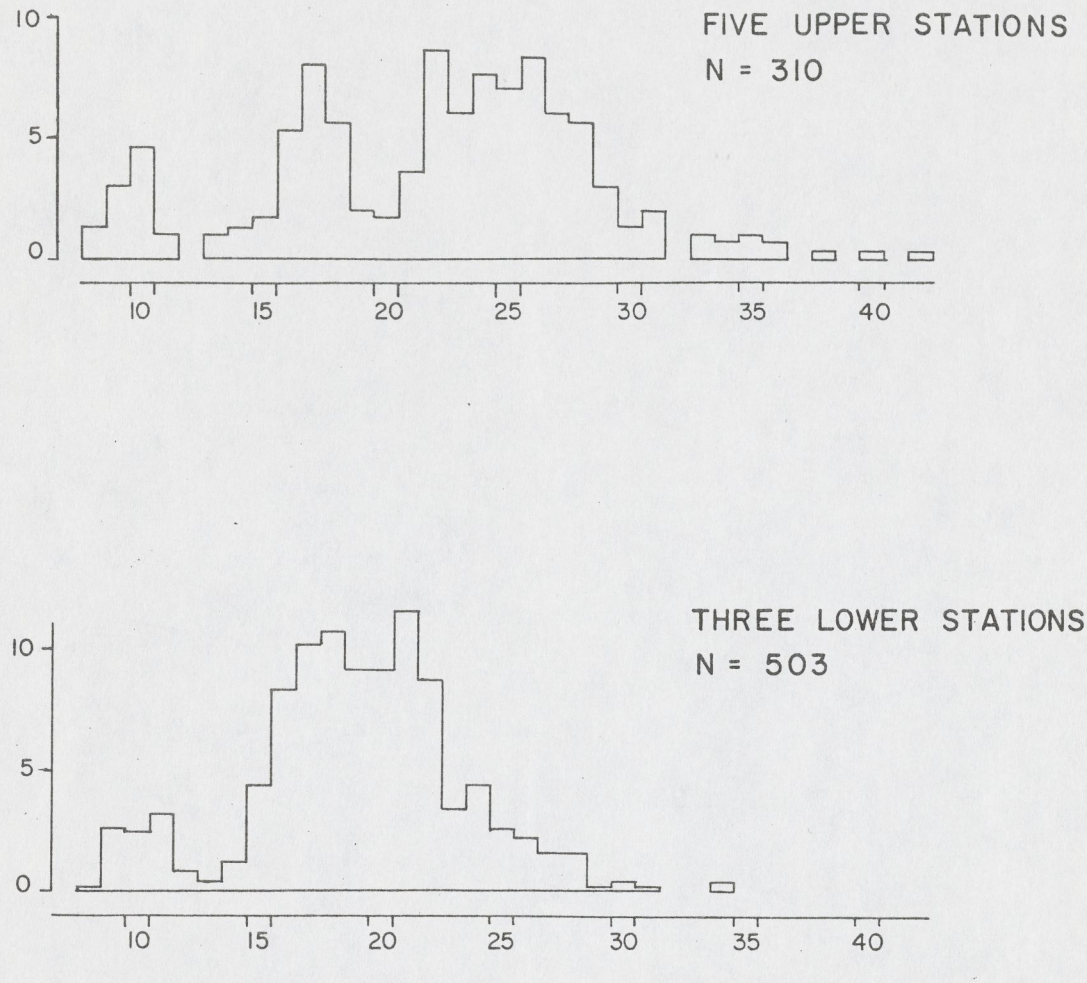

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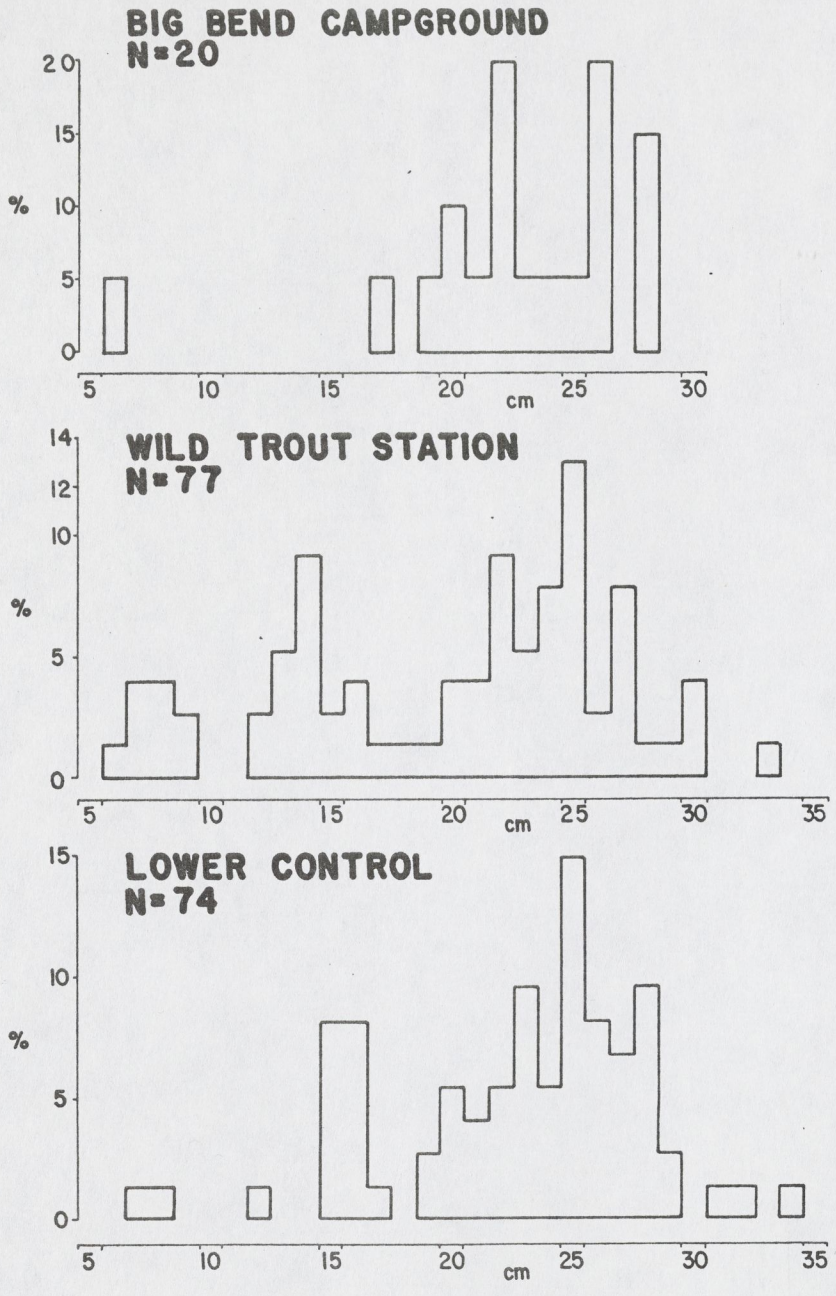
RAINBOWS



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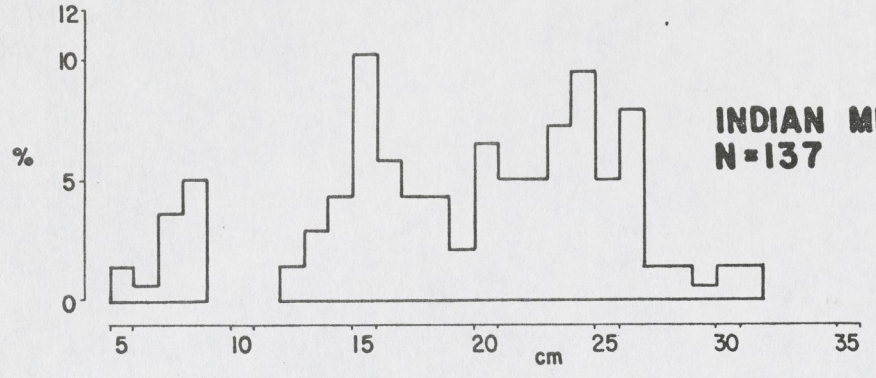
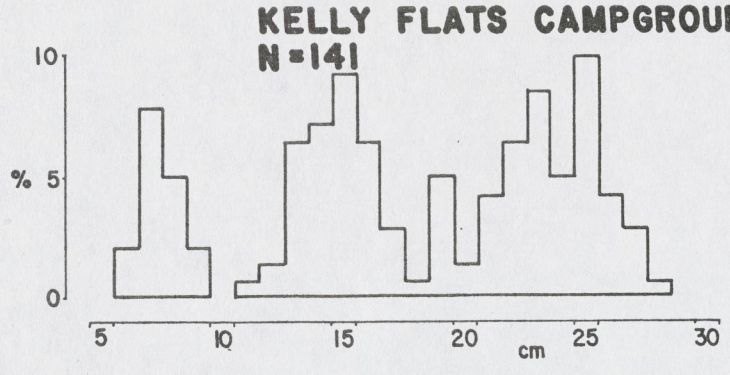
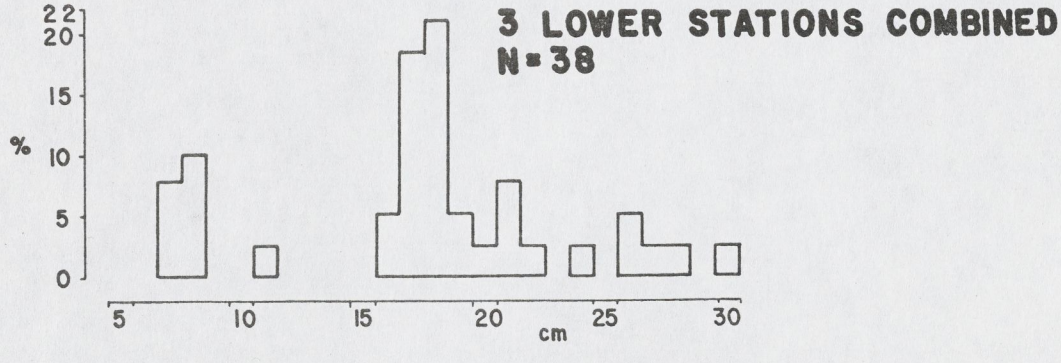
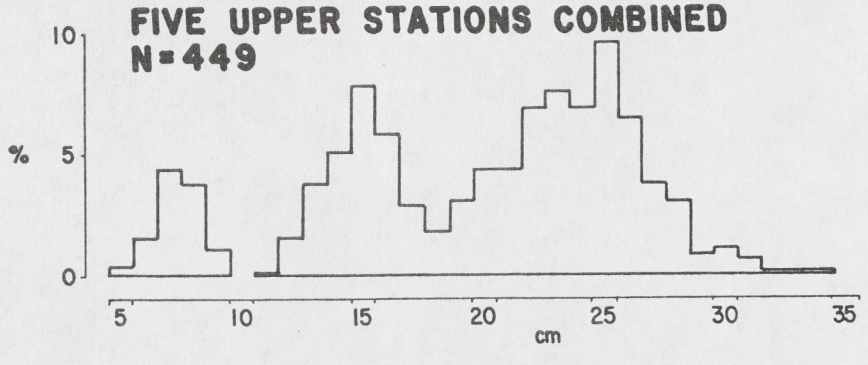
OCTOBER 1980
RAINBOW

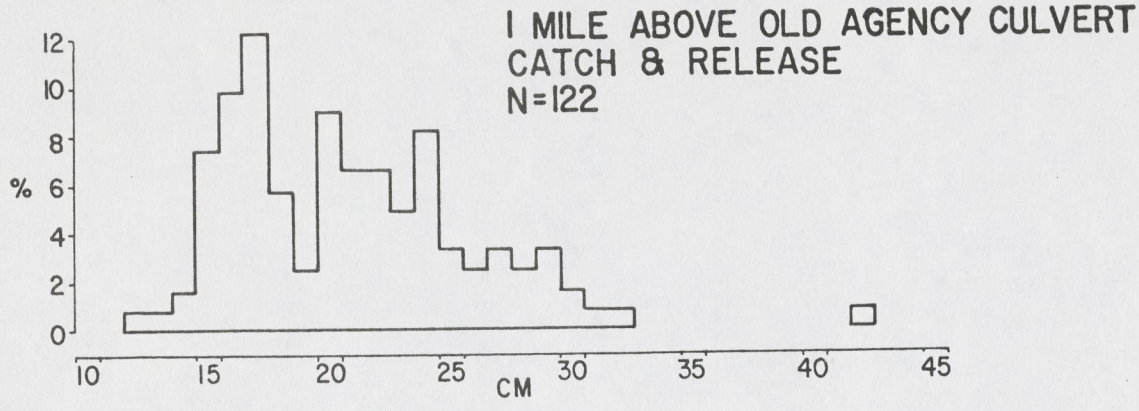


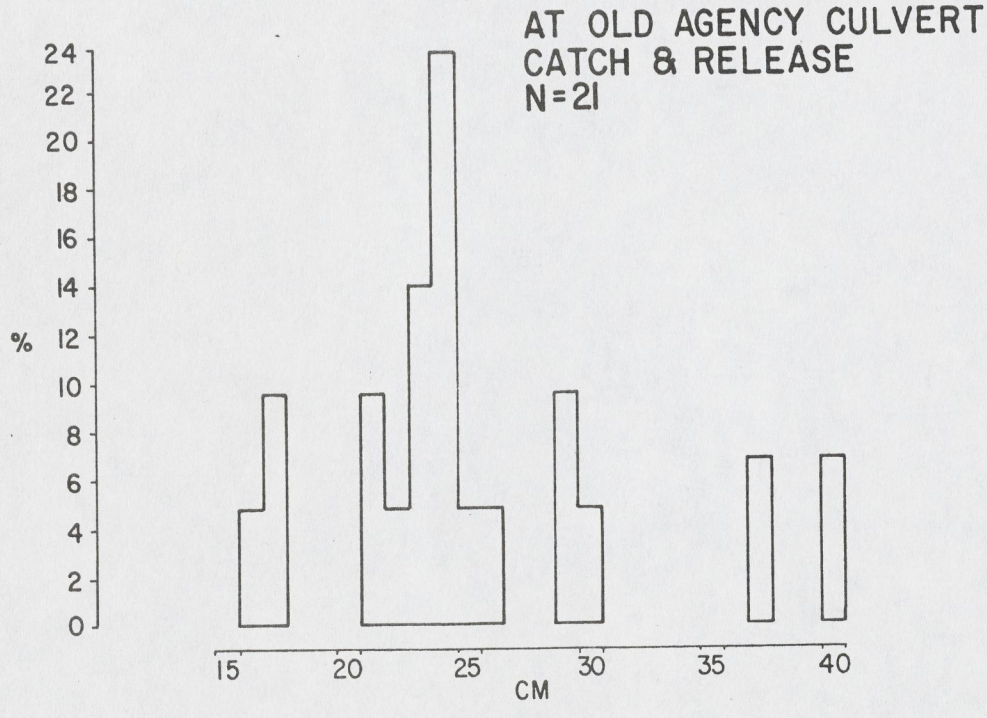






COCHETOPA CREEK
AUGUST 1980
BROWNS





BROOK TROUT
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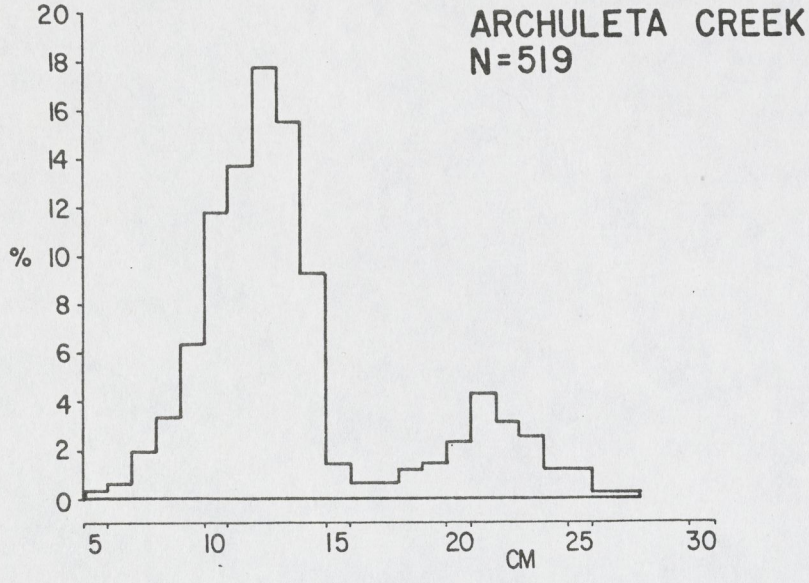
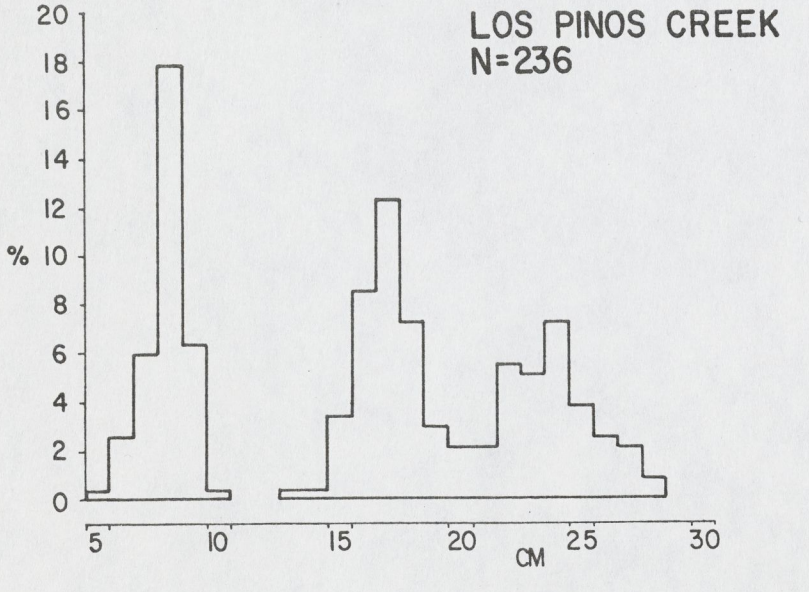
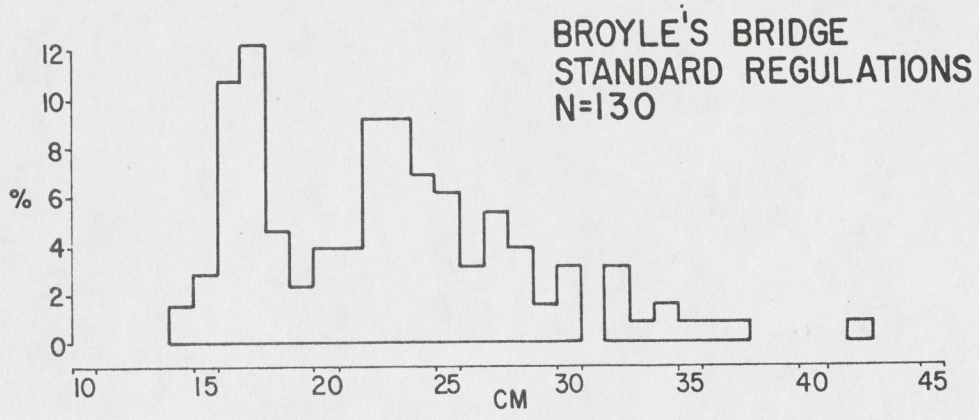
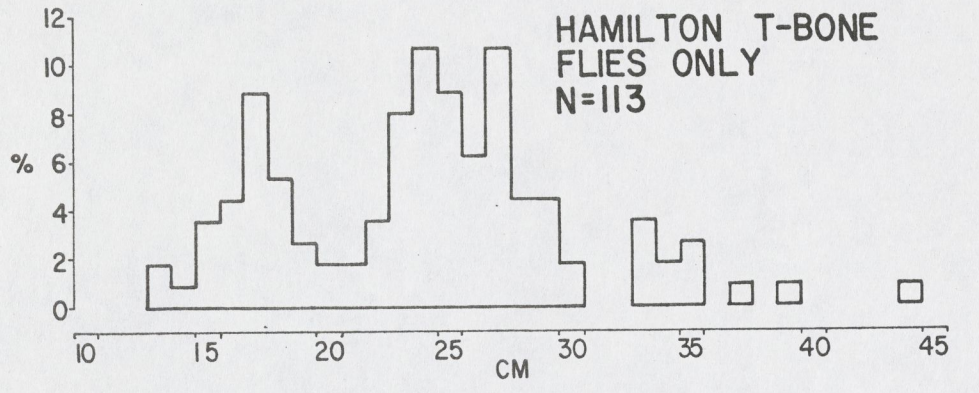
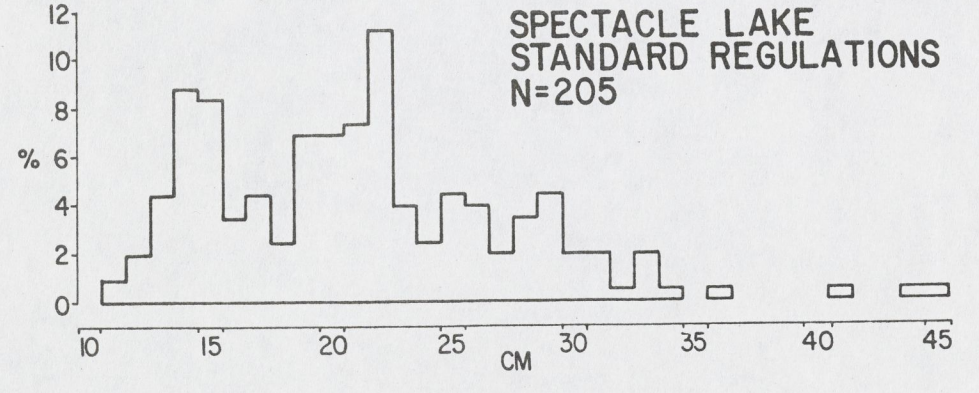


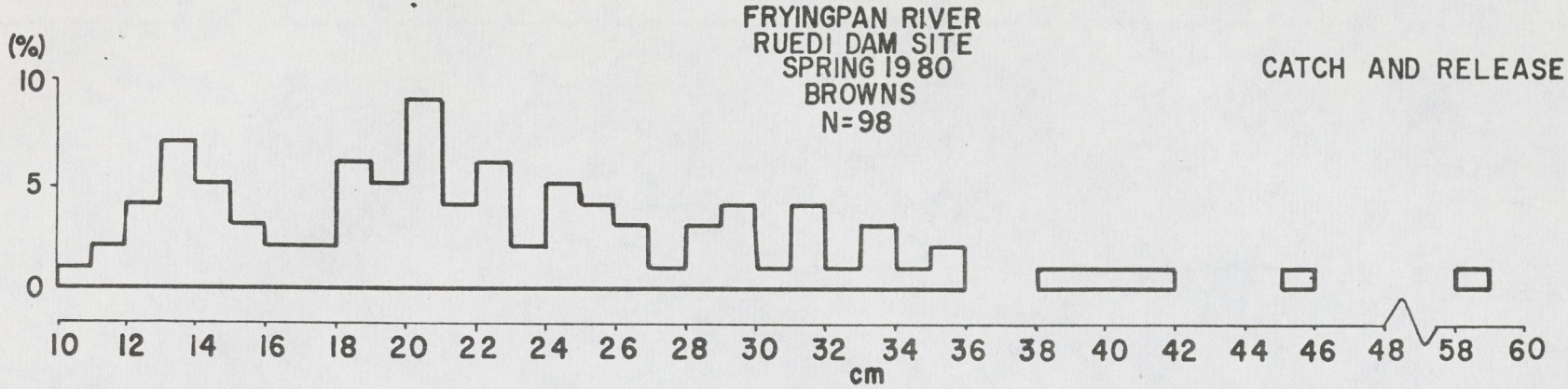


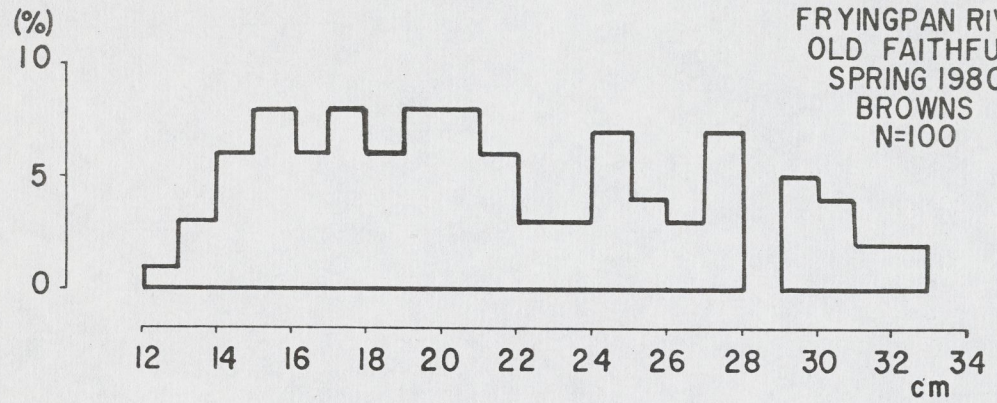
CONEJOS RIVER
SEPTEMBER 1980
BROWNS

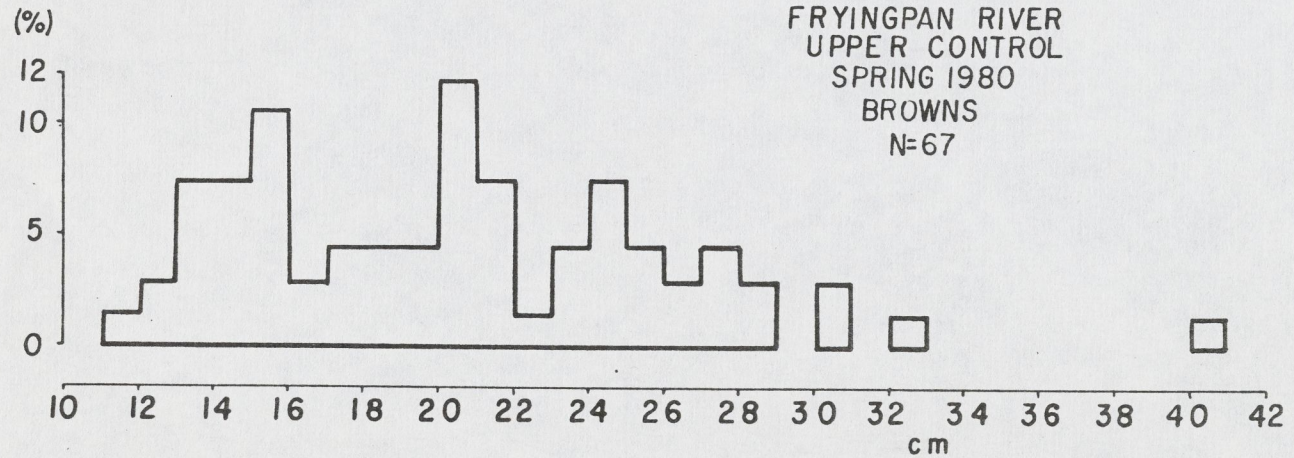


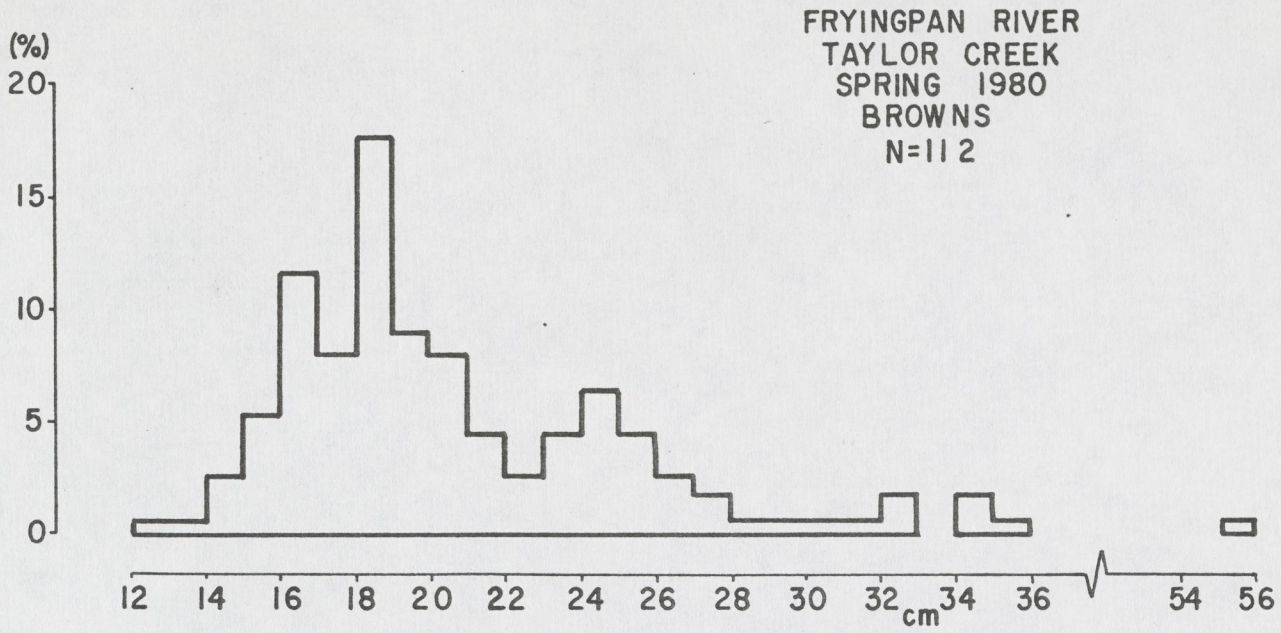


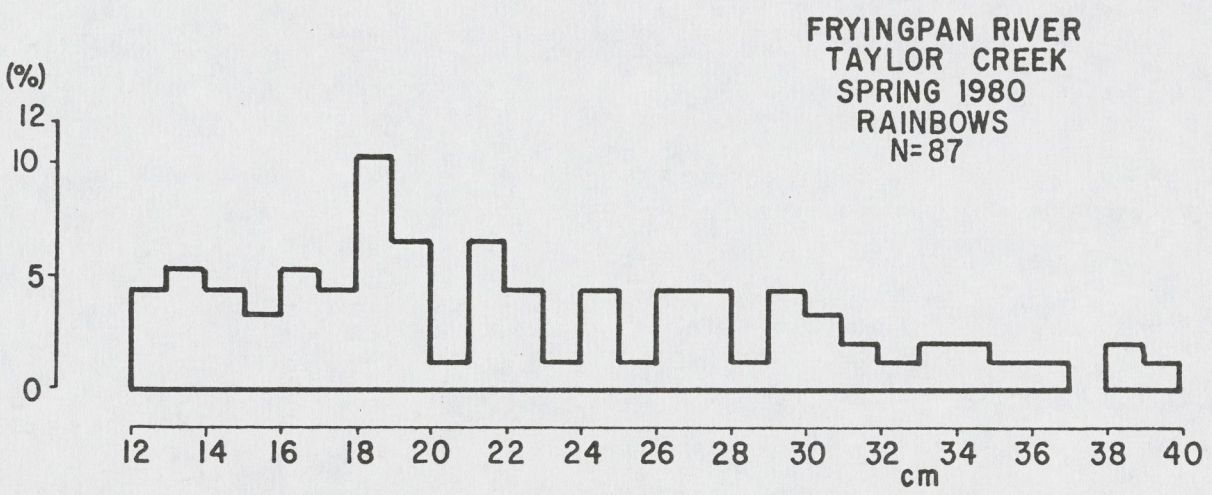


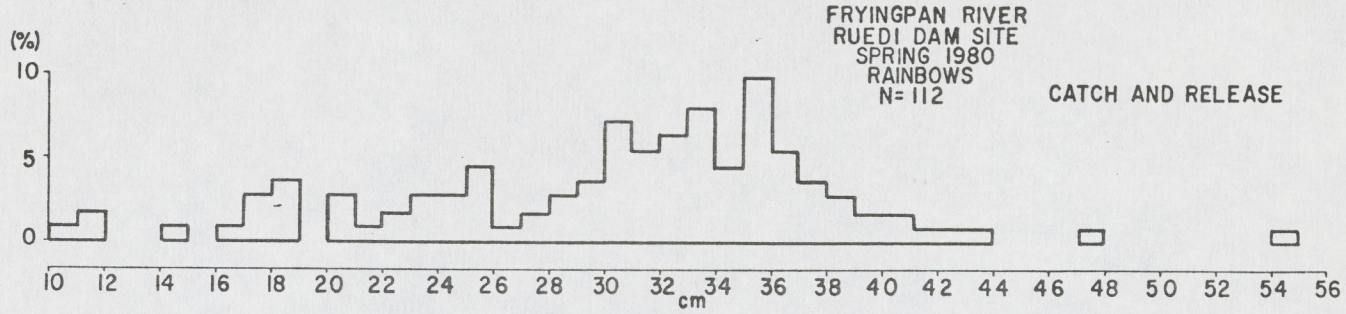

FRYINGPAN RIVER
RUEDI DAM SITE
SPRING 1980
BROWNS
N=98
CATCH AND RELEASE
(%)
10
5
0
10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 58 60
cm

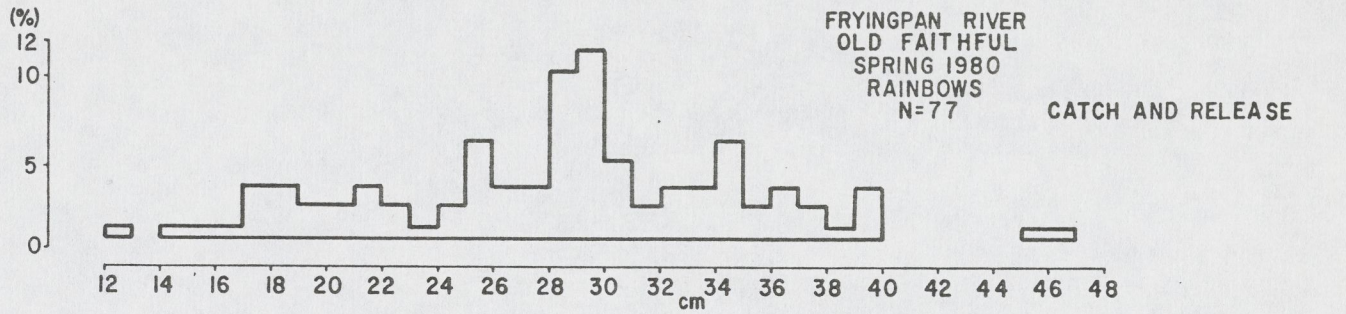

FRYINGPAN RIVER
OLD FAITHFUL
SPRING 1980
BROWNS
N=100
CATCH AND RELEASE
(%)
10
5
0
12 14 16 18 20 22 24 26 28 30 32 34
cm

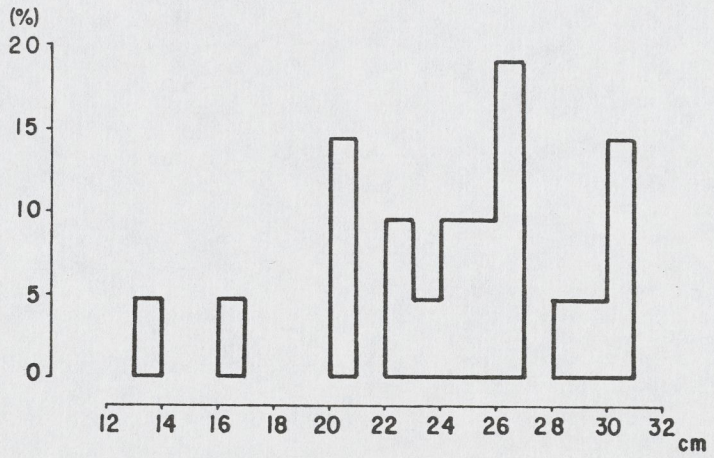

FRYINGPAN RIVER
UPPER CONTROL
SPRING 1980
BROWNS
N=67
CATCH AND KEEP
(%)
12
10
5
0
10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42
cm


FRYINGPAN RIVER
TAYLOR CREEK
SPRING 1980
BROWNS
N=112
(%)
20
15
10
5
0
12 14 16 18 20 22 24 26 28 30 32 34 36 54 56
cm

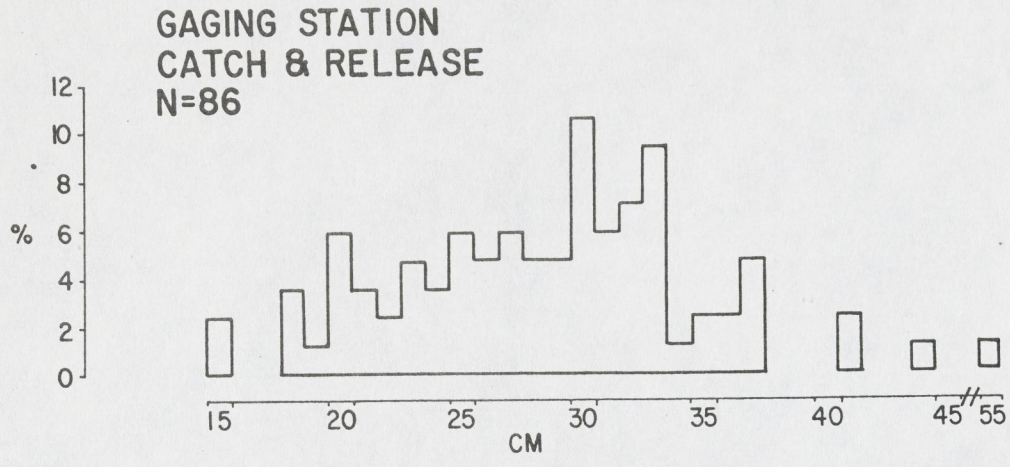

FRYINGPAN RIVER
TAYLOR CREEK
SPRING 1980
RAINBOWS
N=87
(%)
12
10
5
0
12 14 16 18 20 22 24 26 28 30 32 34 36 38 40
cm

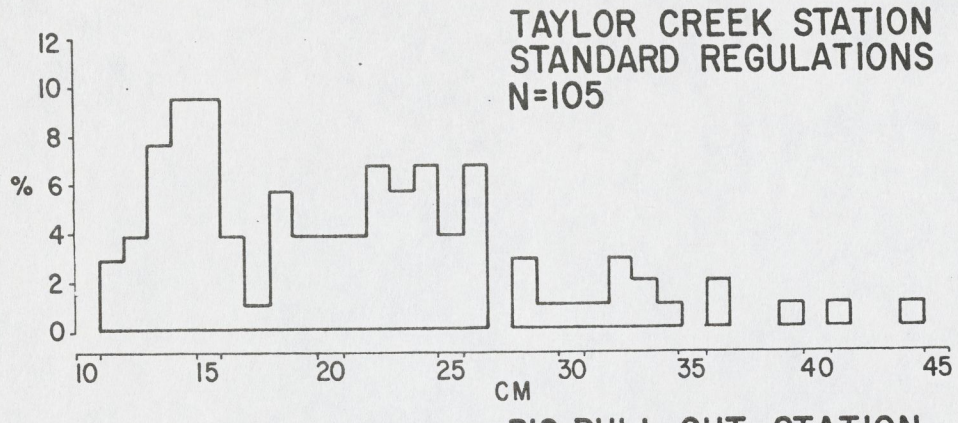

FRYINGPAN RIVER
RUEDI DAM SITE
SPRING 1980
RAINBOWS
N= 112
CATCH AND RELEASE
(%)
10
5
0
10 12 14 16 18 20 22 24 26 28 30 32 cm 34 36 38 40 42 44 46 48 50 52 54 56

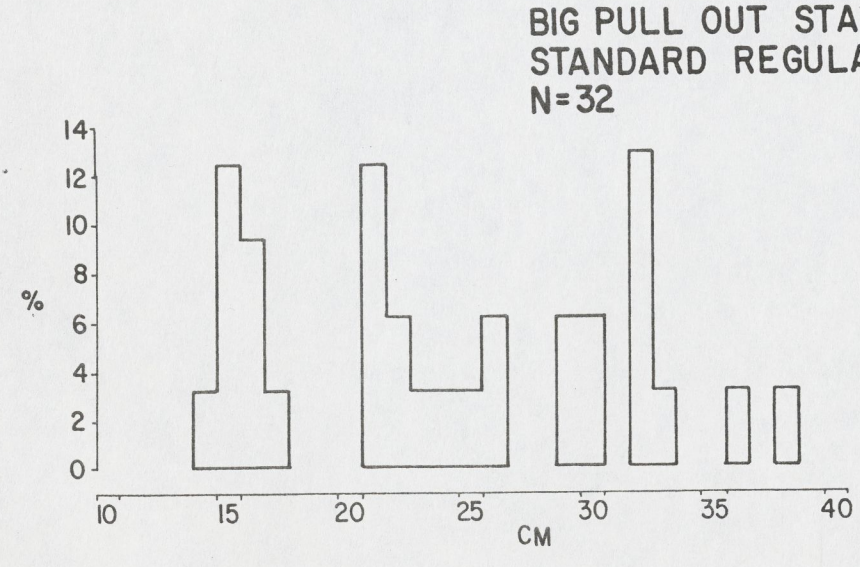

FRYINGPAN RIVER
OLD FAITHFUL
SPRING 1980
RAINBOWS
N=77
CATCH AND RELEASE
(%)
12
10
5
0
12 14 16 18 20 22 24 26 28 30 32 cm 34 36 38 40 42 44 46 48


FRYINGPAN RIVER
UPPER CONTROL
SPRING 1980
RAINBOWS
N=21
CATCH AND KEEP
(%)
20
15
10
5
0
12 14 16 18 20 22 24 26 28 30 32 cm

FRYINGPAN RIVER
SEPTEMBER 1980
BROWNS

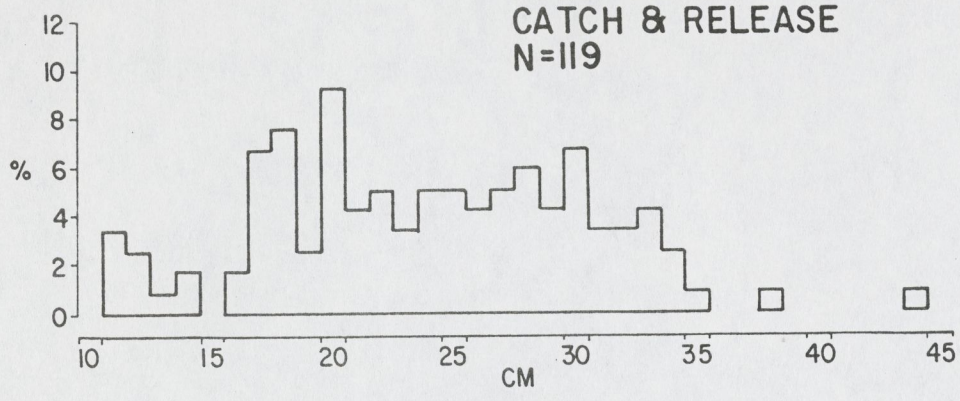




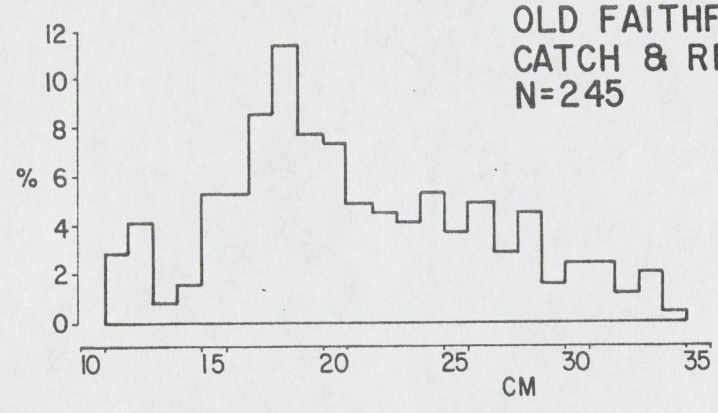


FRYINGPAN RIVER
SEPTEMBER 1980
BROWNS

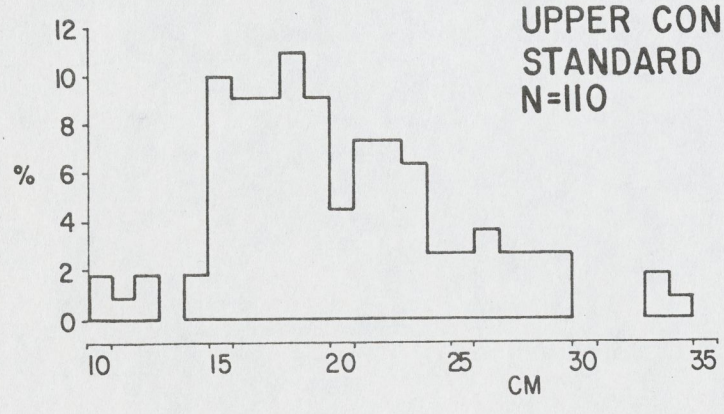
RUEDI DAMSITE STATION
CATCH & RELEASE
N=119



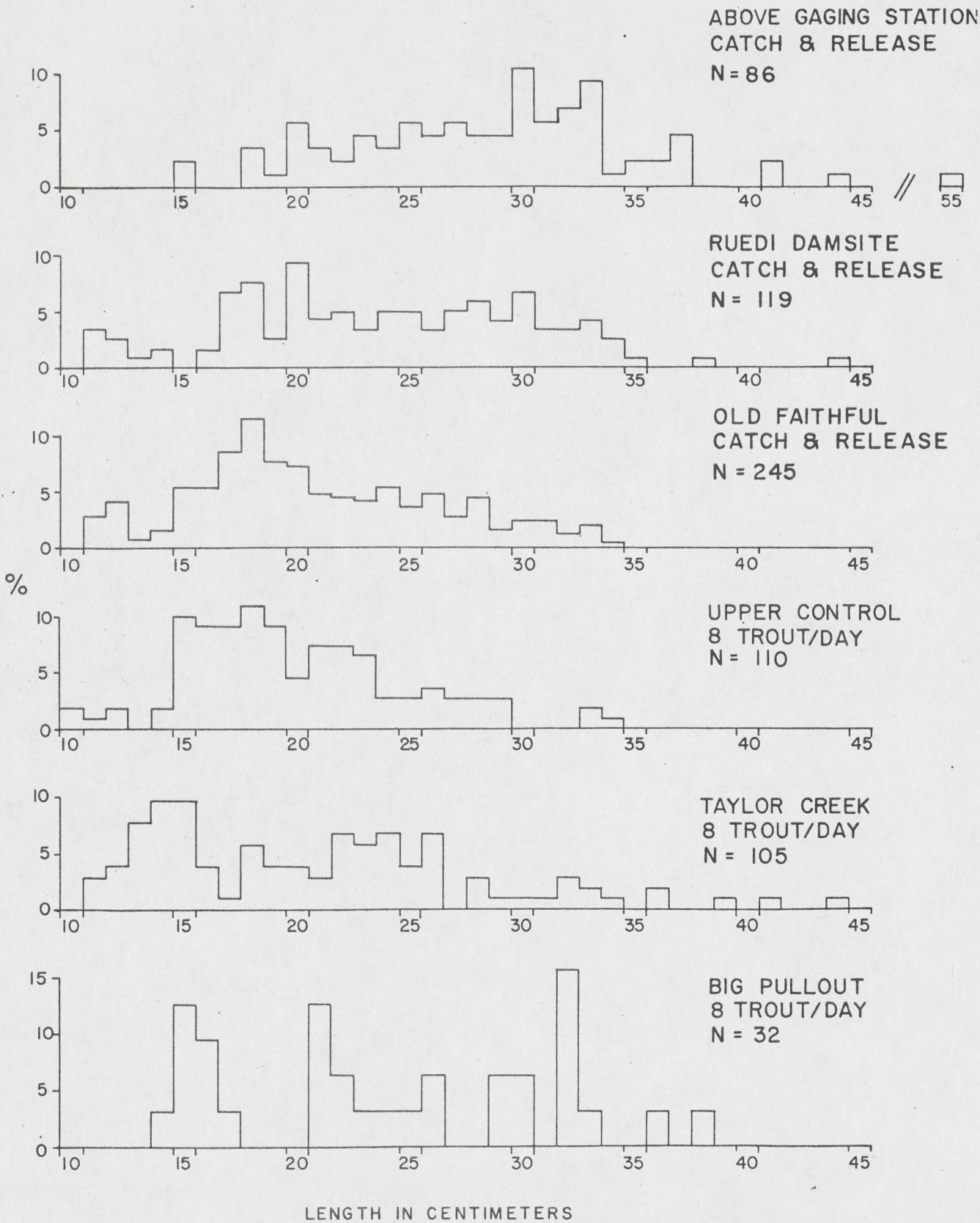
OLD FAITHFUL STATION
CATCH & RELEASE
N=245



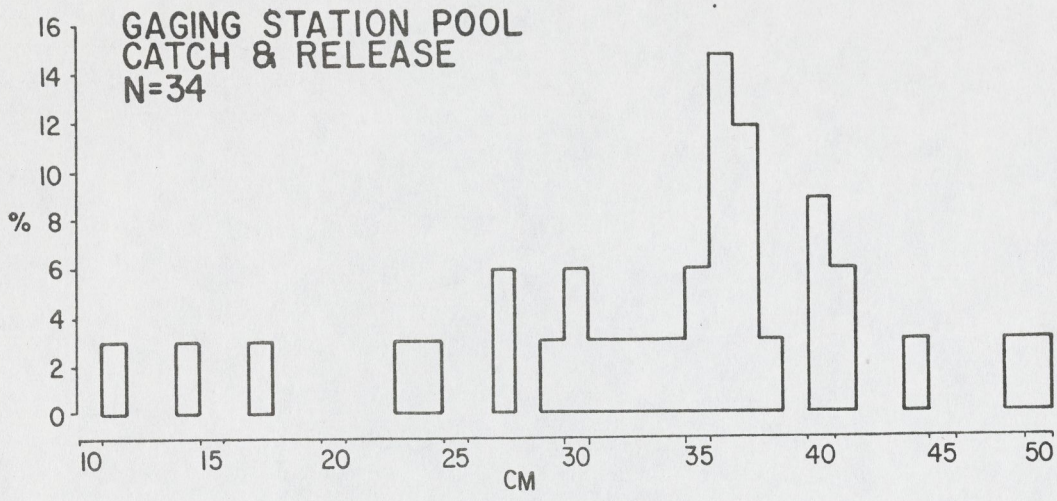
UPPER CONTROL STATION
STANDARD REGULATIONS
N=110

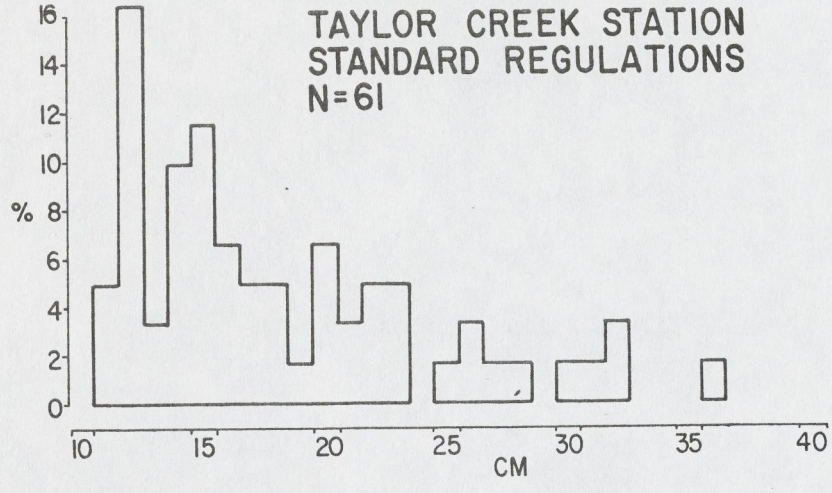


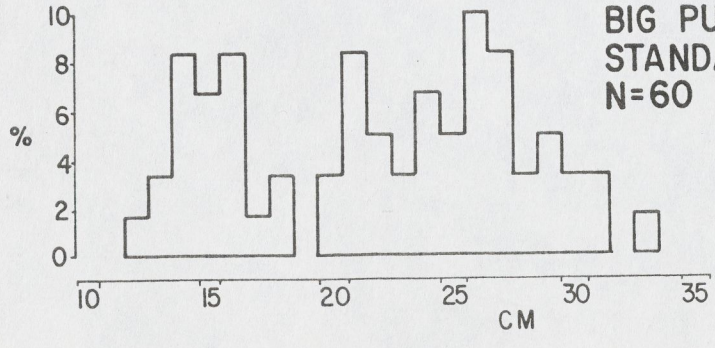
FRYINGPAN RIVER
FALL 1980
BROWN TROUT POPULATIONS



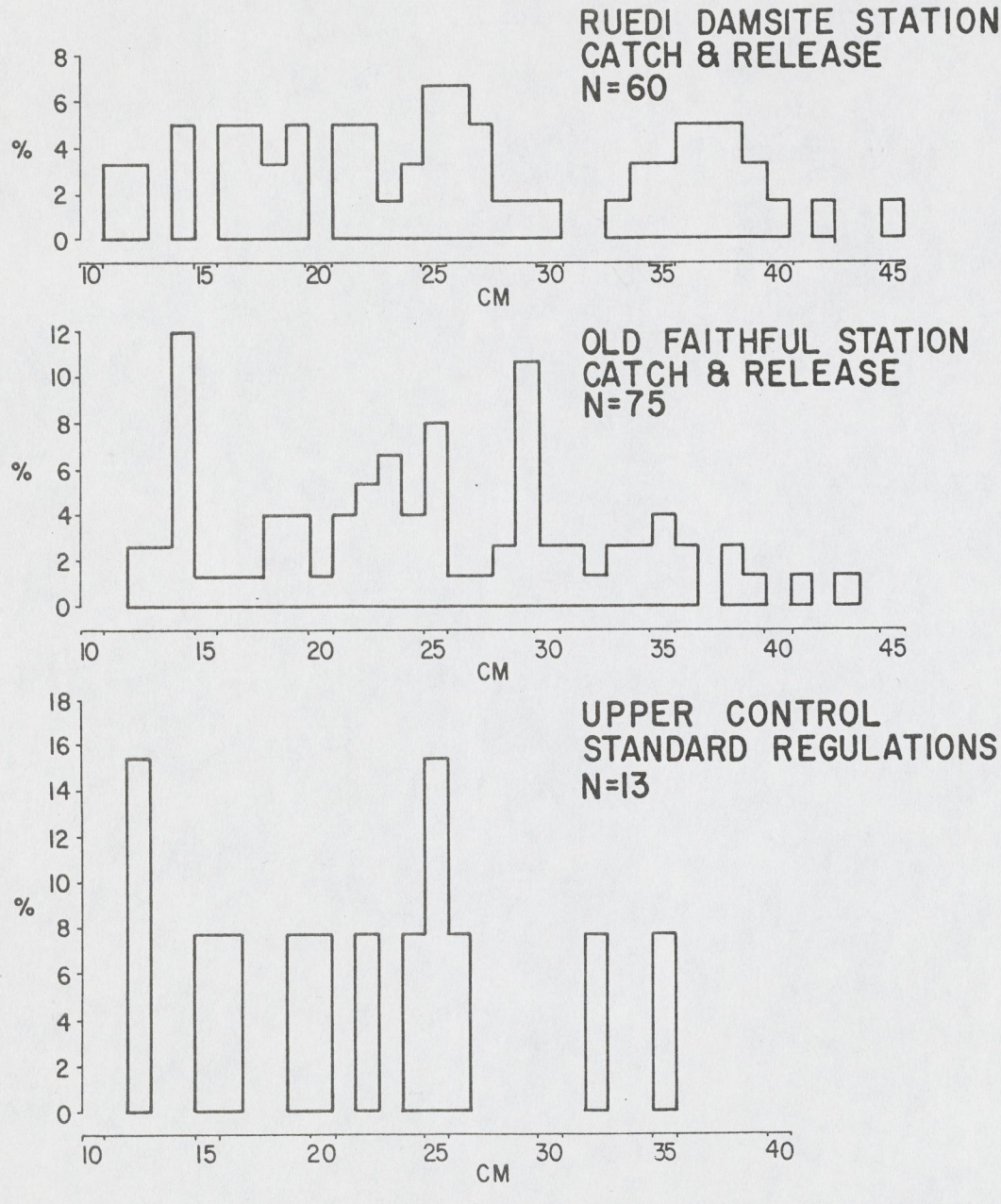
FRYINGPAN RIVER
SEPTEMBER 1980
RAINBOWS



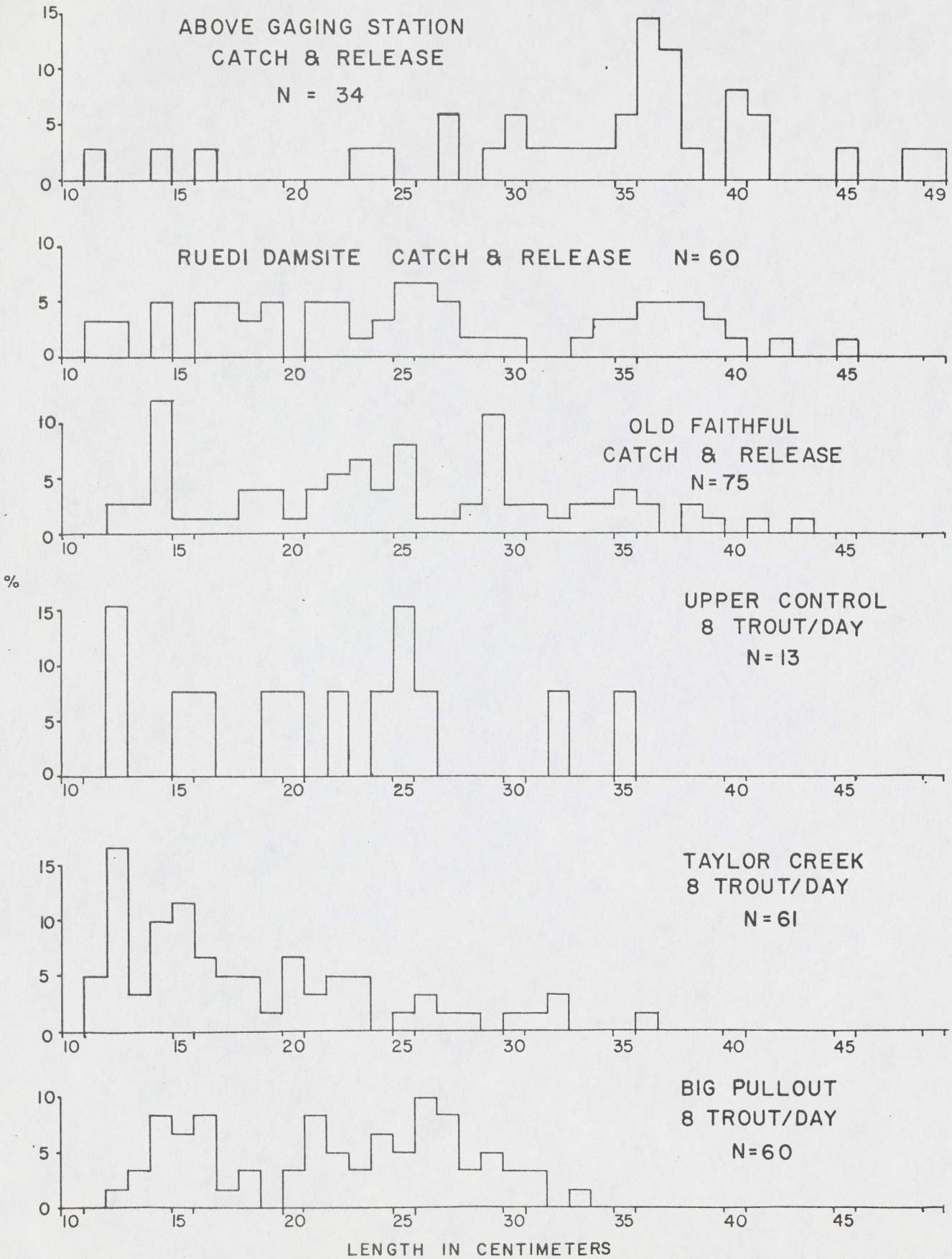




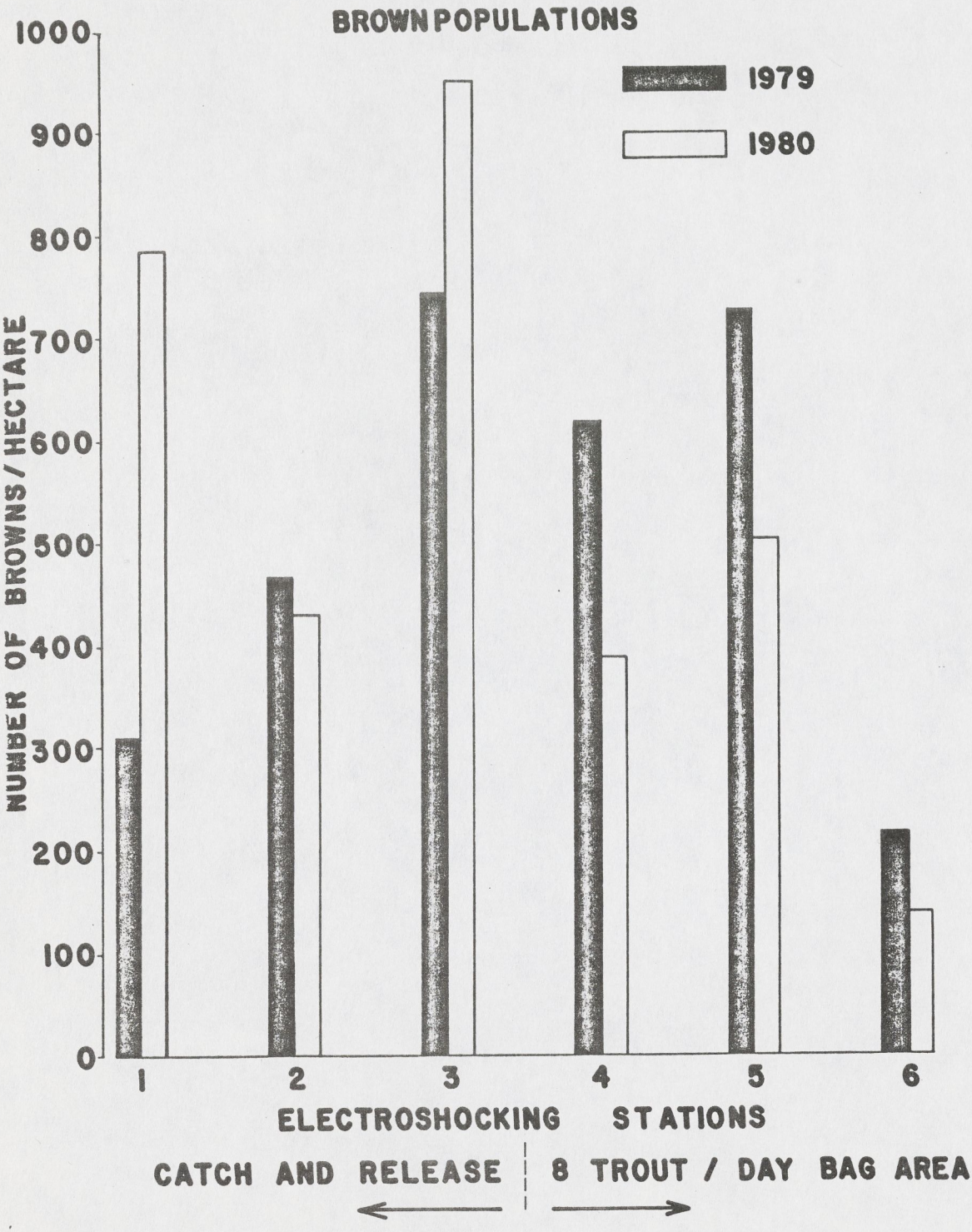
FRYINGPAN RIVER
SEPTEMBER 1980
RAINBOWS

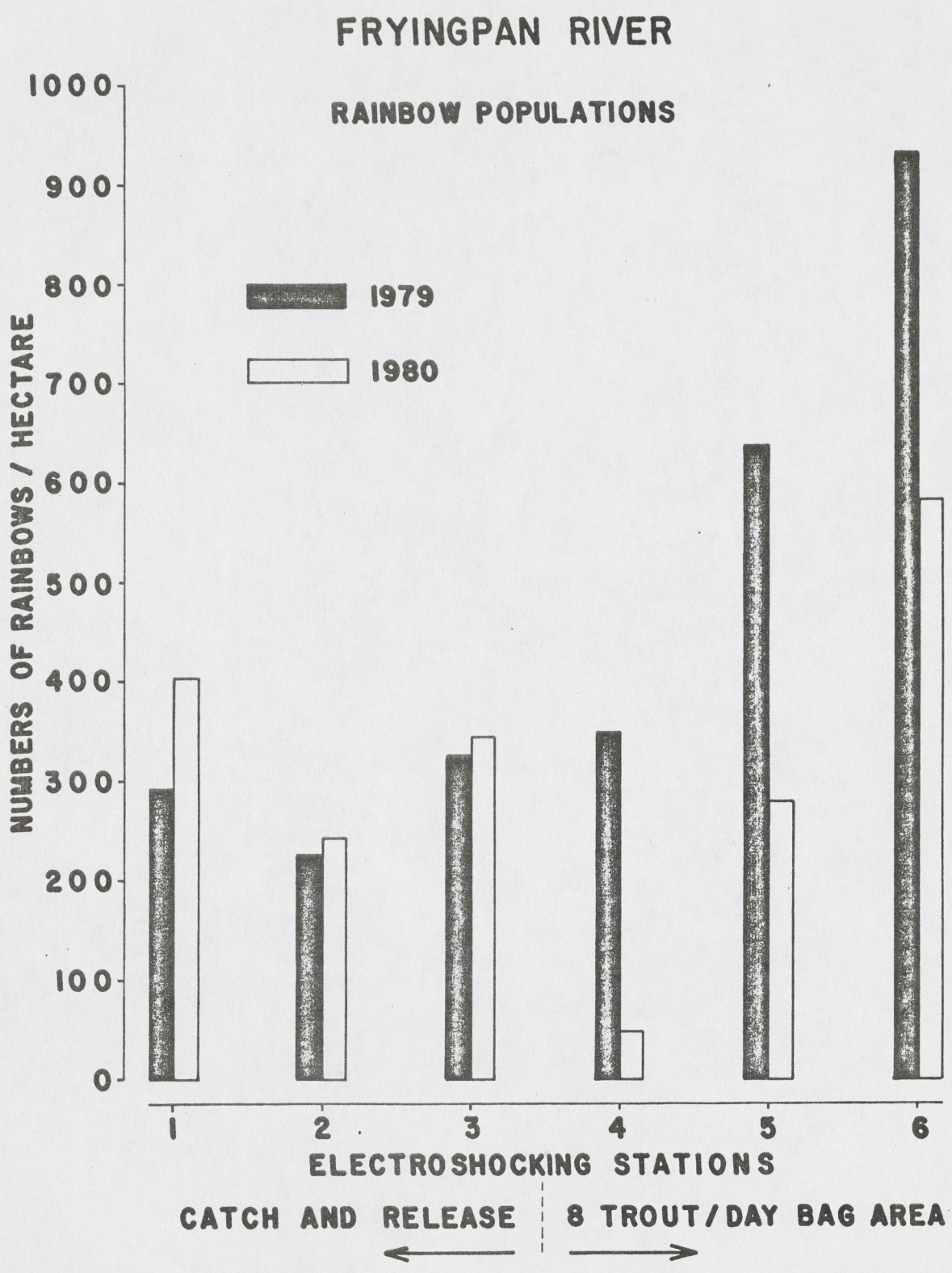


FRYINGPAN RIVER
FALL 1980 RAINBOW TROUT POPULATIONS

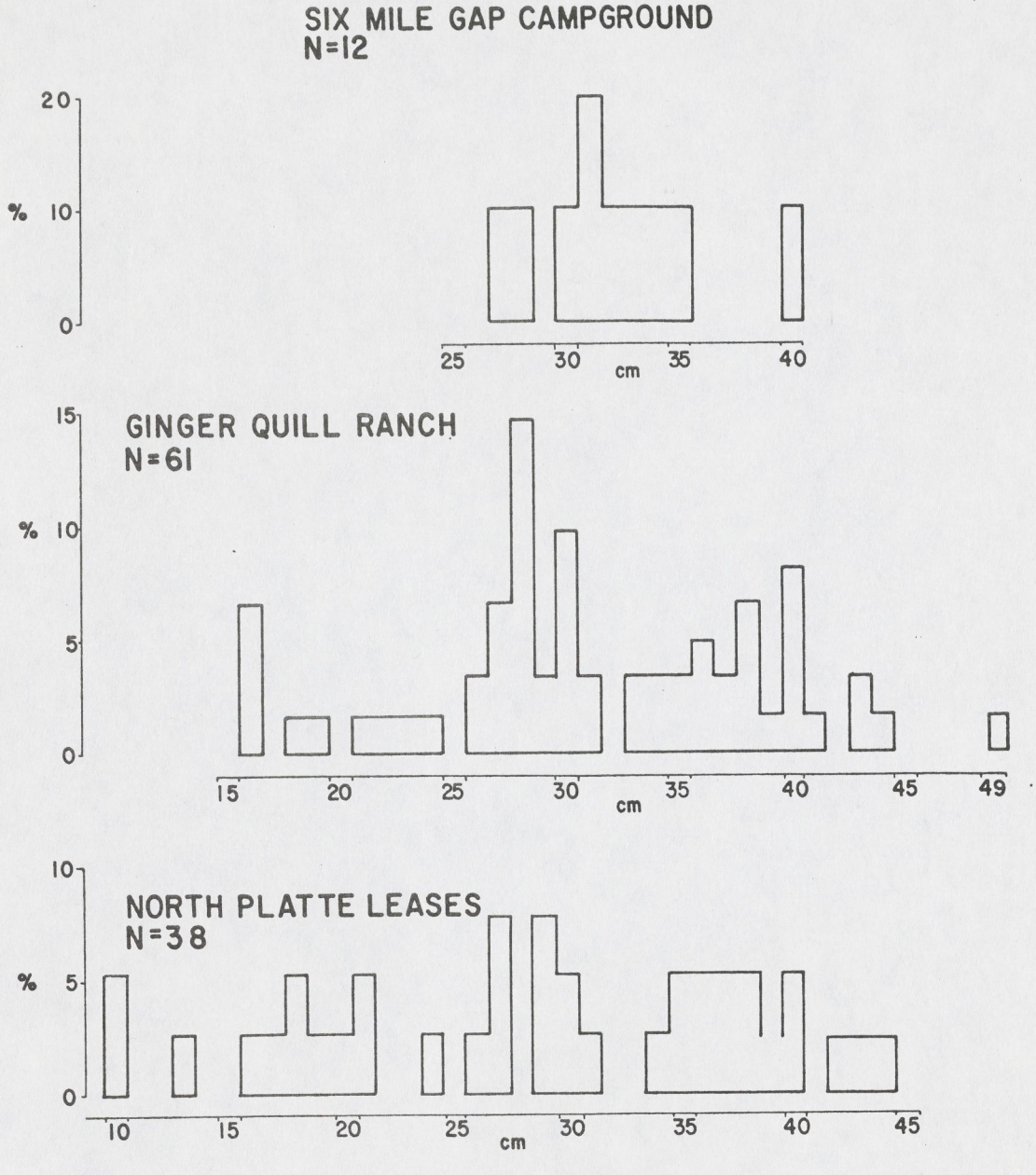


FRYINGPAN RIVER

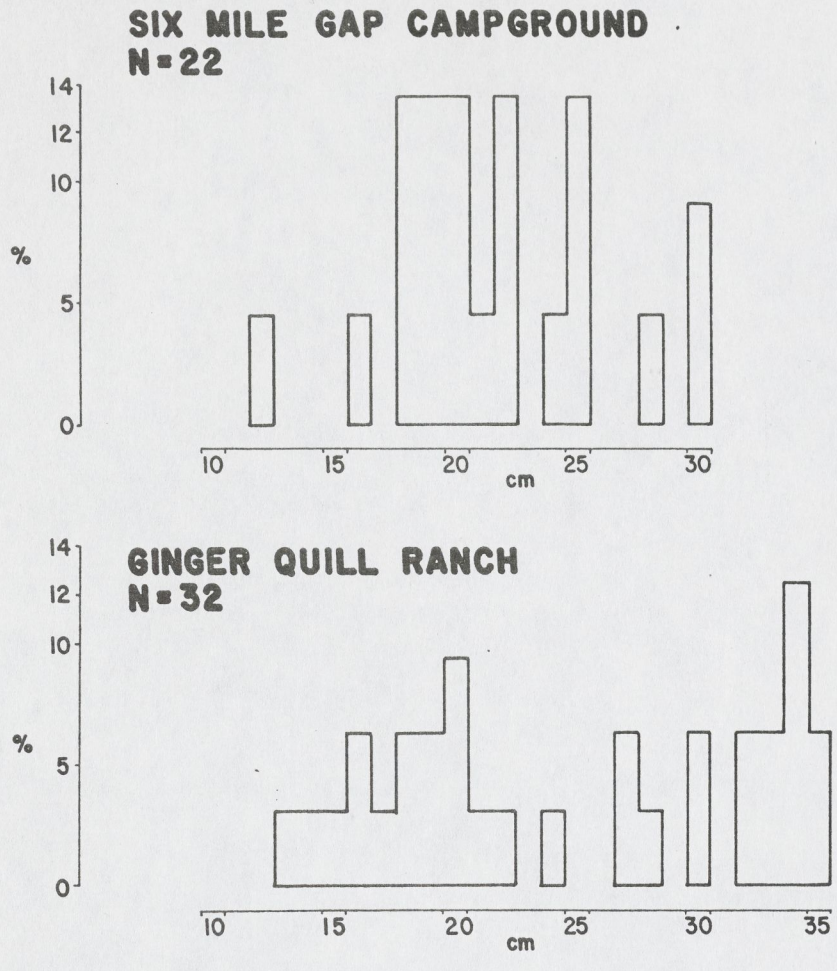



FRYINGPAN RIVER
RAINBOW POPULATIONS
1979
1980
NUMBERS OF RAINBOWS / HECTARE
1000
900
800
700
600
500
400
300
200
100
0
1
2
3
4
5
6
ELECTROSHOCKING STATIONS
CATCH AND RELEASE
8 TROUT/DAY BAG AREA

NORTH PLATTE RIVER
AUGUST 1980
BROWNS

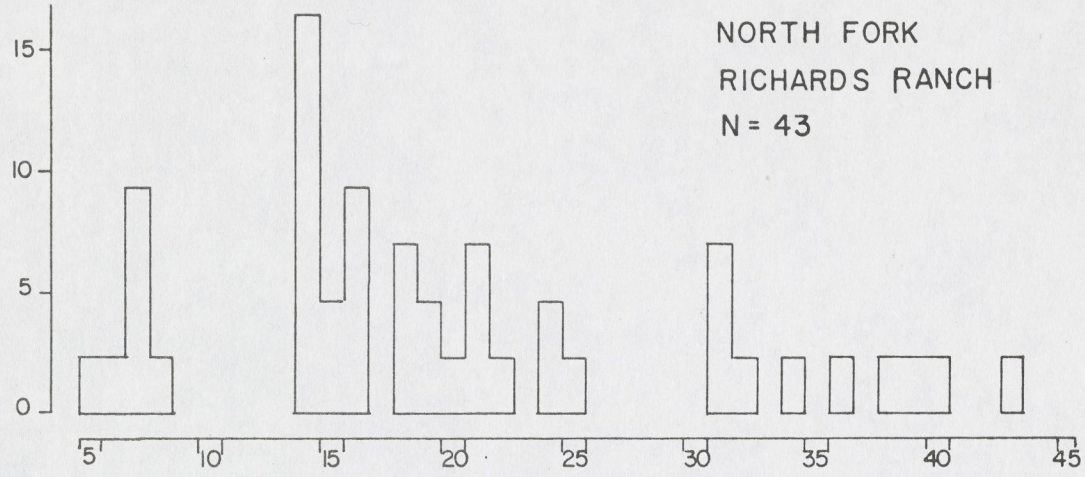


NORTH PLATTE RIVER
AUGUST 1980
RAINBOWS



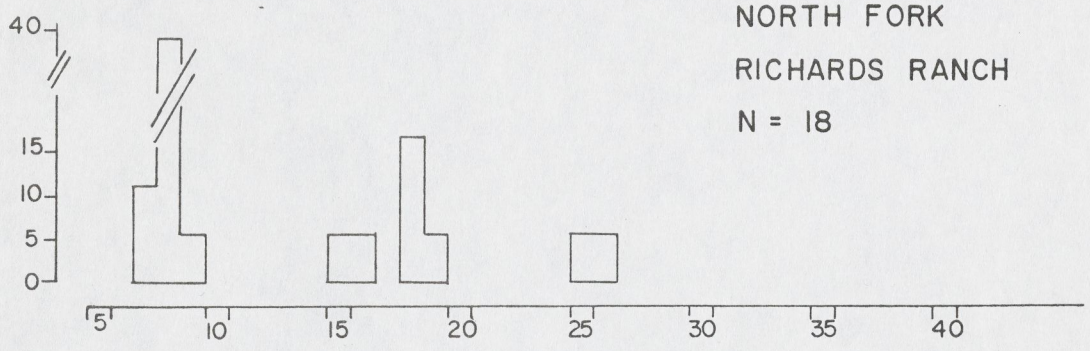
NORTH PARK
AUGUST 1980

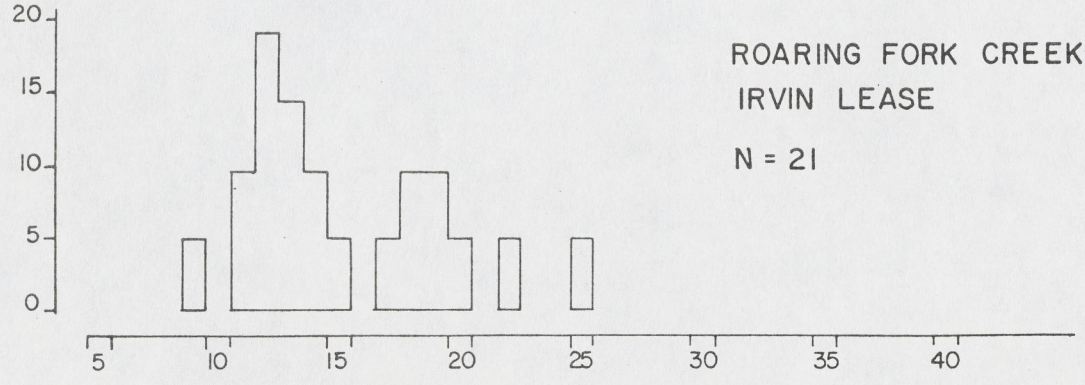
BROWN TROUT



%

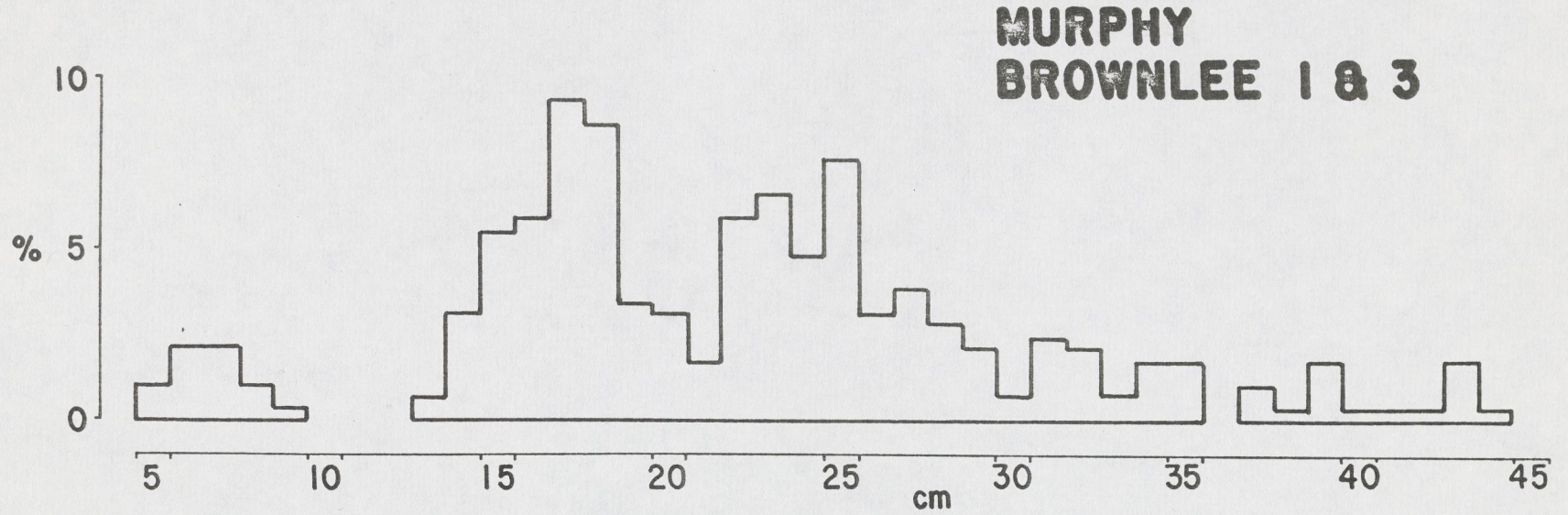
BROOK TROUT



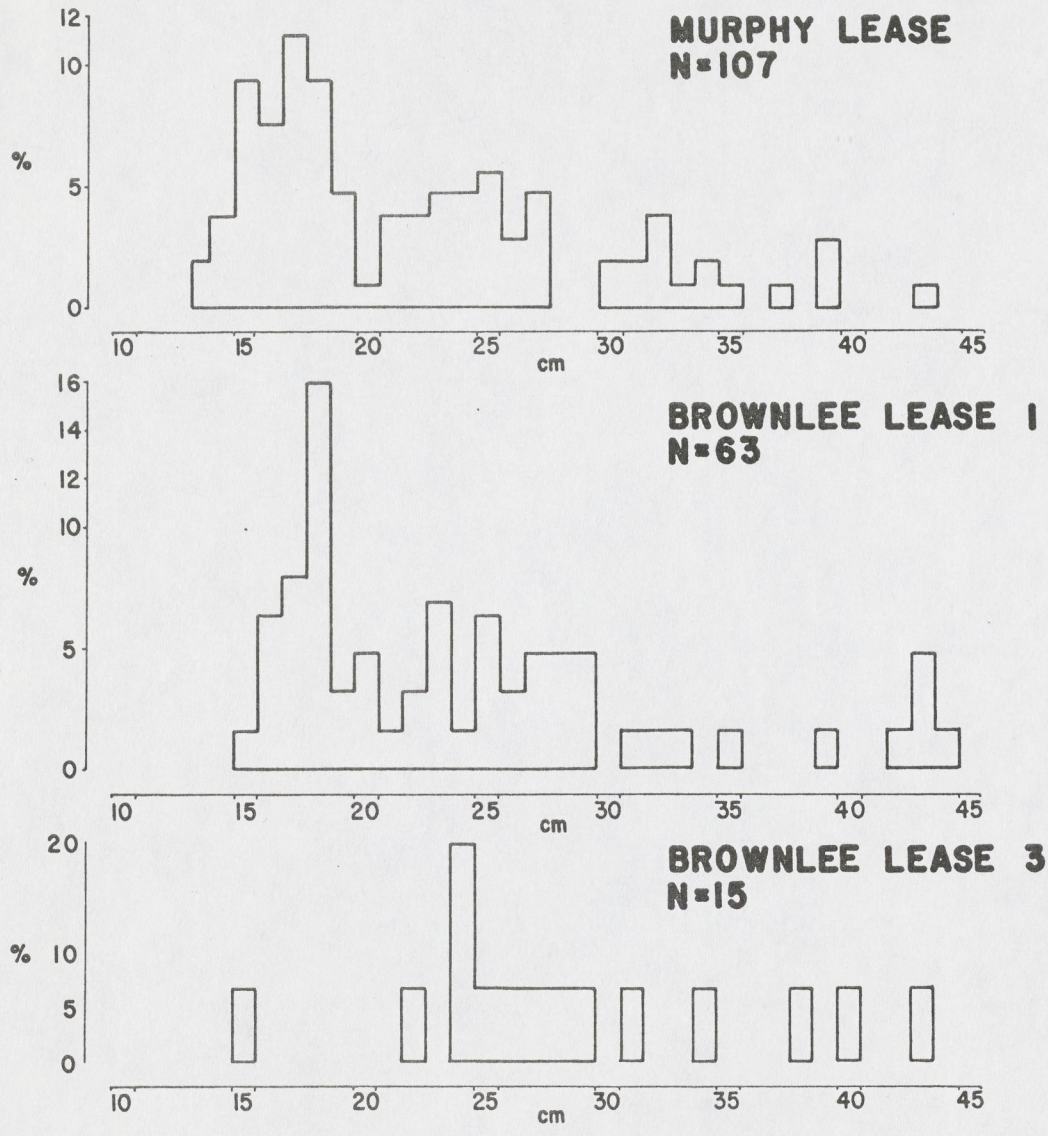


LENGTH IN CENTIMETERS

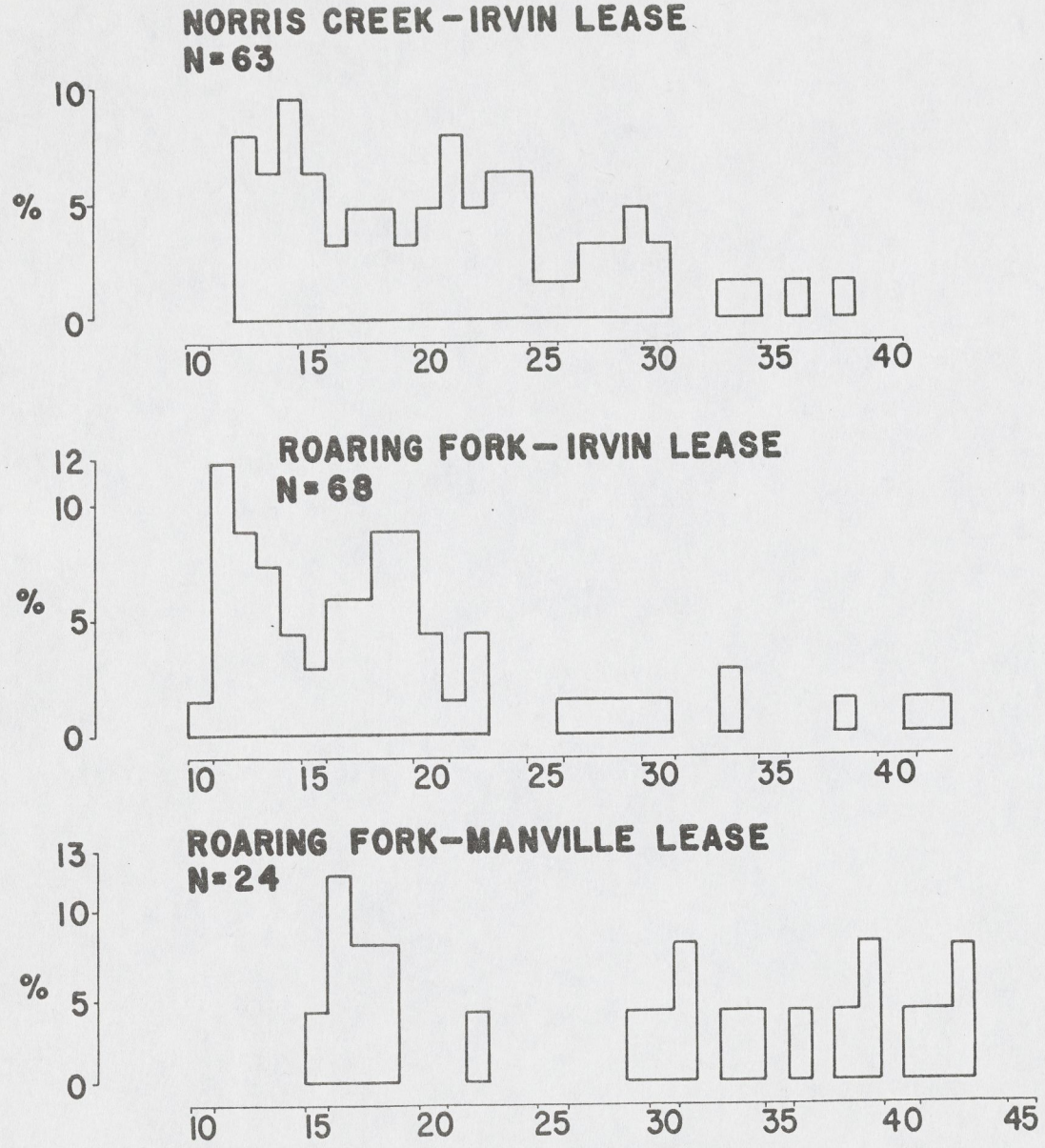
MICHIGAN RIVER & OWL CREEK
AUGUST 1980
BROWNS



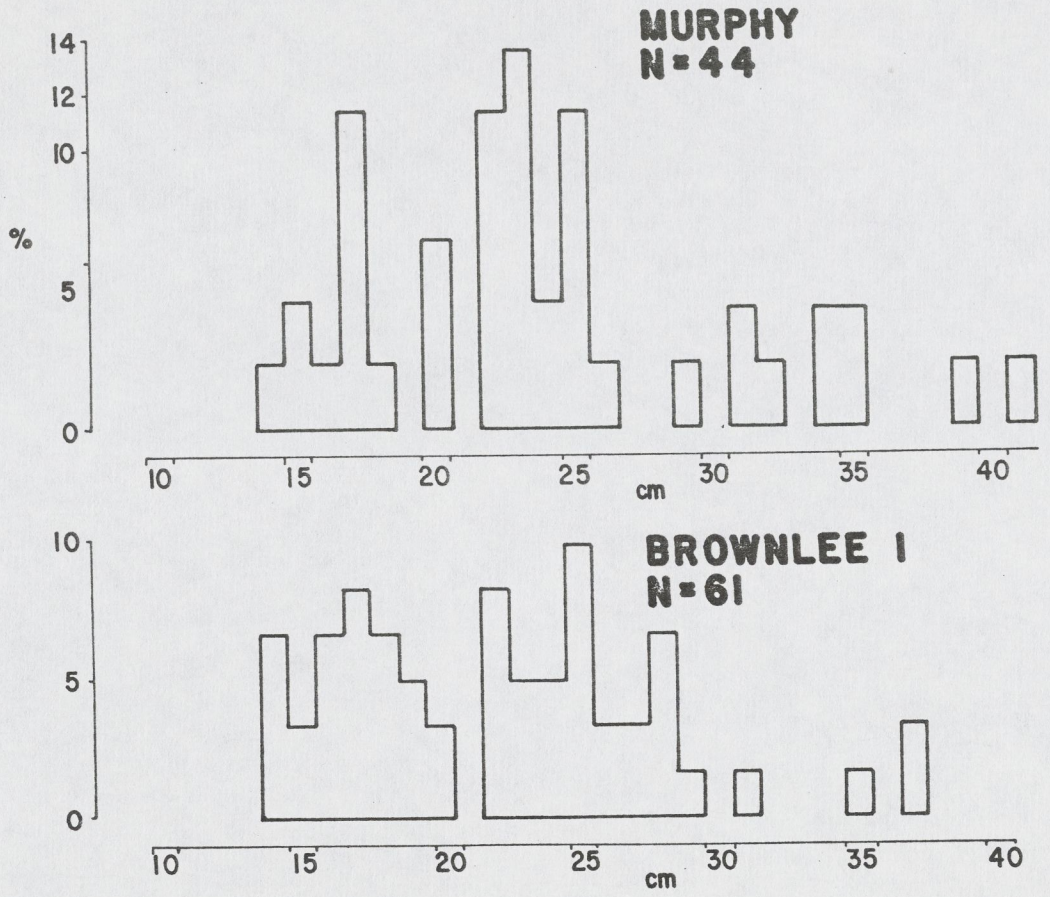
MICHIGAN RIVER
AUGUST 1980
BROWNS



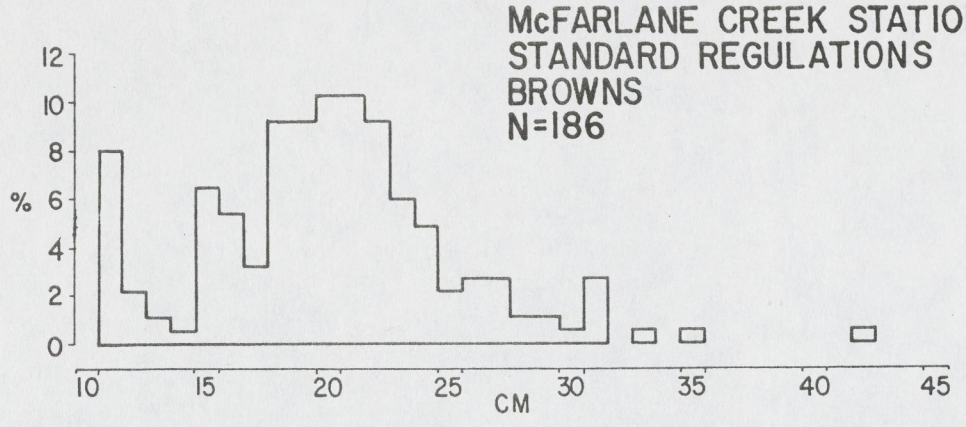
NORRIS & ROARING FORK CREEKS
AUGUST 1980
BROWNS

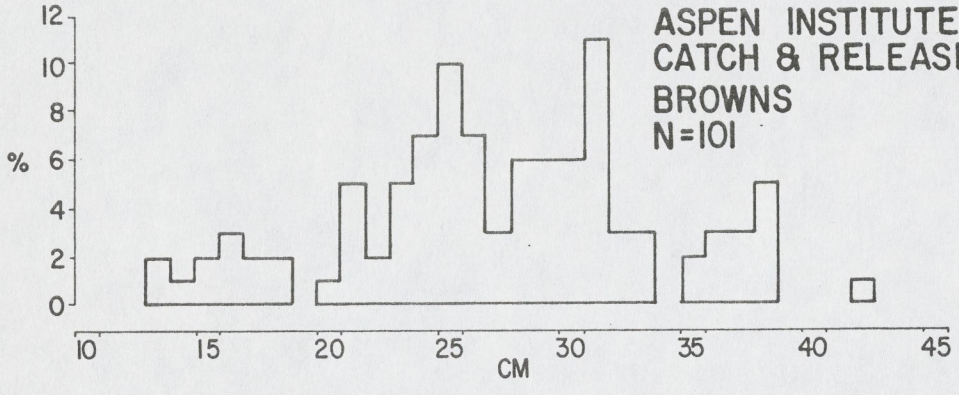


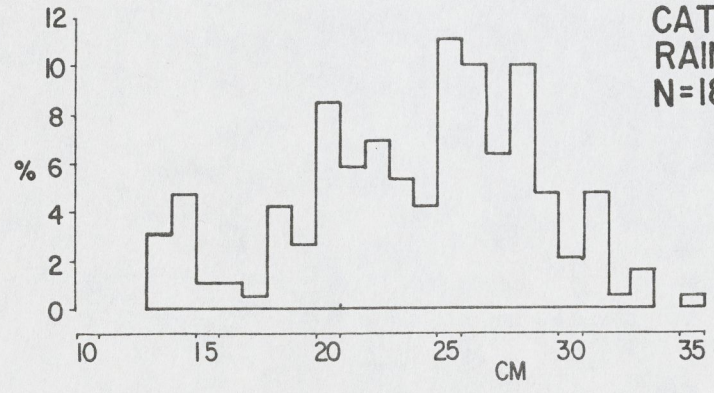
OWL CREEK
AUGUST 1980
BROWNS

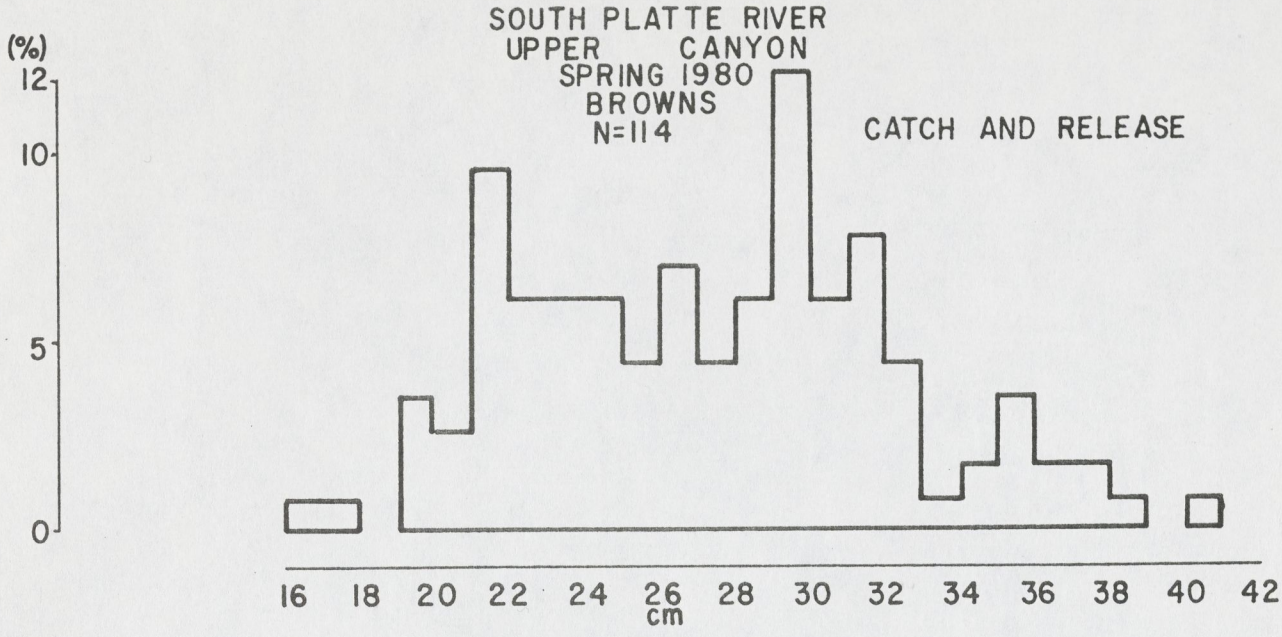


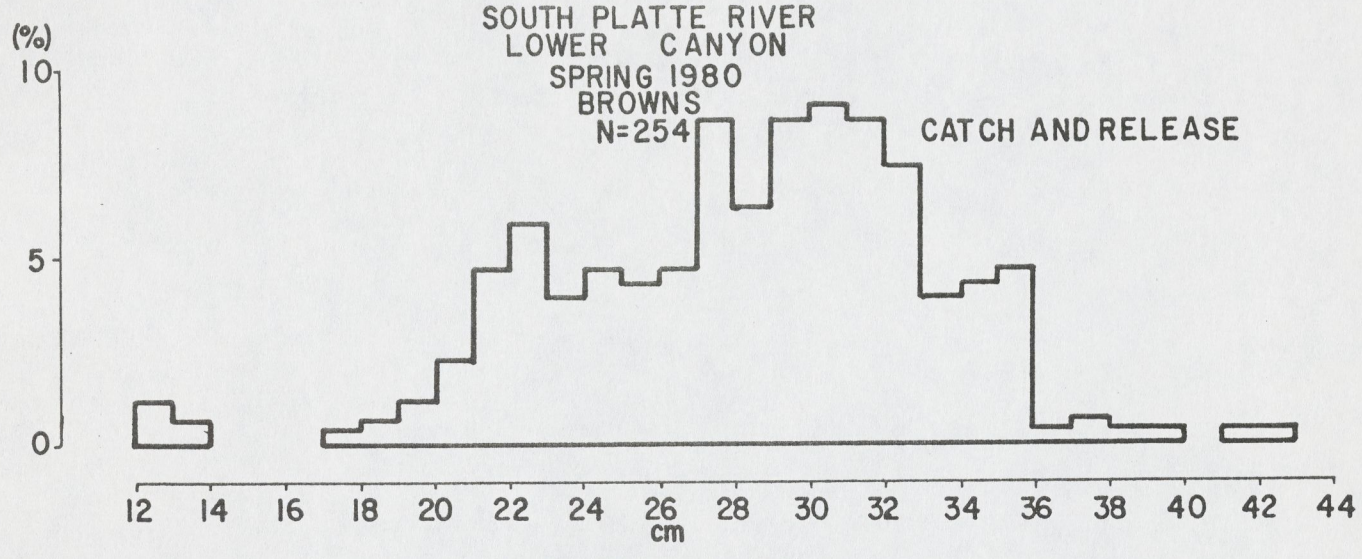
ROARING FORK RIVER
SEPTEMBER 1980

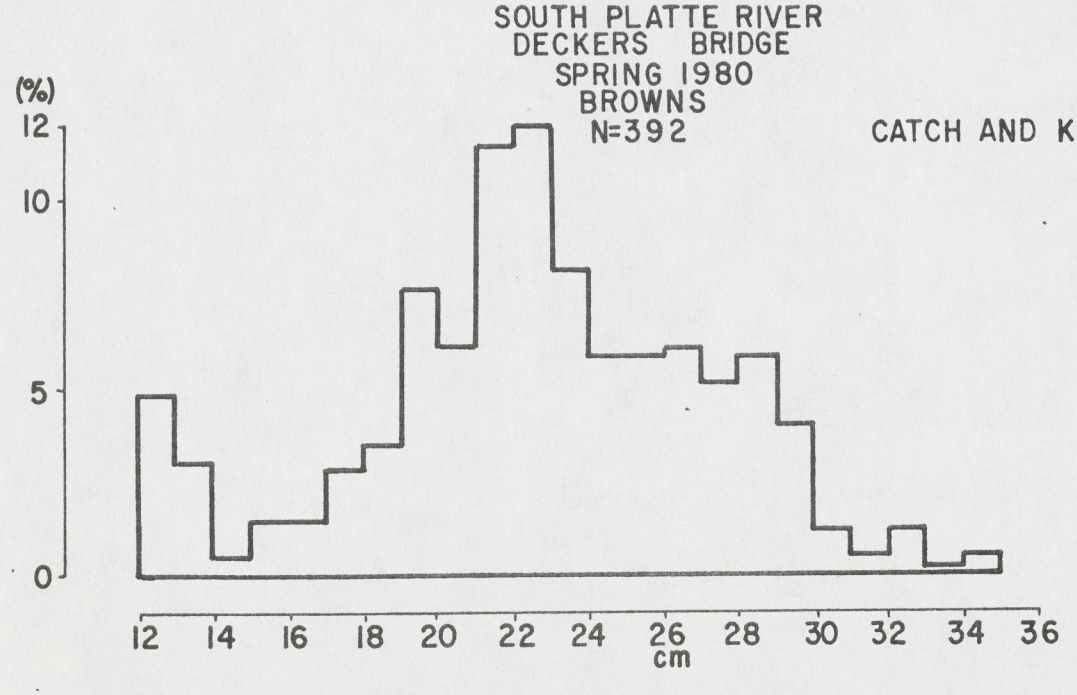


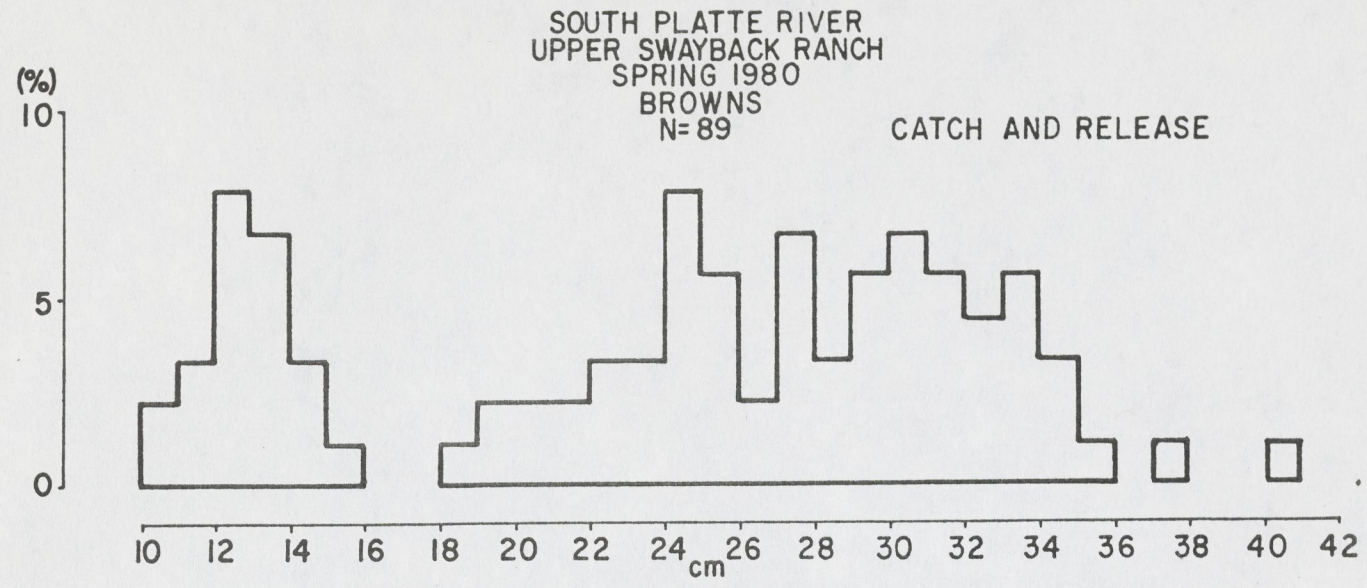


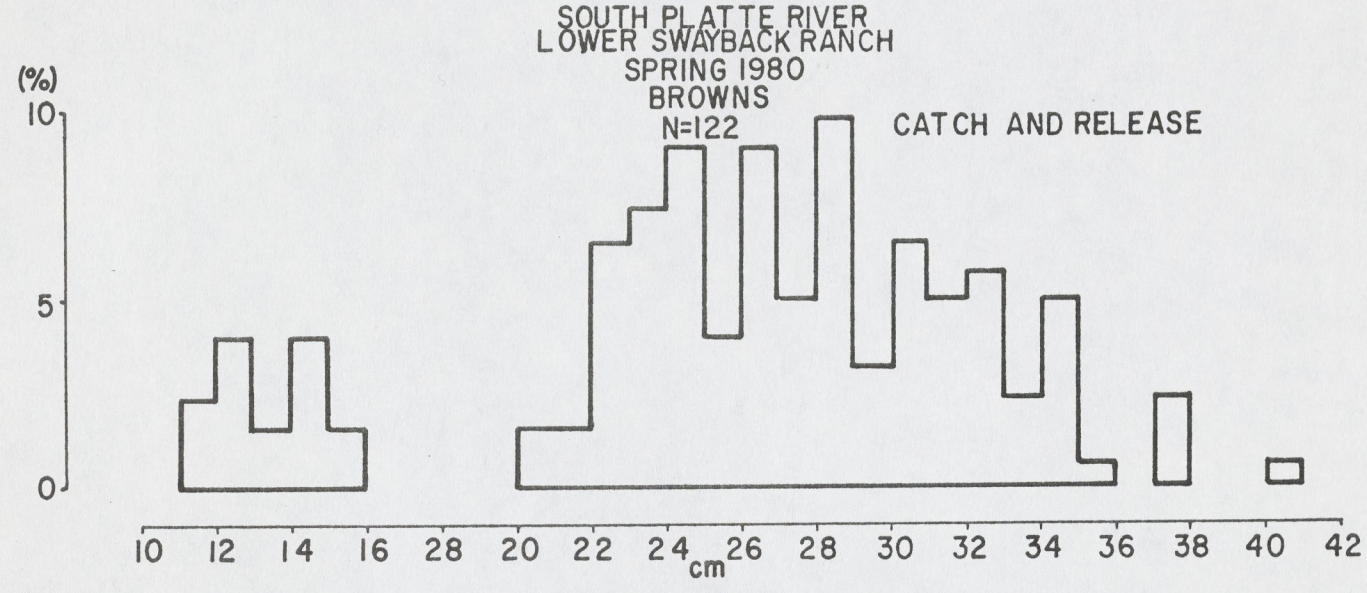


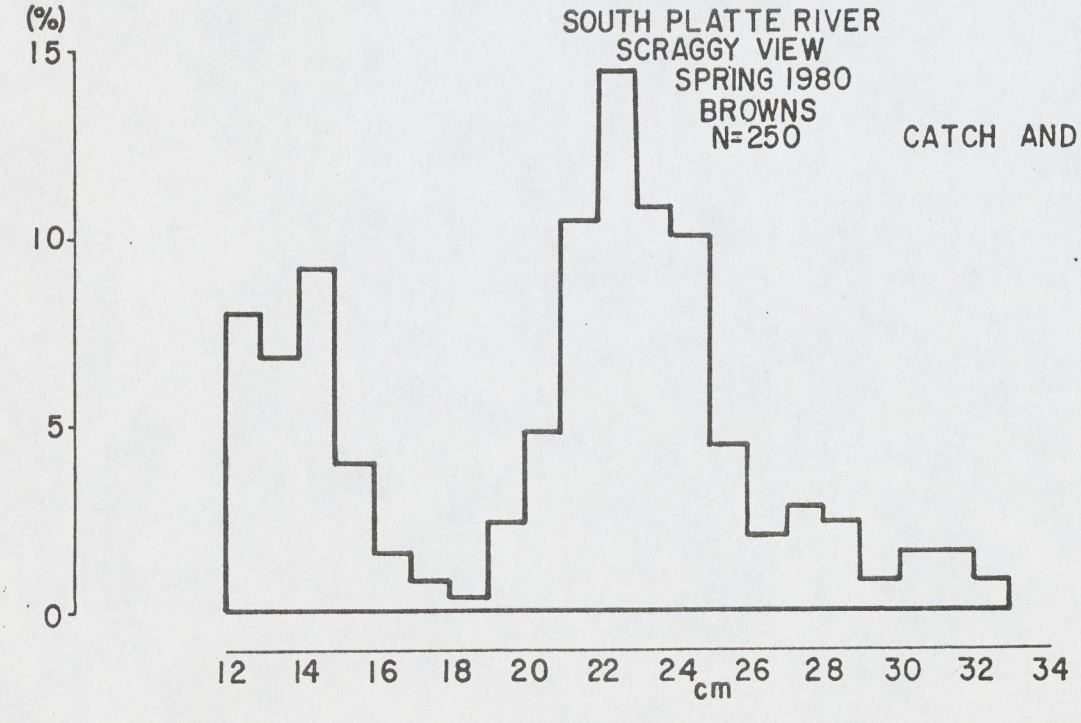

SOUTH PLATTE RIVER
UPPER CANYON
SPRING 1980
BROWNS
N=114
CATCH AND RELEASE
(%)
12
10
5
0
16 18 20 22 24 26 28 30 32 34 36 38 40 42
cm


SOUTH PLATTE RIVER
LOWER CANYON
SPRING 1980
BROWNS
N=254
CATCH AND RELEASE
(%)
10
5
0
12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
cm

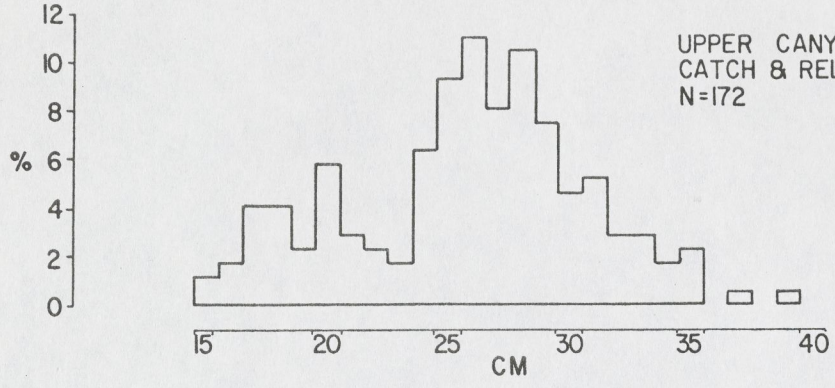

SOUTH PLATTE RIVER
DECKERS BRIDGE
SPRING 1980
BROWNS
N=392
CATCH AND KEEP
(%)
12
10
5
0
12 14 16 18 20 22 24 26 28 30 32 34 36
cm

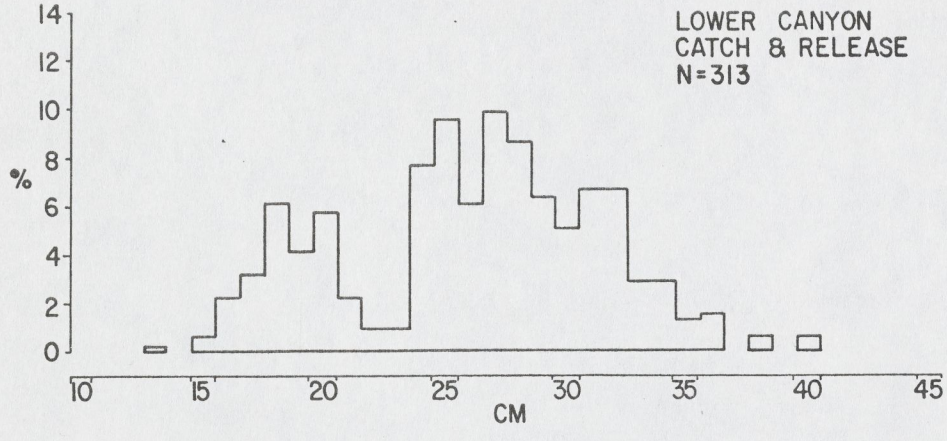

SOUTH PLATTE RIVER
UPPER SWAYBACK RANCH
SPRING 1980
BROWNS
N=89
CATCH AND RELEASE
(%)
10
5
0
10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42
cm

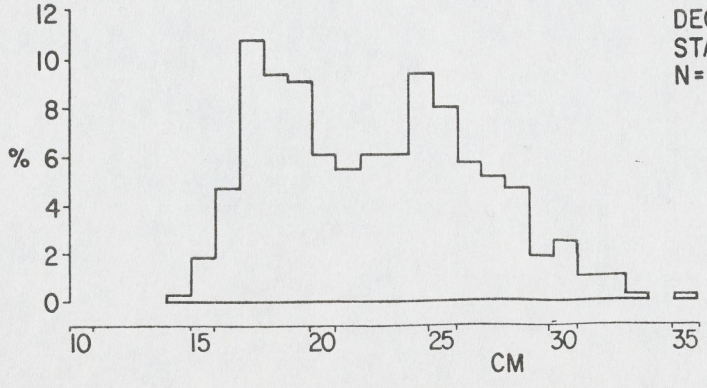

SOUTH PLATTE RIVER
LOWER SWAYBACK RANCH
SPRING 1980
BROWNS
N=122
CATCH AND RELEASE
(%)
10
5
0
10 12 14 16 28 20 22 24 26 28 30 32 34 36 38 40 42
cm


SOUTH PLATTE RIVER
SCRAGGY VIEW
SPRING 1980
BROWNS
N=250
CATCH AND KEEP
(%)
15
10
5
0
12 14 16 18 20 22 24 26 28 30 32 34
cm

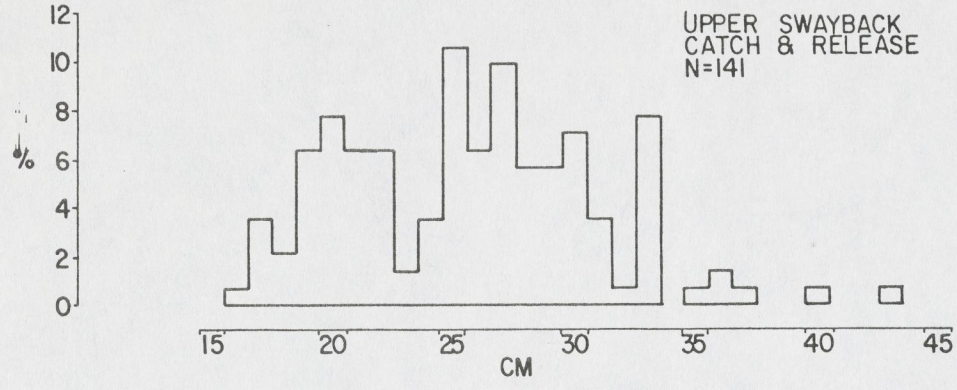
SOUTH PLATTE RIVER
OCTOBER 1980
BROWNS

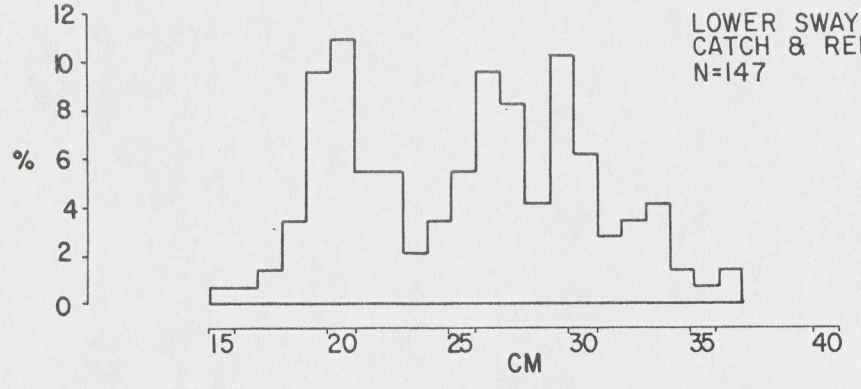


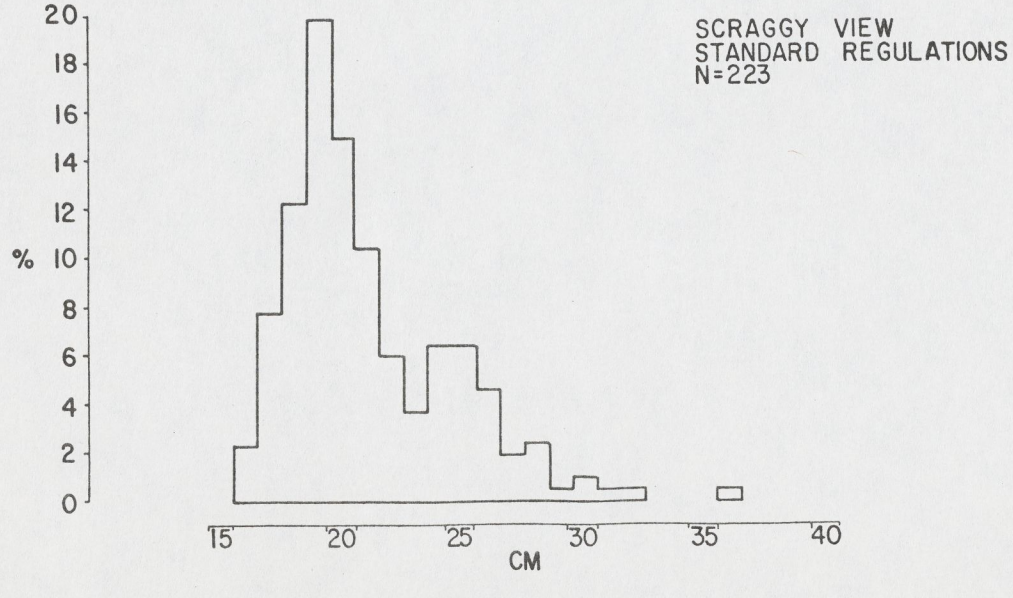




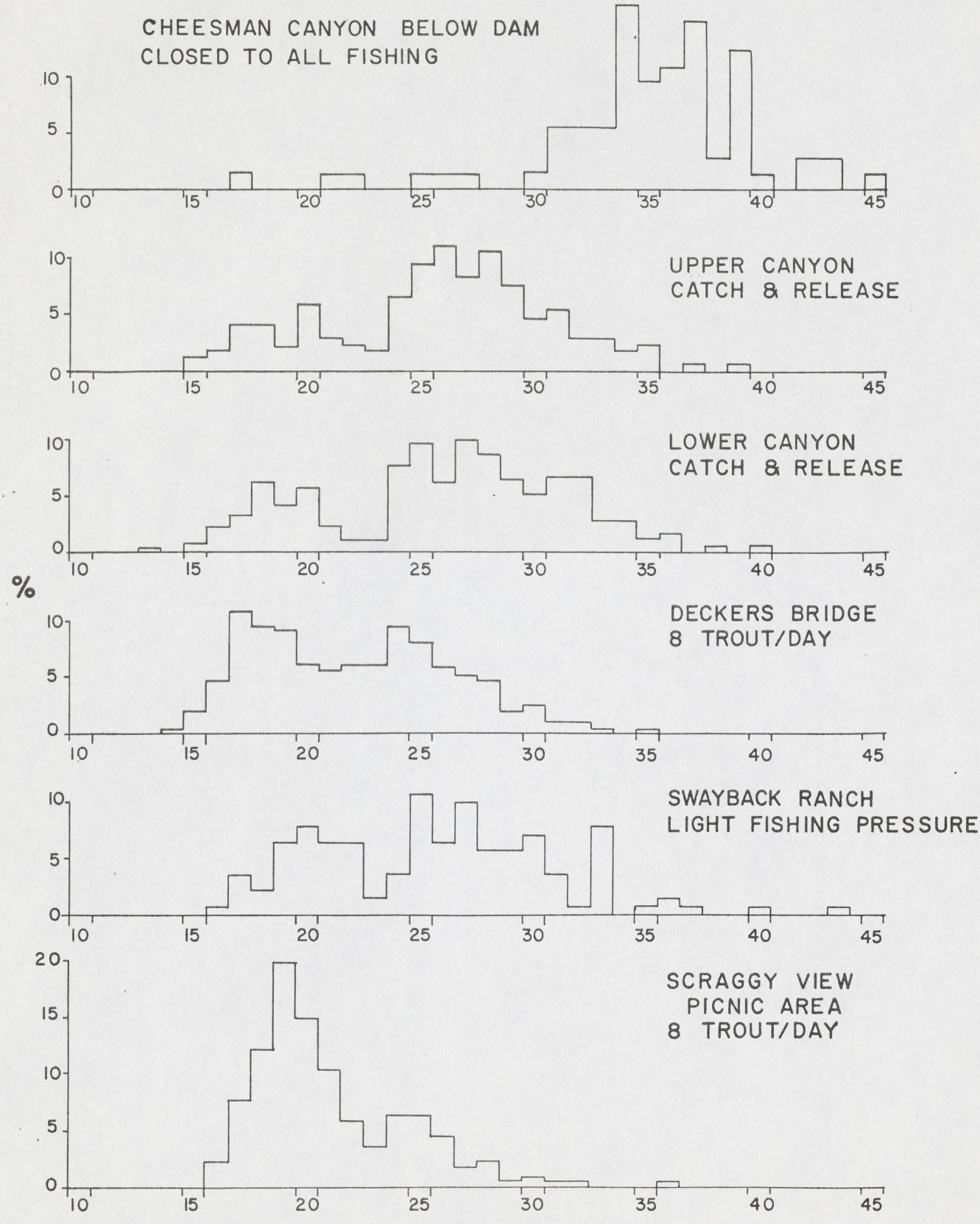
SOUTH PLATTE RIVER
OCTOBER 1980
BROWNS





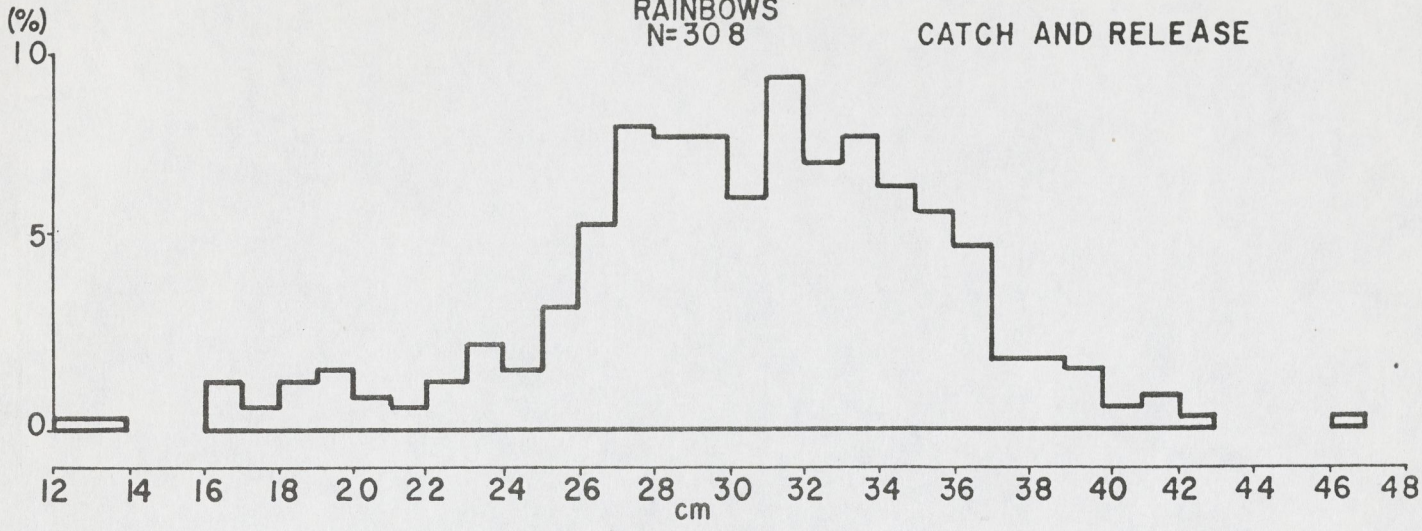


SOUTH PLATTE RIVER
FALL 1980
BROWN TROUT POPULATIONS



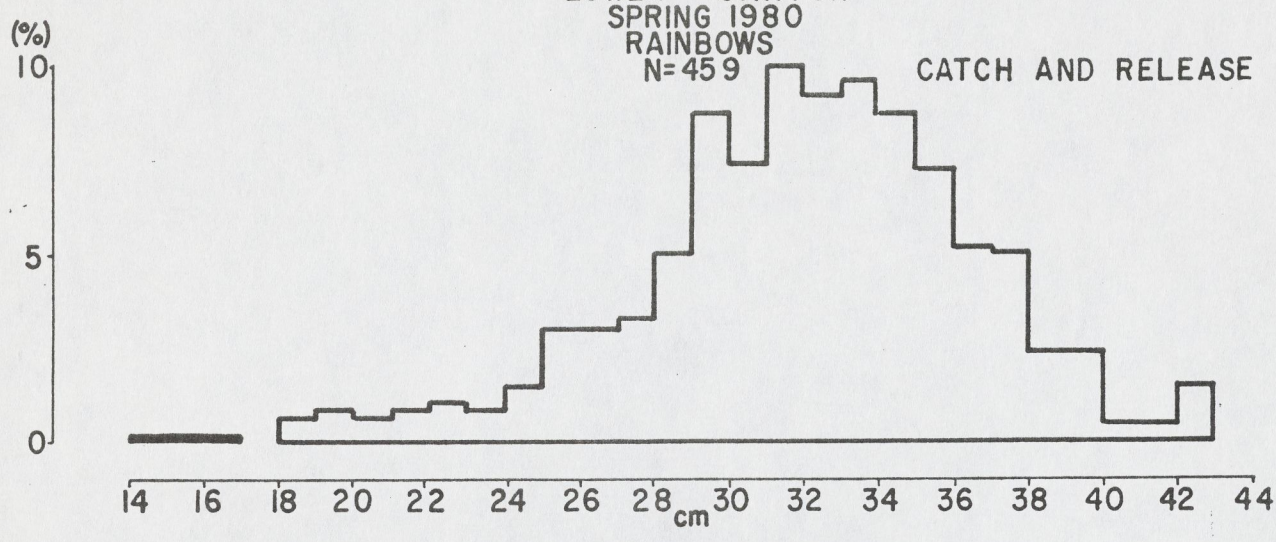
SOUTH PLATTE RIVER
UPPER CANYON
SPRING 1980
RAINBOWS
N=308

CATCH AND RELEASE



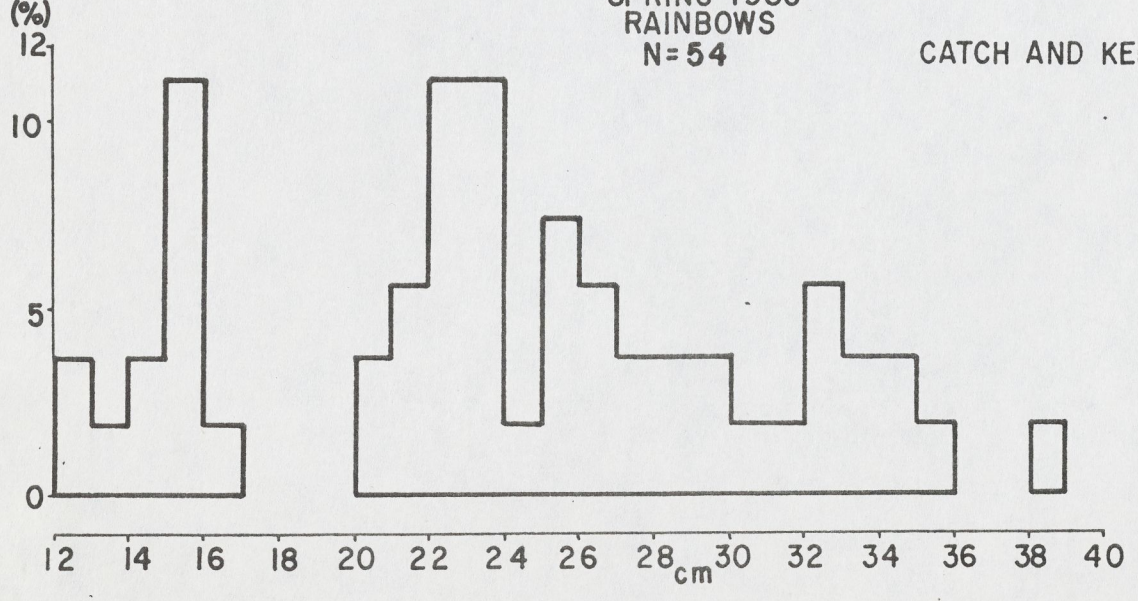
SOUTH PLATTE RIVER
LOWER CANYON
SPRING 1980
RAINBOWS
N=459

CATCH AND RELEASE

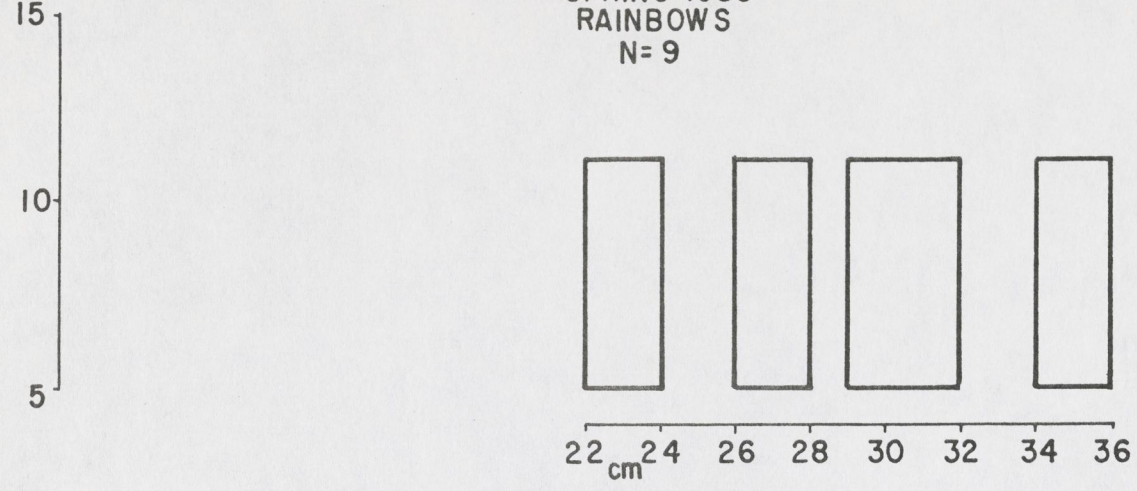


SOUTH PLATTE RIVER
DECKERS BRIDGE
SPRING 1980
RAINBOWS
N=54

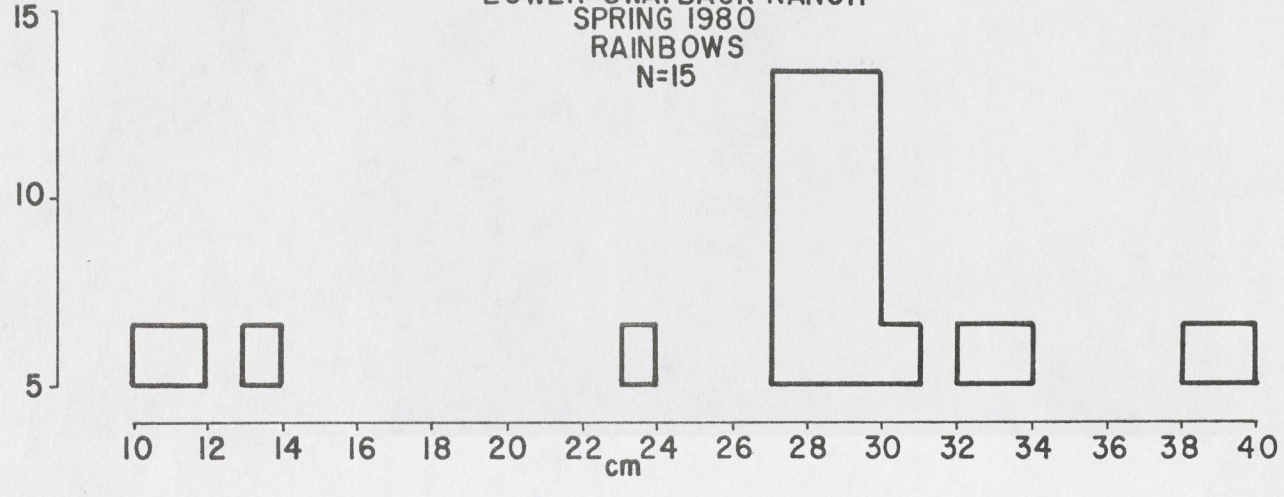
CATCH AND KEEP



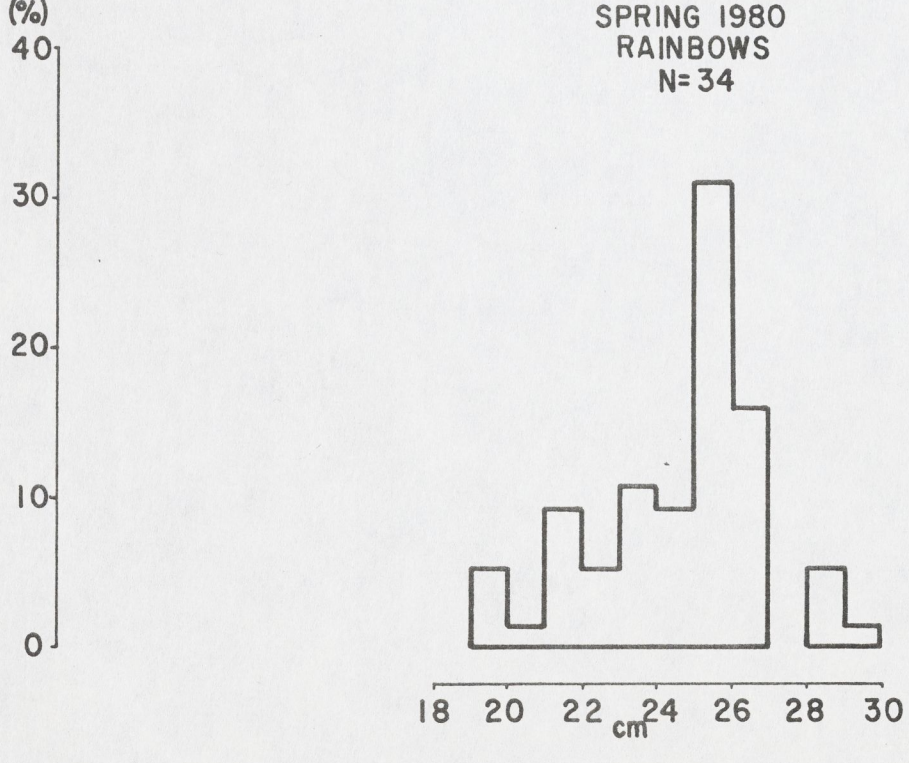
SOUTH PLATTE RIVER
UPPER SWAYBACK RANCH
SPRING 1980
RAINBOWS
N= 9



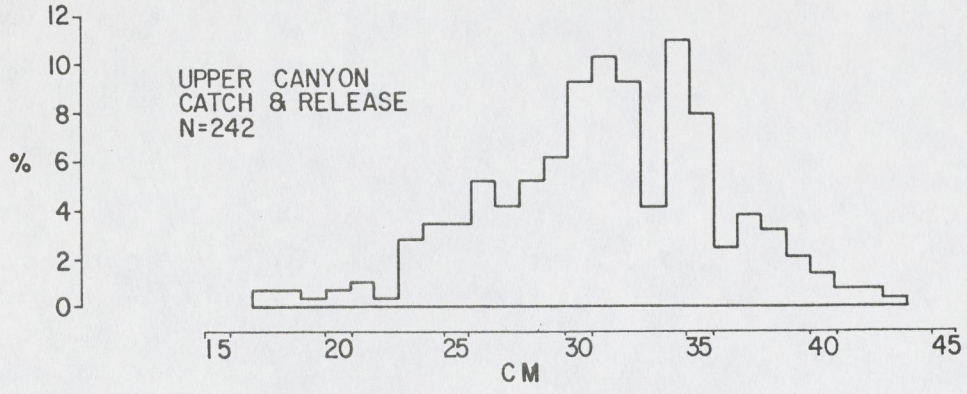
SOUTH PLATTE RIVER
LOWER SWAYBACK RANCH
SPRING 1980
RAINBOWS
N=15

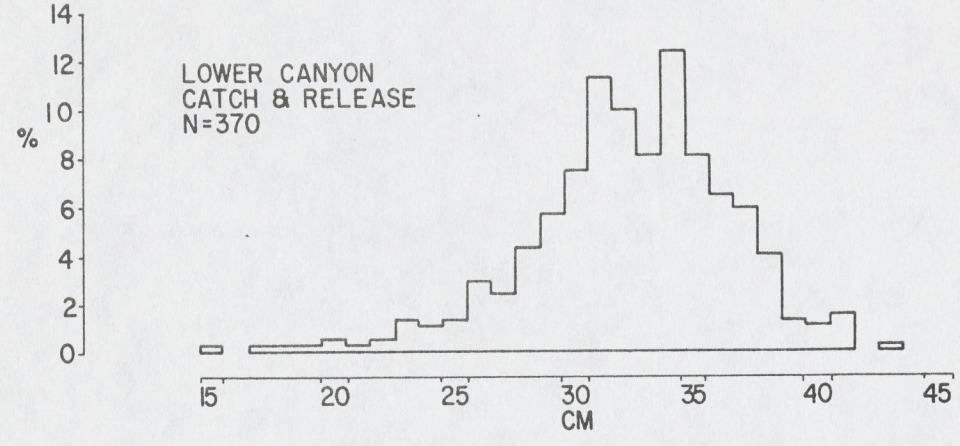


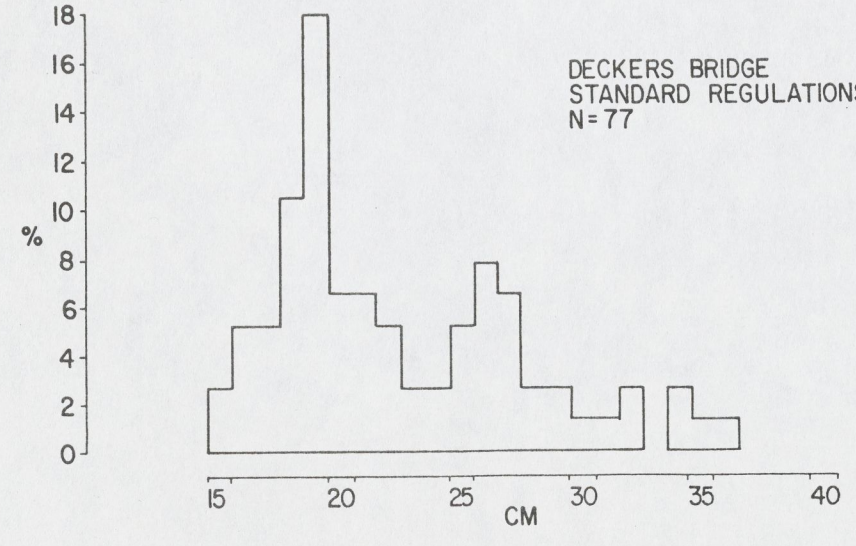
SOUTH PLATTE RIVER
SCRAGGY VIEW
SPRING 1980
RAINBOWS
N=34



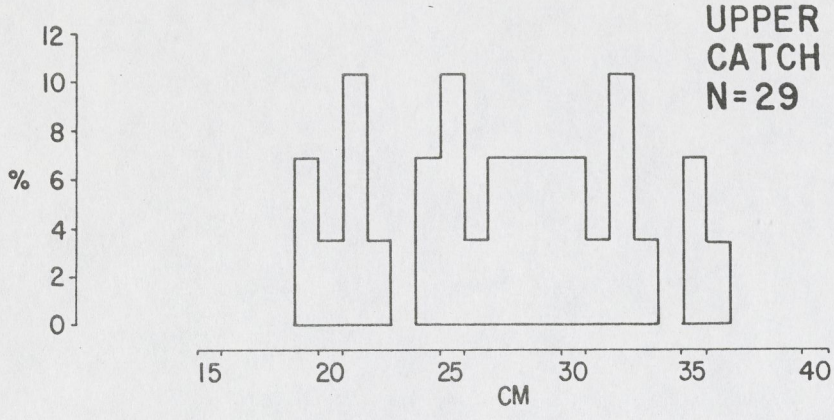
SOUTH PLATTE RIVER
OCTOBER 1980
RAINBOWS

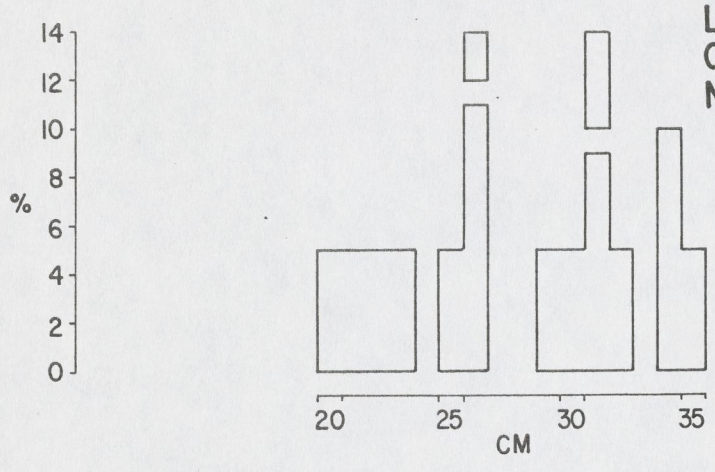


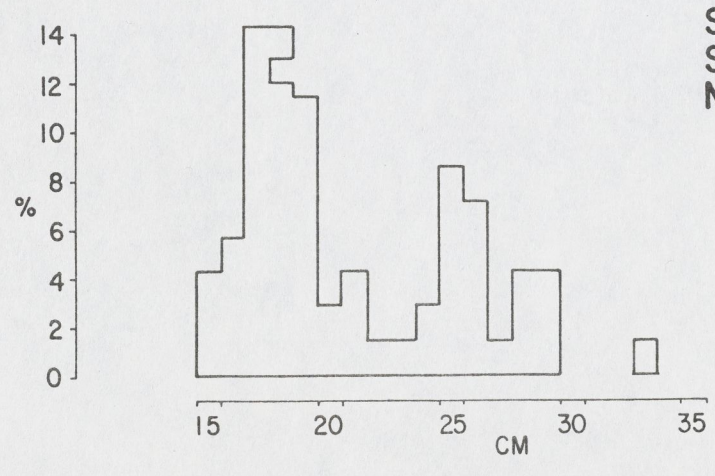




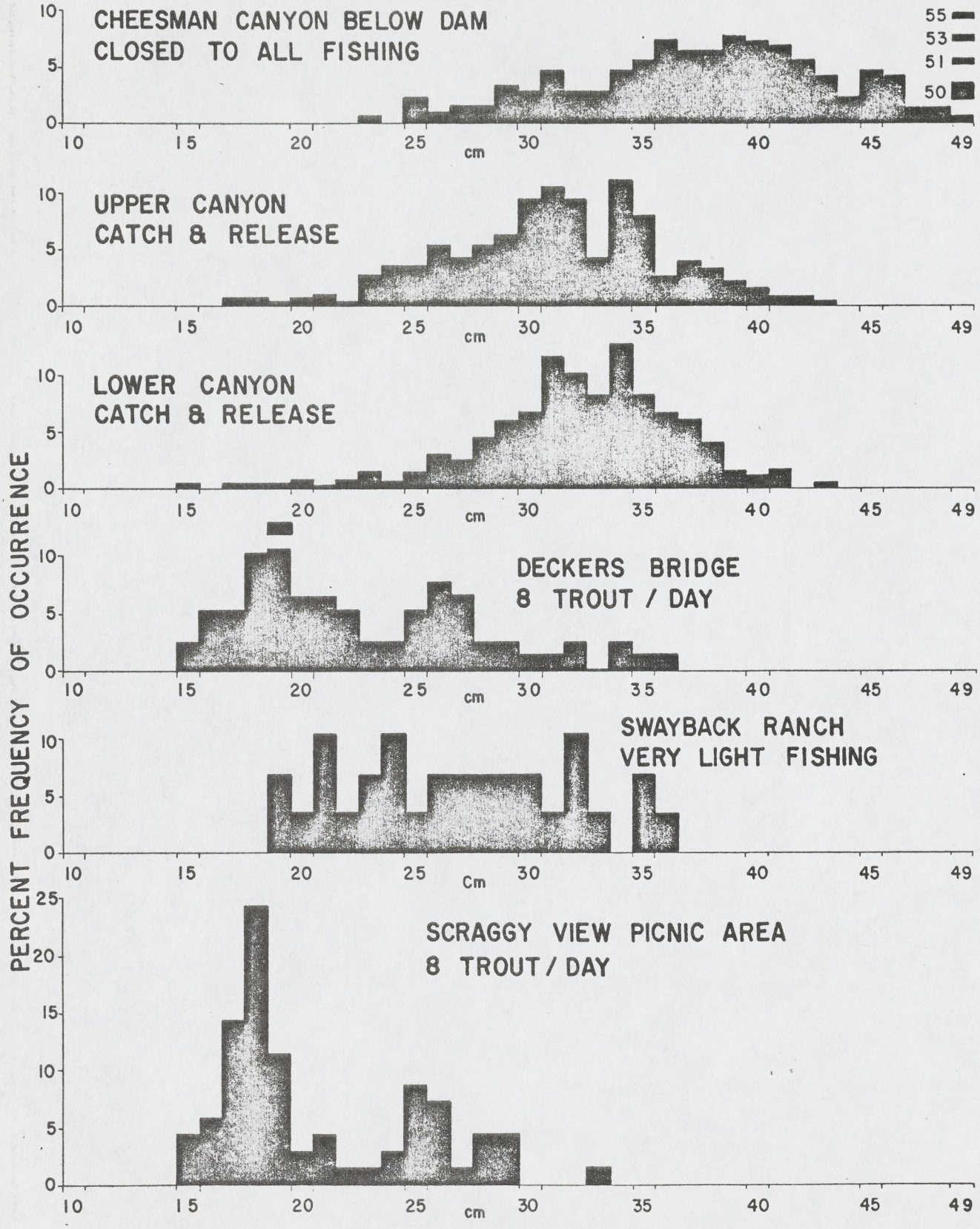
SOUTH PLATTE RIVER
OCTOBER 1980
RAINBOWS





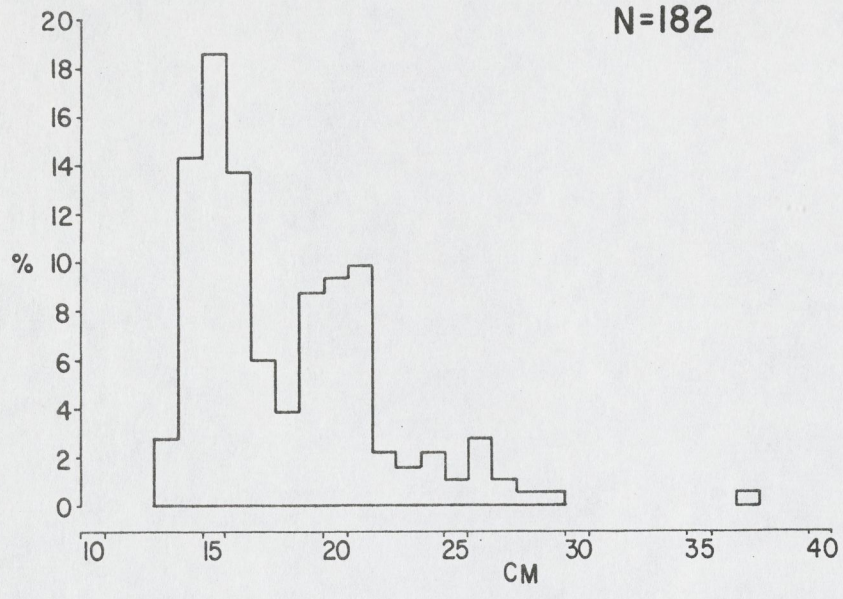


SOUTH PLATTE RIVER
FALL 1980
RAINBOW TROUT POPULATIONS

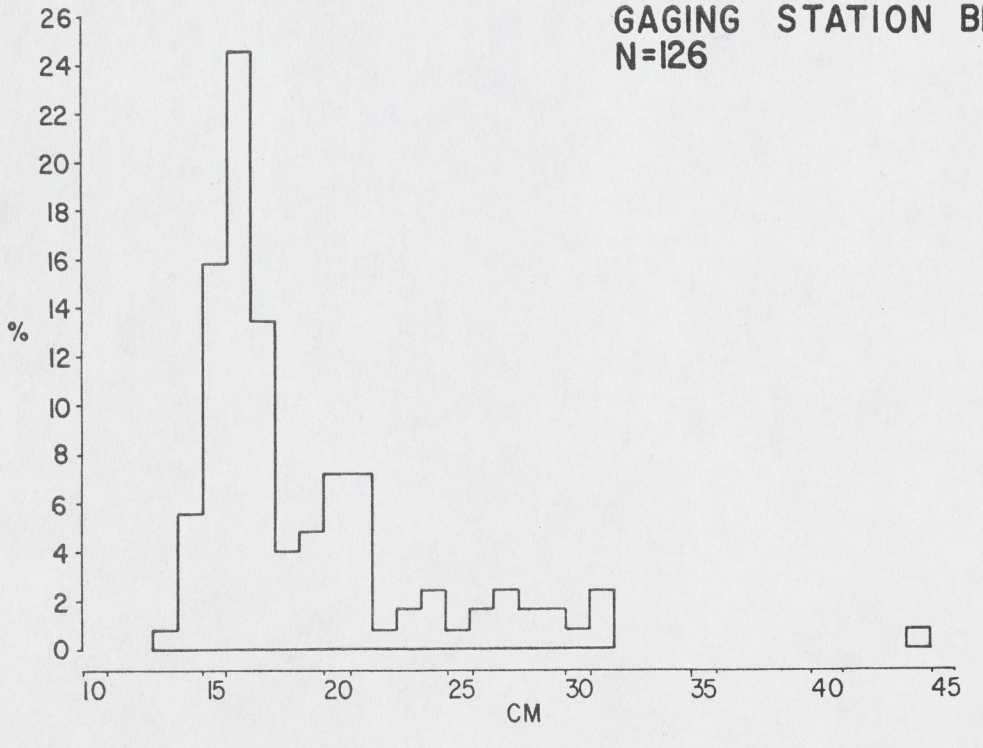


MIDDLE FORK OF THE SOUTH PLATTE RIVER
SEPTEMBER 1980
BROWNS

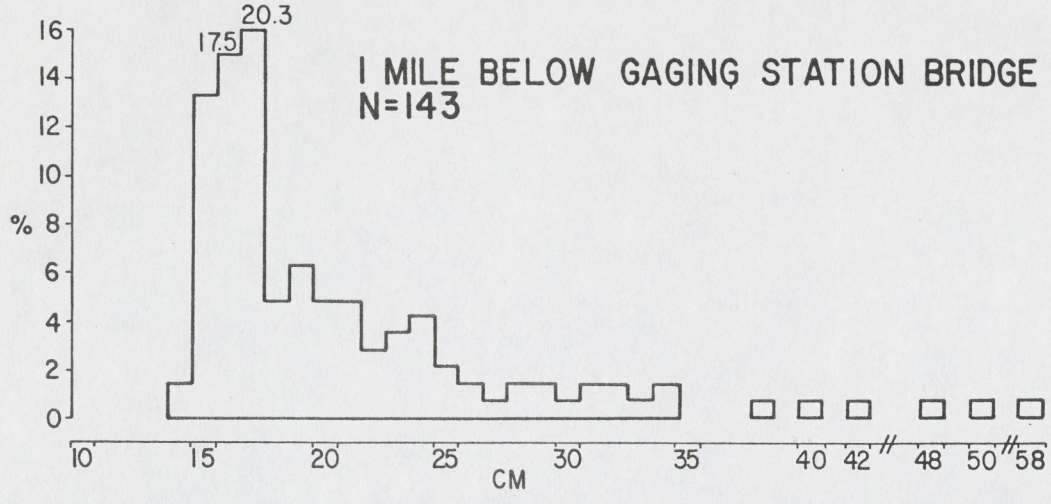
HIGHWAY 9 BRIDGE
N=182

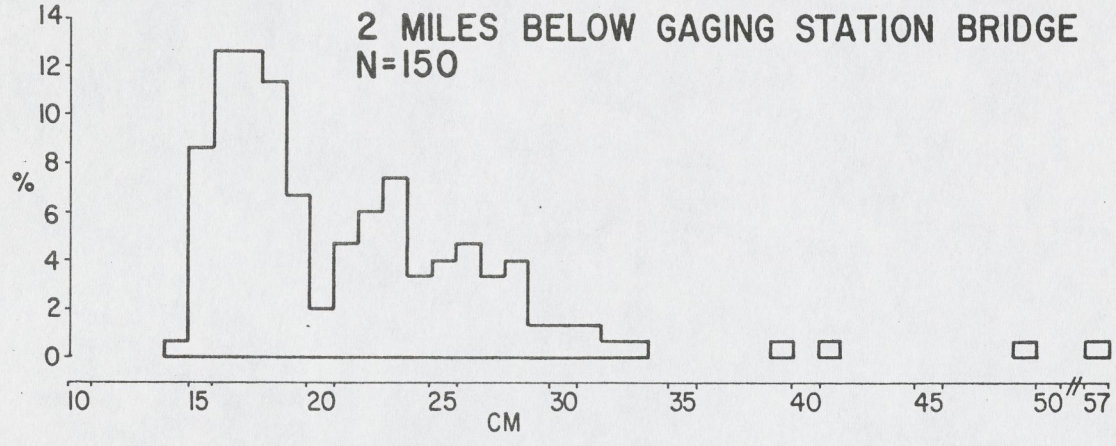


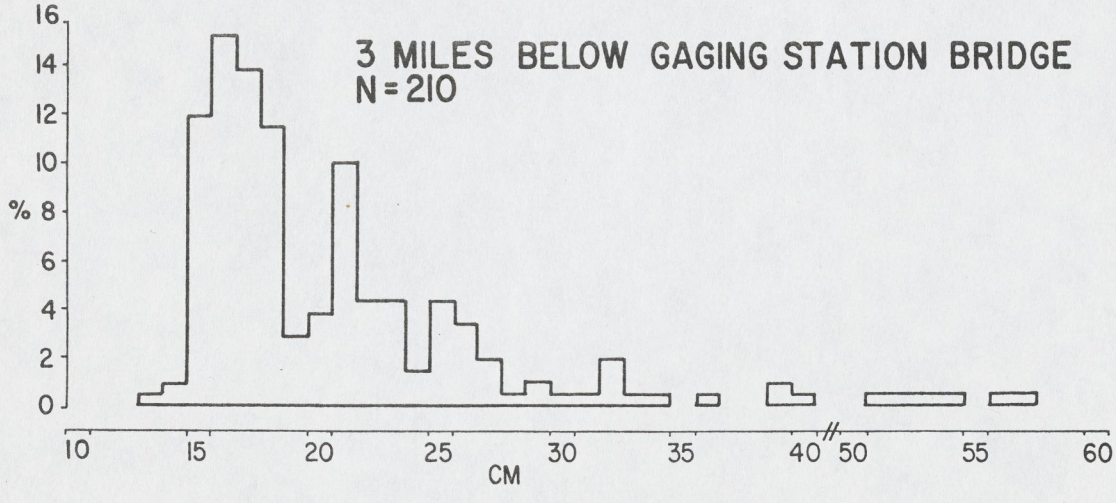
GAGING STATION BRIDGE
N=126



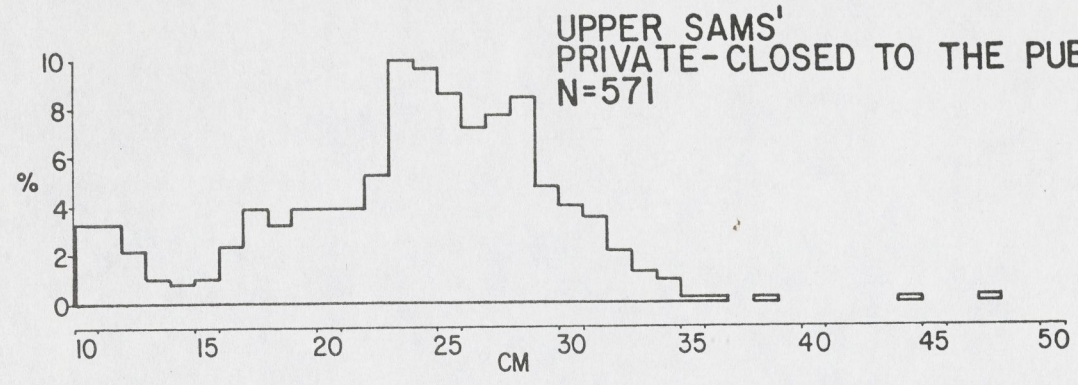
MIDDLE FORK OF THE SOUTH PLATTE RIVER
SEPTEMBER 1980
BROWNS

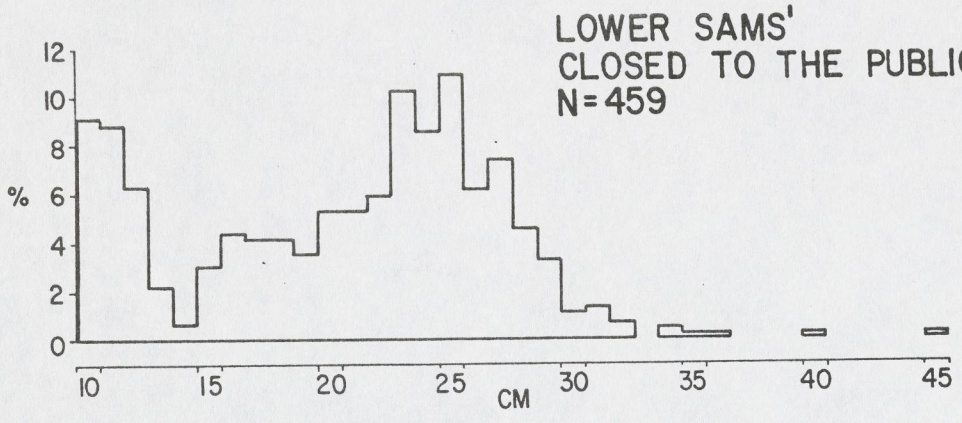


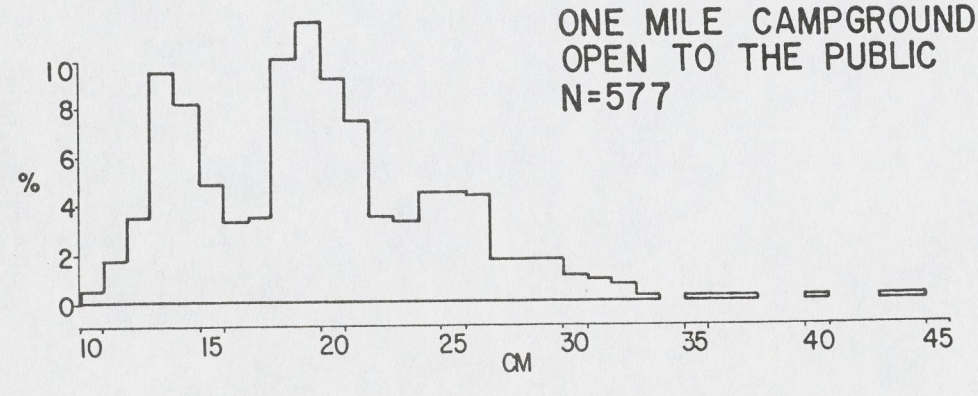




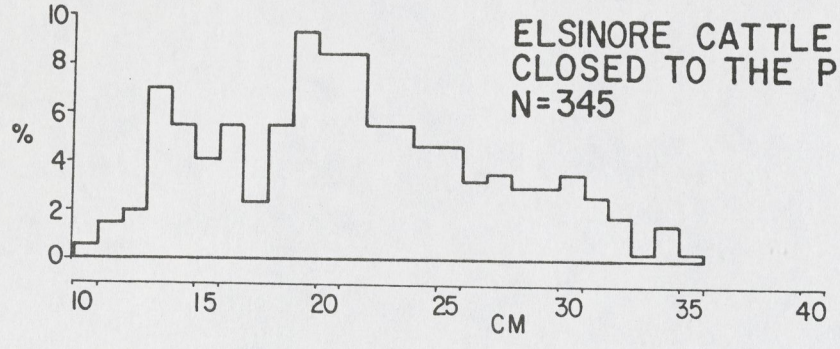
TAYLOR RIVER
OCTOBER 1980
BROWNS

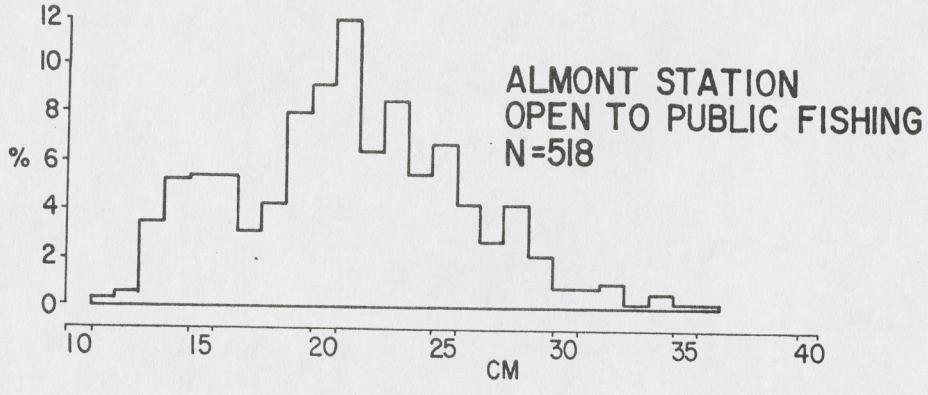


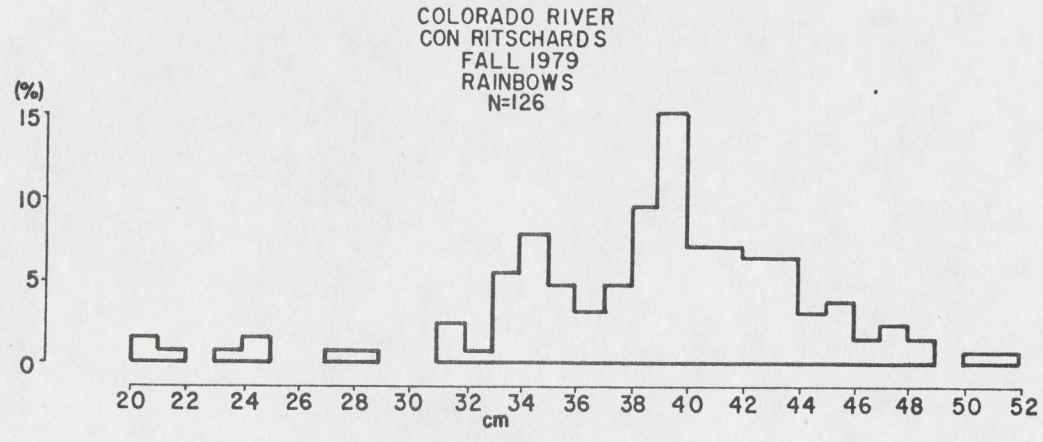


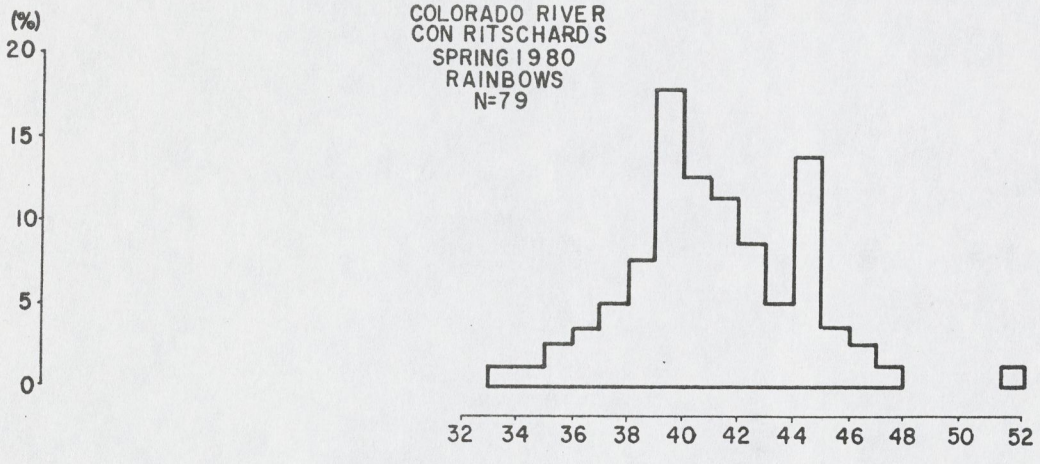


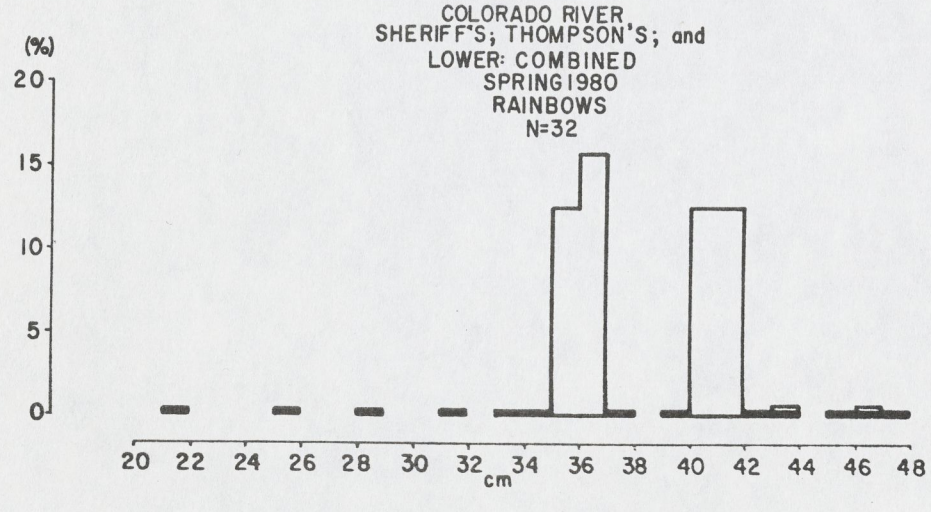
TAYLOR RIVER
OCTOBER 1980
BROWNS



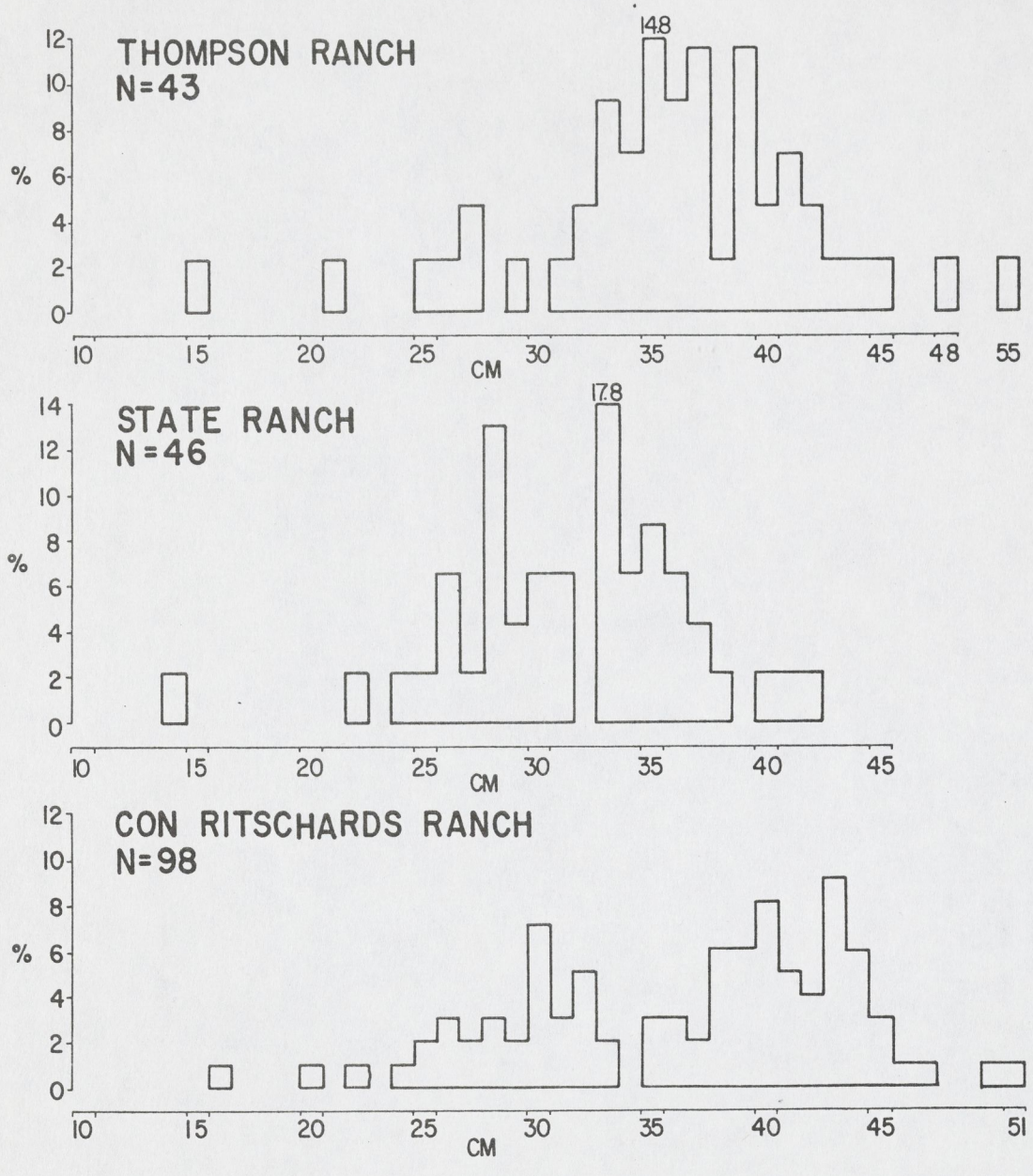


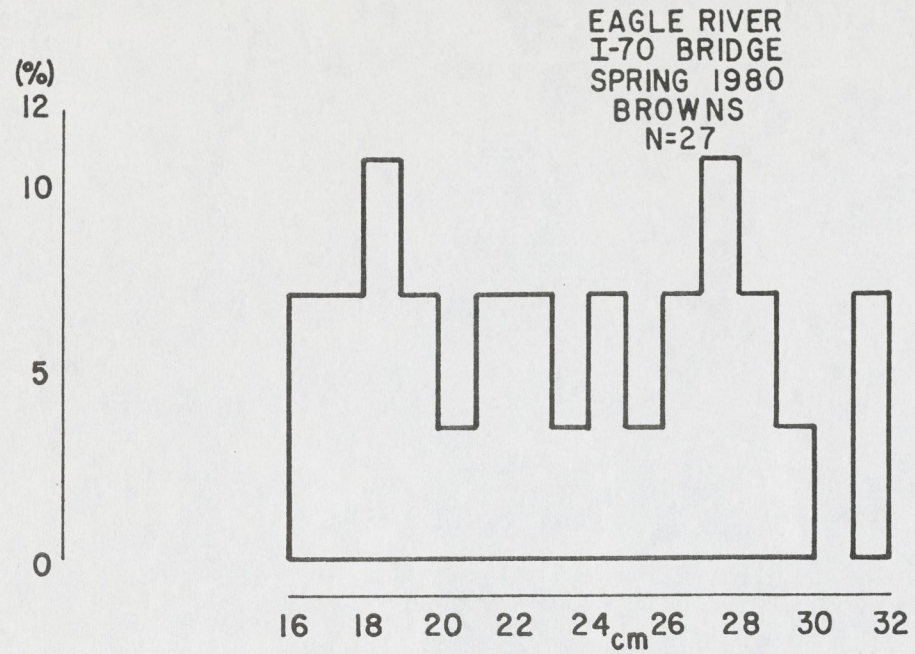

COLORADO RIVER
CON RITSCHARDS
FALL 1979
RAINBOWS
N=126
(%)
15
10
5
0
20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52
cm

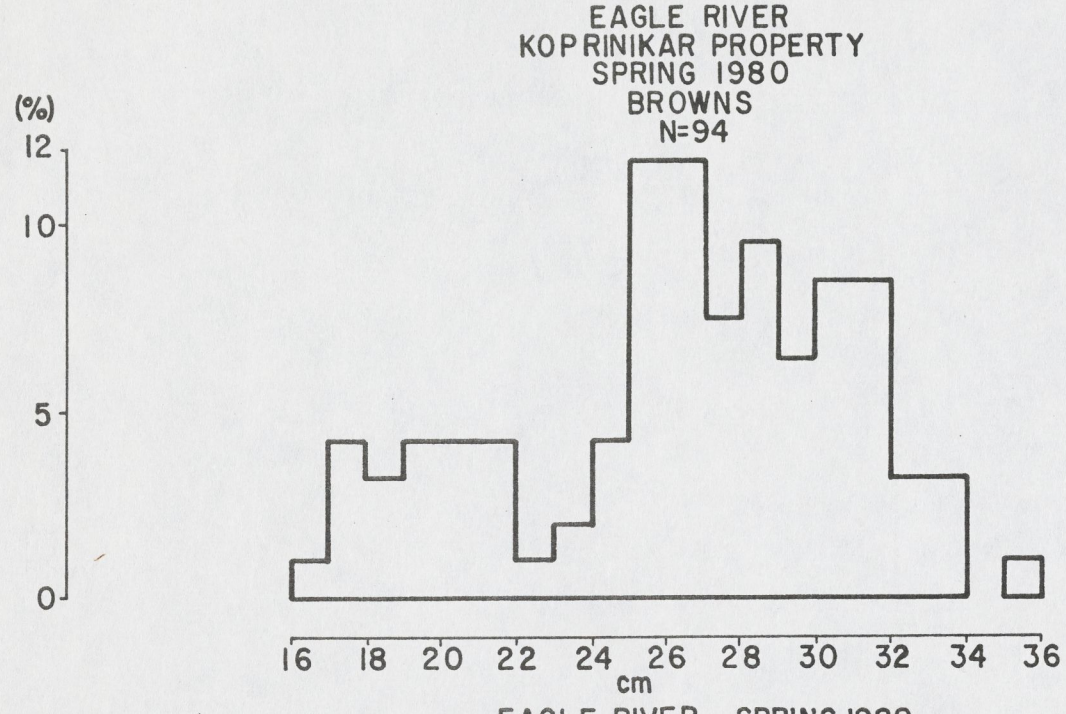

COLORADO RIVER
CON RITSCHARDS
SPRING 1980
RAINBOWS
N=79
(%)
20
15
10
5
0
32 34 36 38 40 42 44 46 48 50 52

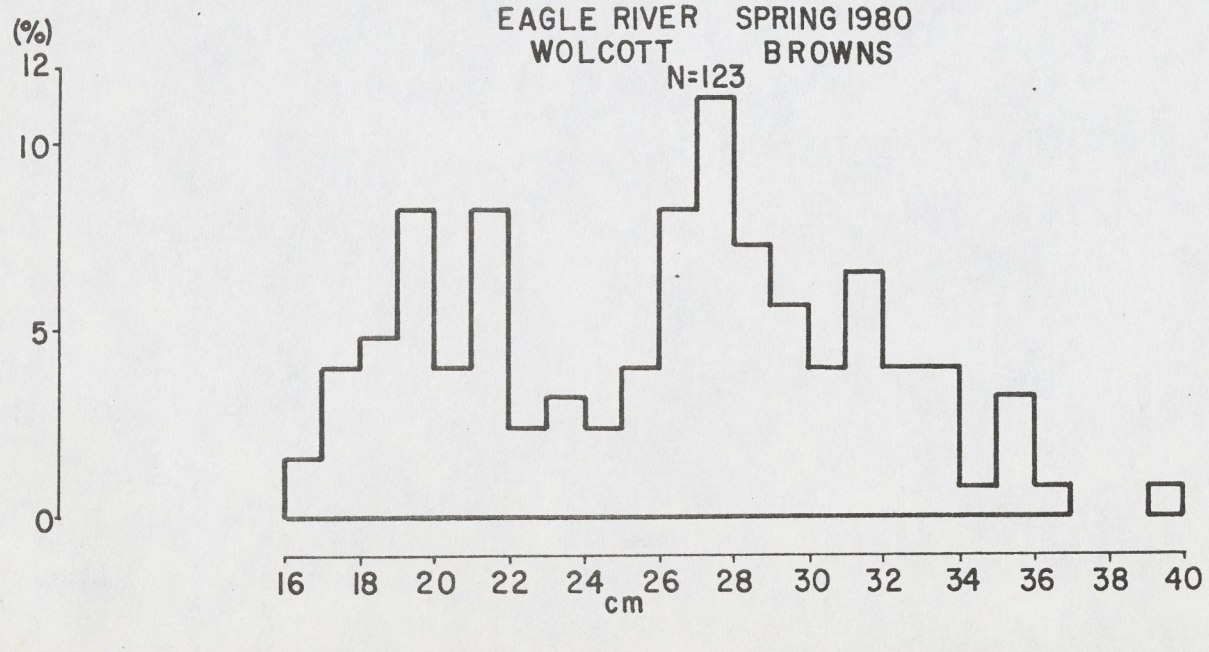

COLORADO RIVER,
SHERIFF'S; THOMPSON'S; and
LOWER: COMBINED
SPRING 1980
RAINBOWS
N=32
(%)
20
15
10
5
0
20 22 24 26 28 30 32 34 36 38 40 42 44 46 48
cm

COLORADO RIVER
FALL 1980
RAINBOWS



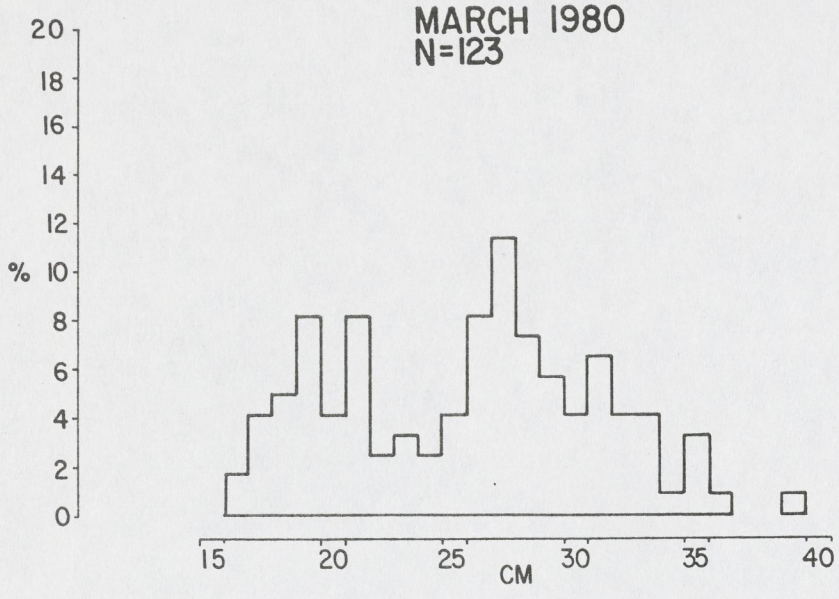

EAGLE RIVER
I-70 BRIDGE
SPRING 1980
BROWNS
N=27
(%)
12
10
5
0
16 18 20 22 24 26 28 30 32
cm

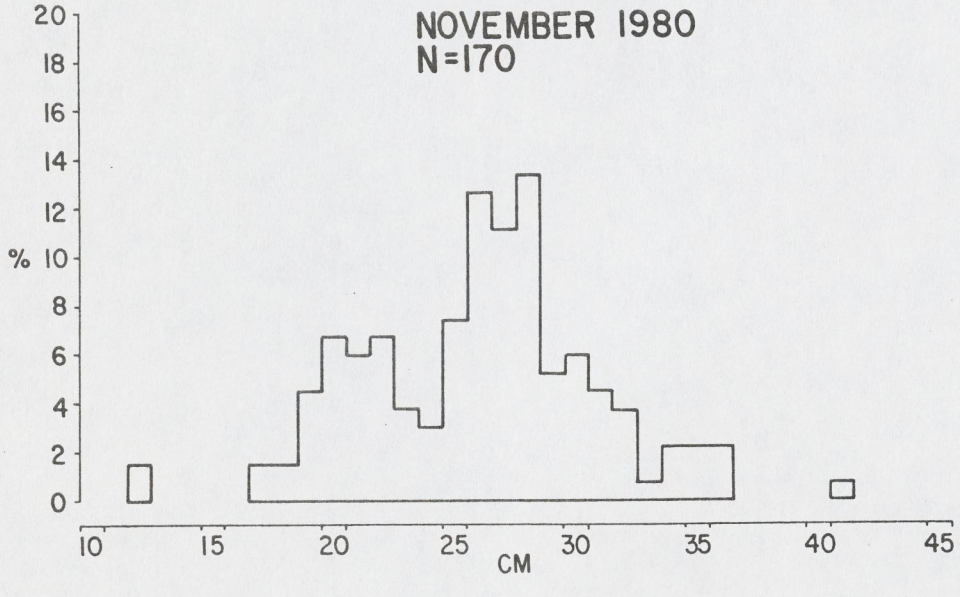

EAGLE RIVER
KOPRINIKAR PROPERTY
SPRING 1980
BROWNS
N=94
(%)
12
10
5
0
16 18 20 22 24 26 28 30 32 34 36
cm


EAGLE RIVER SPRING 1980
WOLCOTT BROWNS
N=123
(%)
12
10
5
0
16 18 20 22 24 26 28 30 32 34 36 38 40
cm

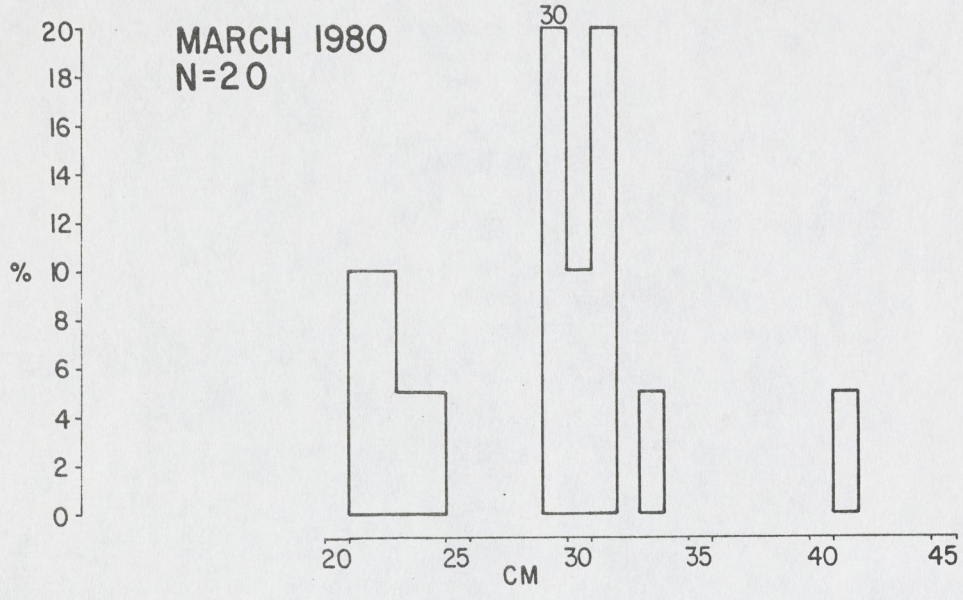
EAGLE RIVER AT WOLCOTT

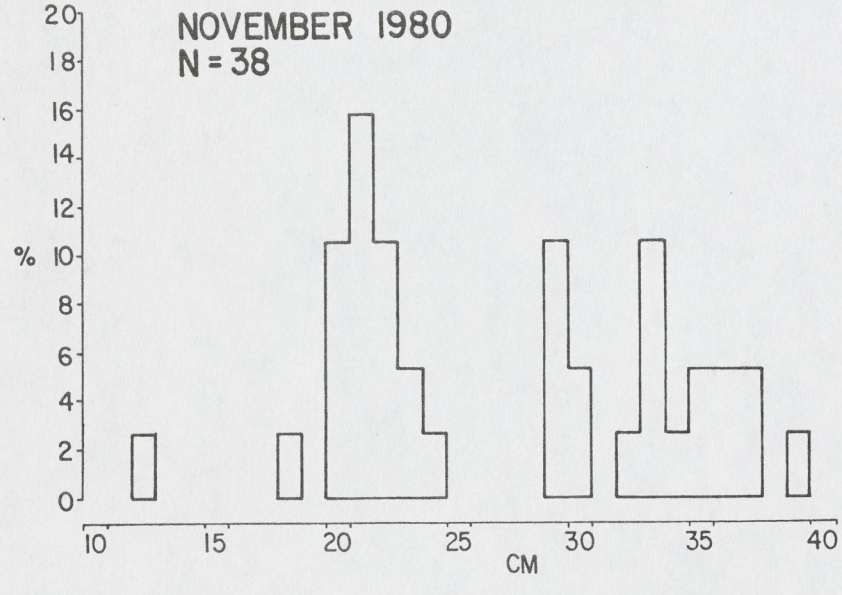
BROWNS



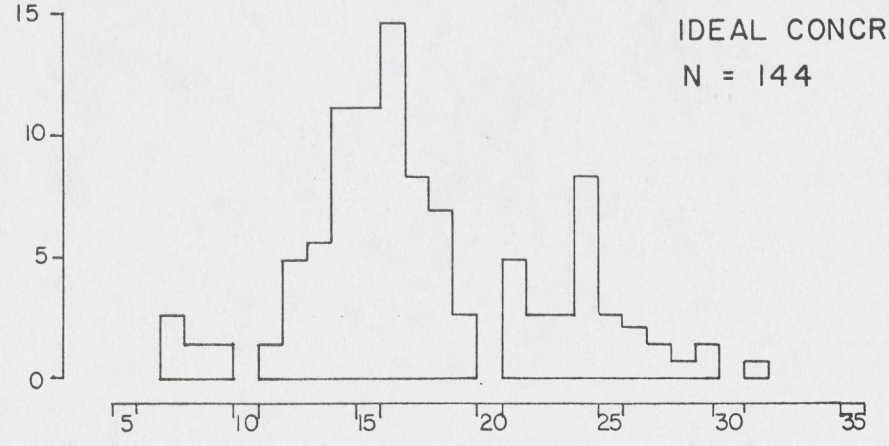


EAGLE RIVER AT WOLCOTT
RAINBOWS



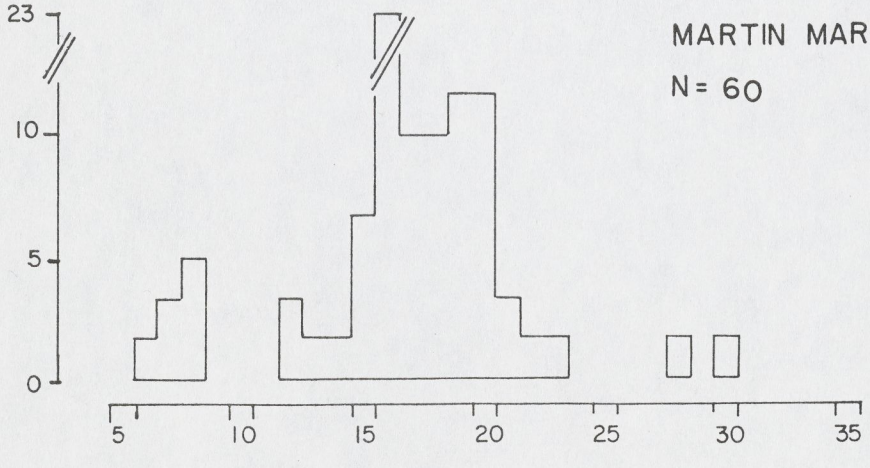


ST VRAIN RIVER
AUGUST 1980
BROWN TROUT POPULATIONS



IDEAL CONCRETE STATION
N = 144

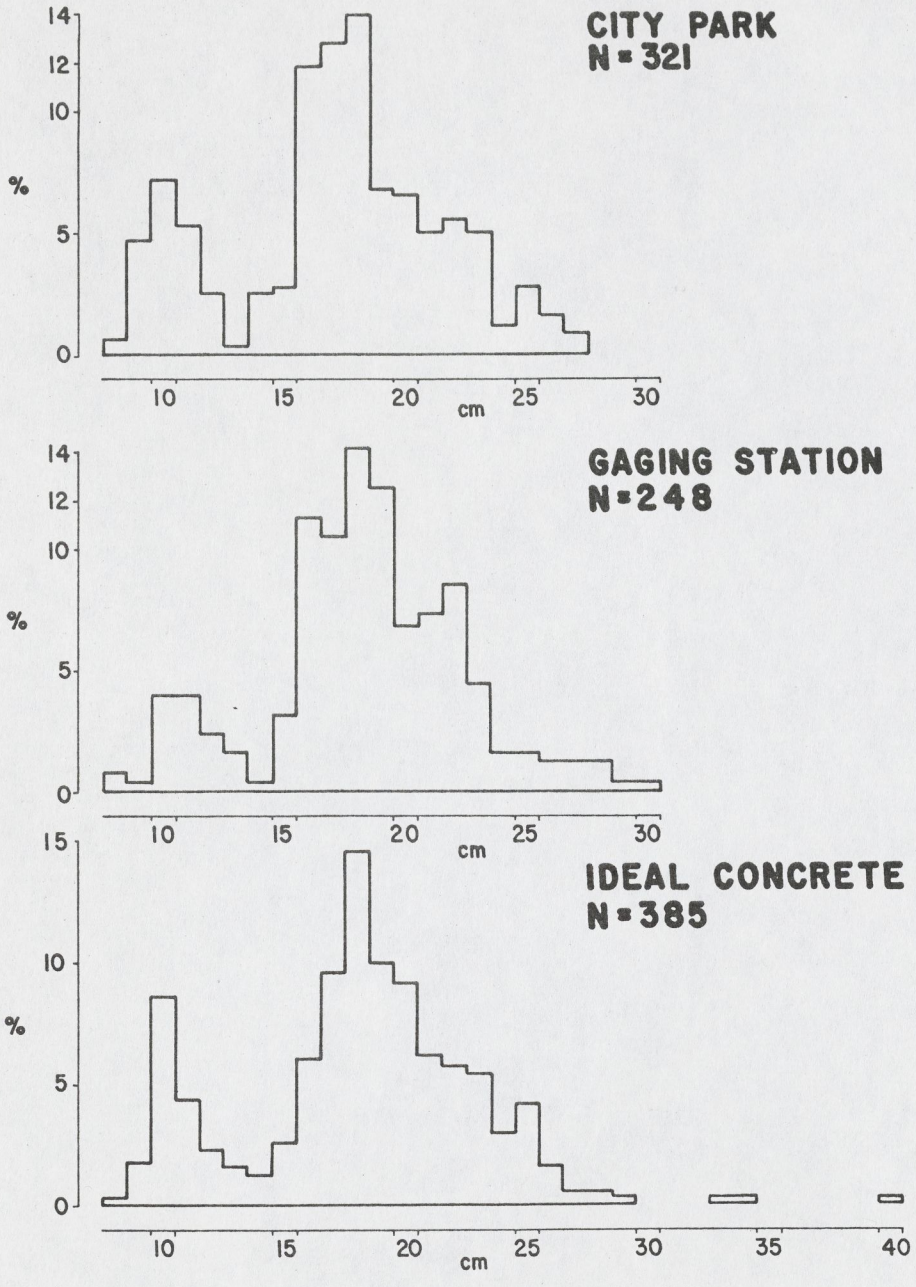
%



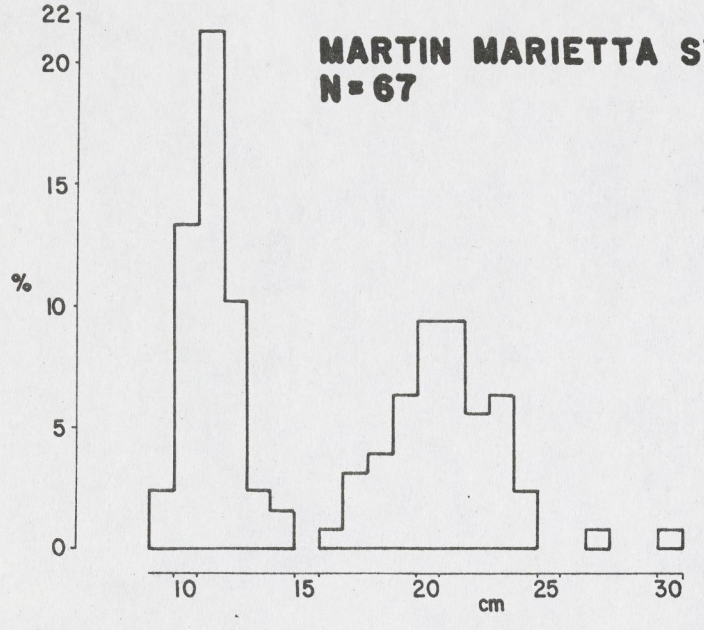
MARTIN MARIETTA STATION
N= 60

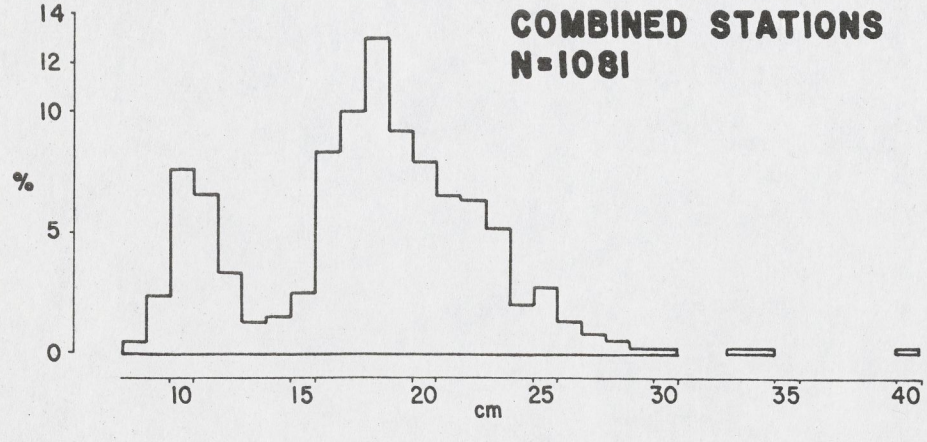
LENTH IN CENTIMETERS

SAINT VRAIN RIVER
NOVEMBER 1980
BROWNS



SAINT VRAIN RIVER
NOVEMBER 1980
BROWNS





APPENDIX III

Back-Calculated Lengths of Trout and Life Tables of Trout for Study Streams

Table III -1. Back-calculated lengths of brown trout from study streams, 1980. All lengths in cm.

Year-class	Age	N	L_c	S.E.	L_1	S.E.	L_2	S.E.	L_3	S.E.	L_4	S.E.	L_5	S.E.
						Poudre River - Upper Stations								
1979	1+	40	16.9	0.25	7.4	0.23								
1978	2+	85	24.1	0.22	8.0	0.16	18.0	0.23						
1977	3+	29	28.3	0.86	8.0	0.34	17.7	0.44	24.7	0.41				
1976	4+	5	34.6	0.93	7.9	0.55	16.0	1.58	25.0	1.78	31.2	1.16		
						St. Vrain River - All Stations								
1979	1+	132	19.0	0.23	9.7	0.17								
1978	2+	50	24.1	0.34	9.4	0.23	18.4	0.30						
1977	3+	2	27.5	0.50	8.1	0.55	18.9	1.40	23.5	2.20				
						Arkansas River - Coaldale								
1979	1+	6	24.7	2.36	13.5	1.36								
1978	2+	32	33.3	0.60	12.5	0.38	24.9	0.61						
1977	3+	14	37.2	0.41	11.9	0.75	24.6	0.92	32.9	0.52				

Table III-2. Back-calculated lengths of brown trout from study streams, 1980. All lengths in cm.

Year class	Age	N	L_c	S.E.	L_1	S.E.	L_2	S.E.	L_3	S.E.	L_4	S.E.	L_5	S.E.	L_6	S.E.	L_7	S.E.
								North Platte - Ginger Quill Range										
1979	1+	4	16.0	0.00	6.2	0.55												
1978	2+	6	26.7	2.08	7.0	0.20	19.8	1.88										
1977	3+	14	29.1	0.51	7.1	0.43	14.4	0.60	22.9	0.70								
1976	4+	9	33.3	1.04	8.3	0.64	14.5	0.65	21.4	0.77	27.5	1.04						
1975	5+	4	40.7	0.85	8.7	1.00	15.3	1.95	23.1	2.45	29.6	2.85	36.0	1.45				
								North Platte - State Leases										
1979	1+	2	17.0	0.99	6.2	0.14												
1978	2+	6	27.3	1.48	7.2	0.73	20.6	1.52										
1977	3+	3	35.3	0.35	7.0	0.75	17.1	1.38	29.5	1.15								
1976	4+	4	34.8	2.72	7.6	1.03	14.6	2.50	22.0	2.34	29.2	2.44						
1975	5+	3	42.7	1.20	6.8	0.77	16.6	0.71	23.9	1.07	30.1	2.02	37.2	1.13				
1974	6+	3	41.0	0.98	7.0	1.10	14.1	1.15	20.9	2.31	26.4	3.12	32.4	1.79	36.7	1.96		
								Michigan River - Murphy and Brownlee 1 and 2 Lease										
1979	1+	16	16.8	0.47	7.7	0.34												
1978	2+	38	25.8	0.42	8.1	0.28	19.1	0.49										
1977	3+	9	32.1	0.90	8.7	0.70	17.8	0.96	25.5	1.22								
1976	4+	13	34.9	0.92	7.6	0.31	14.9	0.62	23.1	0.56	30.4	0.84						
1975	5+	5	39.8	2.18	7.6	0.98	16.0	2.77	22.9	3.16	30.4	2.55	35.8	2.49				
1974	6+	3	40.3	1.33	6.8	1.04	12.3	1.50	19.4	1.73	26.0	0.52	32.6	0.23	36.9	0.86		
1973	7+	2	40.0	0.99	8.2	0.28	14.7	0.07	19.9	2.33	25.8	1.98	29.0	1.56	34.7	1.77	38.2	0.35

Table III-2. Back-calculated lengths of brown trout from study streams, 1980 - continued. All lengths in cm.

Year-class	Age	N	L_c	S.E.	L_1	S.E.	L_2	S.E.	L_3	S.E.	L_4	S.E.	L_5	S.E.	L_6	S.E.	L_7	S.E.
Norris Creek - Irvin Lease																		
1979	1+	17	14.4	0.49	7.0	0.67												
1978	2+	22	22.6	0.43	6.9	0.32	16.6	0.43										
1977	3+	7	28.6	0.37	9.0	1.25	17.4	1.21	25.1	0.53								
1976	4+	2	33.5	0.49	7.1	0.45	16.1	4.17	22.7	4.17	27.2	3.00						
1975	5+	1	38.0	--	8.3	--	4.9	--	20.9	--	29.2	--	33.0	--				
Roaring Fork Creek - Irvin and Manville Lease																		
1979	1+	9	16.7	0.33	8.5	1.17												
1978	2+	14	20.5	0.90	7.0	0.46	15.1	0.50										
1977	3+	10	29.4	1.02	8.1	0.43	16.9	1.07	23.8	1.14								
1976	4+	8	37.6	1.21	7.7	0.96	17.3	1.24	26.8	1.45	32.7	1.32						
1975	5+	2	42.5	1.50	8.6	1.30	20.7	1.35	28.8	2.55	36.9	0.75	39.6	0.55				
North Fork of North Platte - Richards Ranch																		
1979	1+	9	14.8	0.33	7.0	0.20												
1978	2+	9	20.7	0.77	6.1	0.63	14.2	0.87										
1977	3+	2	31.0	0.00	7.1	1.20	16.9	0.71	27.9	0.28								
1976	4+	2	38.5	0.49	7.7	2.33	17.8	0.21	27.6	0.78	34.6	1.77						
1975	5+	1	43.0	--	7.2	--	17.7	--	26.3	--	33.9	--	3.71	--				

Table III-3. Life tables - Conejos River (brown trout/ha).

Sample period season	calendar year	Year-class 1979	1978	1977	1976	1975	1974	1973	1972	1971
				Broyles Bridge Station						
1976						319	210	53	35	18
1978				315	103	161	4	0	0	0
1979			205	76	45	17	3	0	0	0
1980		175	219	59	26	0	0	0	0	0
				Hamilton - T-Bone Ranch Station						
1979			170	30	25	20	11			
1980		82	125	51	17	5	0			
				Spectacle Lake Station						
1976						317	258	79	33	2
1978				965	354	54	27	5	0	0
1979			311	500	59	47	6	0	0	0
1980		315	564	198	58	23	0	0	0	0

Table III-4. Life tables - Fryingpan River (brook trout/ha).

Sample period season	calendar year	Year-class 1980	1979	1978	1977	1976	1975	1974
			Gaging Station #1 - Catch & Release					
Fall	1980		125	318	70	11	0	
			Ruedi Damsite #2 - Catch & Release					
Fall	1978				35	164	42	
Fall	1979			385	151	33	0	
Spring	1980			152	117	12	0	
Fall	1980		109	290	65	4	0	
			Old Faithful Section #3 - Catch & Release					
Fall	1979			100	11	13		
Spring	1980			47	15	0		
Fall	1980		72	188	18	0		

Table III-5. Life tables - Fryingpan River (brown trout/ha).

Sample period season	calendar year	Year-class 1979	1978	1977	1976	1975	1974	1973	1972
				Gaging Station Pool #1 - Catch & Release					
Fall	1979		31	109	106	46	17	0	0
Fall	1980	24	186	397	168	9	0	0	0
				Ruedi Damsite Station #2 - Catch & Release					
Fall	1978			51	204	108	34	3	0
Fall	1979		159	180	69	53	5	0	0
Spring	1980		70	91	51	26	13	0	0
Fall	1980	51	174	171	31	4	0	0	0
				Old Faithful Station #3 - Catch & Release					
Fall	1979		243	352	107	40	0	0	0
Spring	1980		194	208	67	14	0	0	0
Fall	1980	204	479	248	21	0	0	0	0
				Upper Standard Regulation Station #4 - 8 Fish/Day					
Fall	1979		252	271	58	27	4	0	0
Spring	1980		108	85	22	6	3	0	0
Fall	1980	104	226	77	6	0	0	0	0
				Taylor River Station #5 - 8 Fish/Day					
Fall	1978			86	198	131	44	0	0
Fall	1979		348	265	80	31	0	0	0
Spring	1980		237	170	43	13	6	0	0
Fall	1980	192	170	110	32	0	0	0	0
				Big Pull-Out Station #6 8 Fish/Day					
Fall	1980	30	39	54	16	0	0	0	0

Table III-6. Life tables - Fryingpan River (rainbows/ha).

Sample period season	calendar year	Year-class 1979	1978	1977	1976	1975	1974	1973	1972
				Gaging Station Pool #1 - Catch & Release					
Fall	1979			51	124	98	20		
Fall	1980	31	23	121	112	78	38		
				Ruedi Damsite Station #2 - Catch & Release					
Fall	1978			46	245	71	41	12	
Fall	1979		30	81	58	40	11	0	
Spring	1980		45	87	84	59	22	0	
Fall	1980	45	71	66	35	16	8	0	
				Old Faithful Station #3 - Catch & Release					
Fall	1979		29	134	96	46	19	0	
Spring	1980		26	113	77	35	12	0	
Fall	1980	78	98	84	43	29	12	0	
				Upper Standard Regulation Station #4 - 8 Fish/Day					
Fall	1979		125	122	75	19	7	0	
Spring	1980		17	53	20	2	0	0	
Fall	1980	13	19	10	6	0	0	0	
				Taylor Creek Staiton #5 - 8 Fish/Day					
Fall	1978			130	267	84	10	3	
Fall	1979		345	206	53	22	6	0	
Spring	1980		130	212	49	24	7	0	
Fall	1980	140	97	22	11	10	0	0	
				Big Pullout Station #6 - 8 Fish/Day					
Fall	1979		122	168	50	1	0	0	
Fall	1980	146	212	159	50	15	0	0	

Table III-7. Life tables - Roaring Fork River (species/ha).

Sample period		Year-class						
season	calendar year	1980	1979	1978	1977	1976	1975	1974
				Aspen Institute Station (Rainbows)				
Fall	1978				197	260	101	10
Fall	1979			99	361	274	92	12
Fall	1980		57	126	246	88	22	0
				Aspen Institute Station (Browns)				
Fall	1978				145	43	20	29
Fall	1979			67	123	120	33	--
Fall	1980			22	98	114	19	19
				McFarlane Creek Station (Browns)				
Fall	1979			134	428	128	141	6
Fall	1980		91	128	402	224	5	0

Table III-8. Life tables - South Platte River (browns/ha).

Sample period season	calendar year	Year-class 1980	1979	1978	1977	1976	1975	1974	1973
		Below Cheesman Dam - Closed to Fishing							
Fall	1980		4	133	159	5			
		Upper Canyon Section - Catch & Release							
Fall	1979			78	245	402	36		
Spring	1980		6	230	385	75	0		
Fall	1980		182	311	472	43	0		
		Lower Canyon Section - Catch & Release							
Fall	1979			116	367	520	42		
Spring	1980		22	237	595	195	0		
Fall	1980		219	319	492	34	0		
		Wigwam Club - Private Harvest Allowed							
Fall	1979			87	459	739	61	0	
		Deckers Bridge Section - 8 Fish/Day							
Fall	1979			657	327	435	30	0	
Spring	1980		142	816	433	35	0	0	
Fall	1980		792	467	179	292	11	0	
		Upper Swayback Ranch - Private - Light Harvest							
Fall	1979			27	256	384	26		
Spring	1980		85	68	159	31	0		
Fall	1980		12	168	273	90	0		
		Lower Swayback Ranch - Private - Light Harvest							
Spring	1980		89	149	319	84	0		
Fall	1980		16	165	266	51	0		
		Scraggy View - 8 Fish/Day							
Fall	1979			102	343	512	16		
Spring	1980		360	769	264	14	0		
Fall	1980		118	524	74	54	0		

Table III-9. Life tables - South Platte River (rainbow trout/ha).

Sample period		Year-class							
season	calendar year	1980	1979	1978	1977	1976	1975	1974	1973
		Below Cheesman Dam - Closed to Fishing							
Fall	1980		3	117	396	384	65	4	0
		Upper Canyon Section - Catch & Release							
Fall	1979			106	682	583	56	0	0
Spring	1980			177	786	626	78	0	0
Fall	1980		35	344	655	288	139	0	0
		Lower Canyon Section - Catch & Release							
Fall	1979			105	758	685	88	0	0
Spring	1980			93	732	703	114	0	0
Fall	1980		20	249	557	274	127	0	0
		Deckers Bridge Section - 8 Fish/Day							
Fall	1979			237	181	62	8	0	0
Spring	1980			45	67	51	32	6	0
Fall	1980		20	219	106	70	0	0	0
		Upper Swayback Ranch Section							
Fall	1979		10	19	67	105	29	0	0
Fall	1980		14	103	127	28	0	0	0
		Scraggy View Section - 8 Fish/Day							
Fall	1979			107	152	24	2	0	
Spring	1980			53	67	17	1	0	
Fall	1980		12	115	74	22	5	8	

Table III-10. Life tables - Middle Fork of the South Platte River (browns/ha).

Sample period		Year-class							
season	calendar year	1980	1979	1978	1977	1976	1976	1974	1973
			Station #1 - at Garo Bridge						
Fall	1979		655	491	770	144	109	12	
Fall	1980	353	637	950	103	77	0	0	
			Station #2 - at Gaging Station Bridge						
Fall	1979		1,007	403	374	118	47	8	
Fall	1980	115	592	267	83	43	8	0	
			State #3 - 1 Mile below Gaging Station Bridge						
Fall	1979		1,624	856	418	127	26	9	
Fall	1980	342	1,047	390	238	12	49	25	
			Station #4 - 2 Miles below Gaging Station Bridge						
Fall	1980	636	604	321	265	67	8	0	
			Station #5 - 3 Miles below Gaging Station Bridge						
Fall	1980	524	708	321	172	85	19	19	6

Table III-11. Life tables - Taylor River (brown trout).

Year-class	Spring 1974	Fall 1974	Spring 1975	Fall 1975	Fall 1979	Fall 1980
			Almont Station			
1969	9	9				
1970	171	41	6	0		
1971	372	421	47	43		
1972	310	322	249	360		
1973		106	119	296		
1974			89	57	6	0
1975					27	37
1976					289	62
1977					713	429
1978					143	438
1979						79
			Elsenore Cattle			
1969		15				
1970	91	75	--	18		
1971	231	493	53	93		
1972	278	263	190	405		
1973		159	217	262		
1974				88	28	0
1975					39	49
1976					263	110
1977					684	385
1978					228	447
1979						141

Table III-11. Life tables - Taylor River (brown trout) - continued.

Year-class	Spring 1974	Fall 1974	Spring 1975	Fall 1975	Fall 1979	Fall 1980
			One Mile Campground			
1969	20	5	0			
1970	31	37	15	22		
1971	573	527	0	44		
1972	392	433	407	386		
1973		283	353	334		
1974				199	66	0
1975					10	42
1976					324	83
1977					1,066	525
1978					530	855
1979						328
			Lower Sams			
1969		42				
1970	322	297	--	33		
1971	730	467	168	420		
1972	74	124	532	395		
1973		14	128	137		
1974				25	31	
1975					53	87
1976					463	170
1977					711	952
1978					36	603
1979						186
			Upper Sams			
1969		47				
1970	170	395	--	30		
1971	695	439	190	358		
1972	108	65	474	554		
1973		54	103	166		
1974					6	
1975					27	37
1976					289	62
1977					713	429
1978					143	438
1979						79

Table III-12. Life tables - Eagle River (browns and rainbows/ha).

Sample period		Year-class					
season	calendar year	1980	1979	1978	1977	1976	1975
			Wolcott (Browns)				
Spring	1980			73	239	41	15
Fall	1980		49	171	33	1	0
			Wolcott (Rainbows)				
Spring	1980			21	45	3	
Fall	1980	3	27	35	34	0	

APPENDIX IV

Miscellaneous Figures and Data

Table IV-1. Length-weight regressions for rainbow and brown trout in two study streams.

Stream name	Length-weight regressions
Cache la Poudre River	
Browns	Log wt. = -3.995 + 2.810 Log L
Rainbows	Log wt. = -4.317 + 2.917 Log L
St. Vrain River	
Browns	Log wt. = -.4.437 + 2.934 Log L

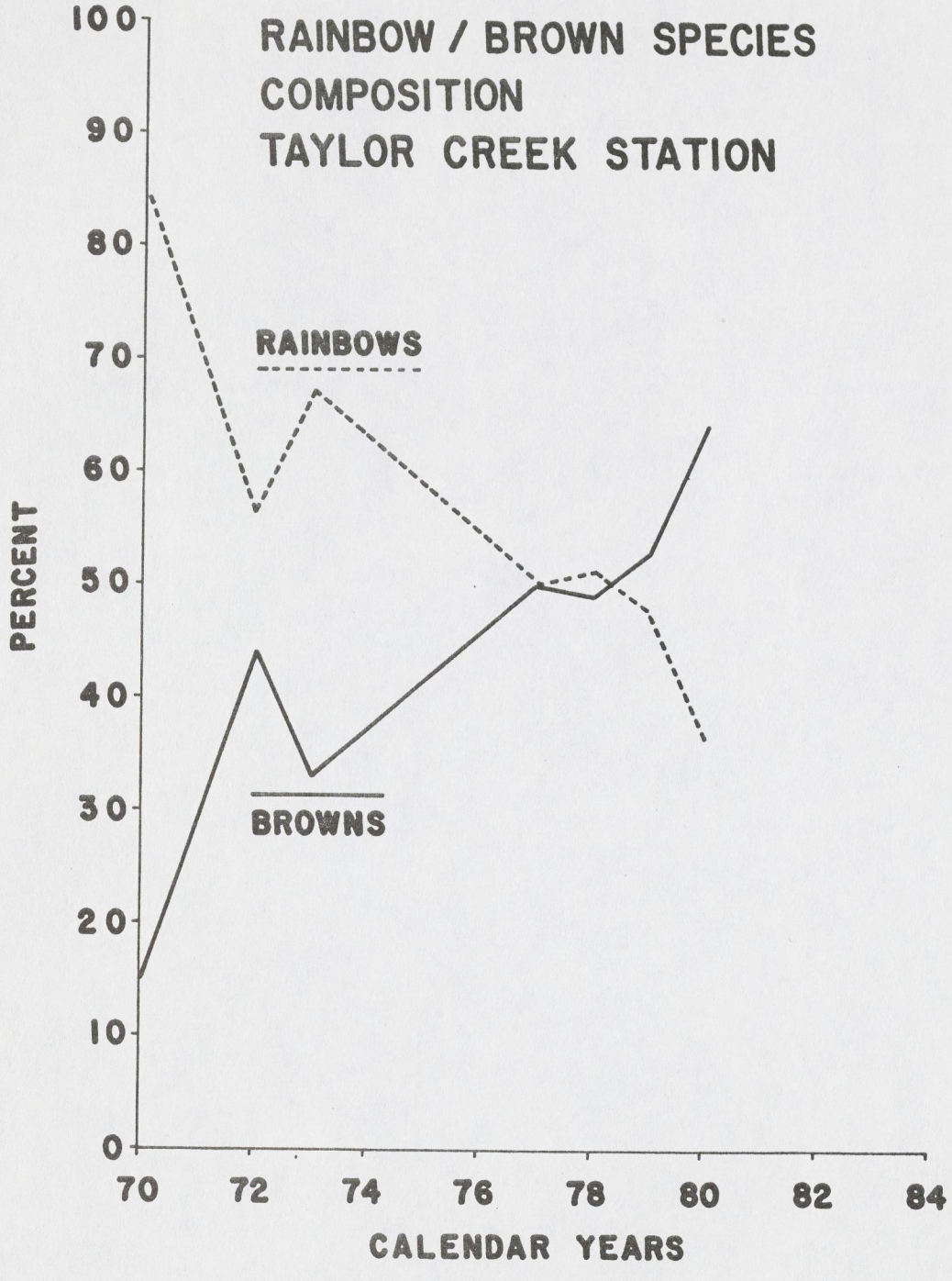


Figure IV-1. Rainbow/brown species composition, Taylor Creek Station.

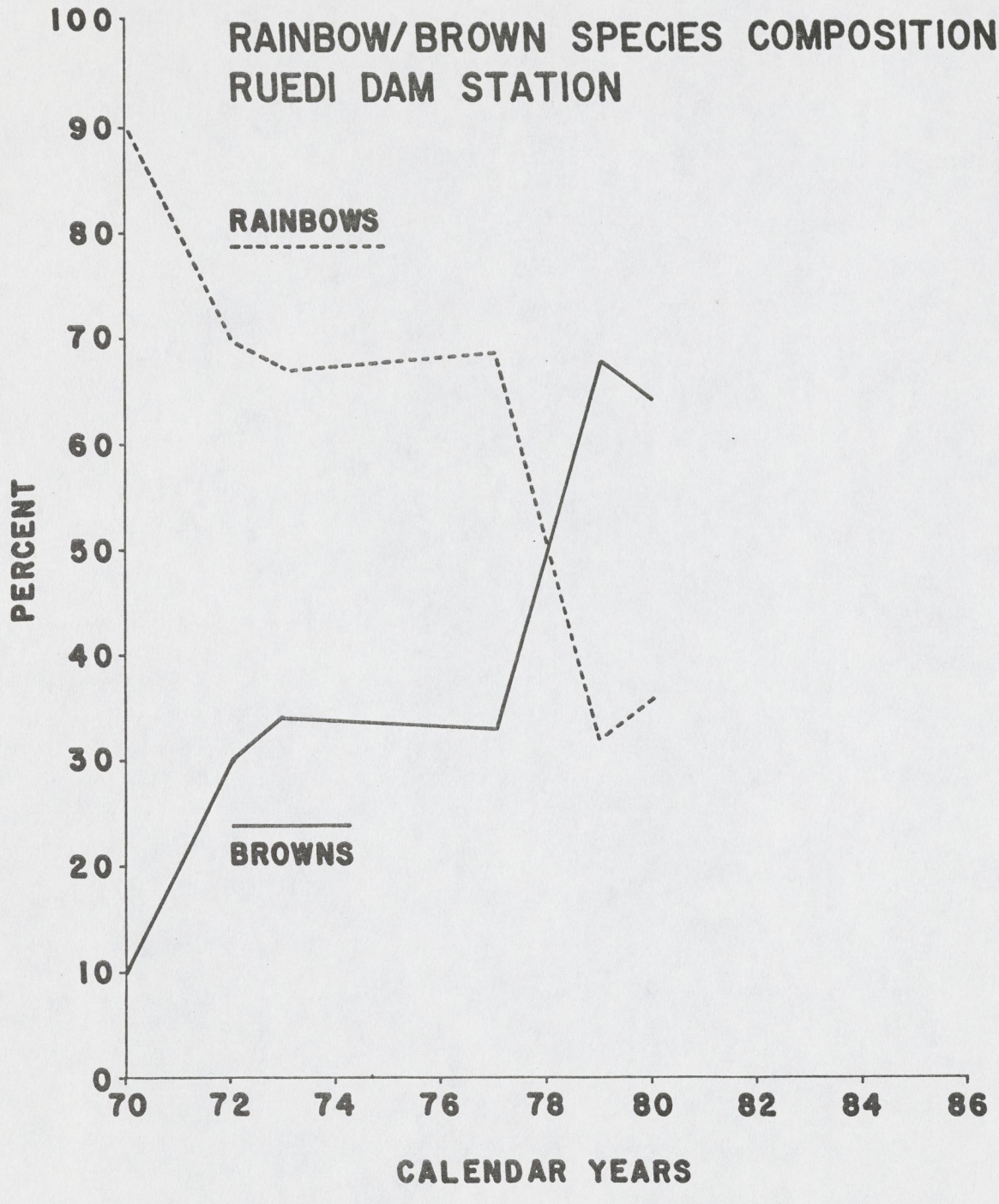


Figure IV-2. Rainbow/brown species composition, Ruedi Dam station.

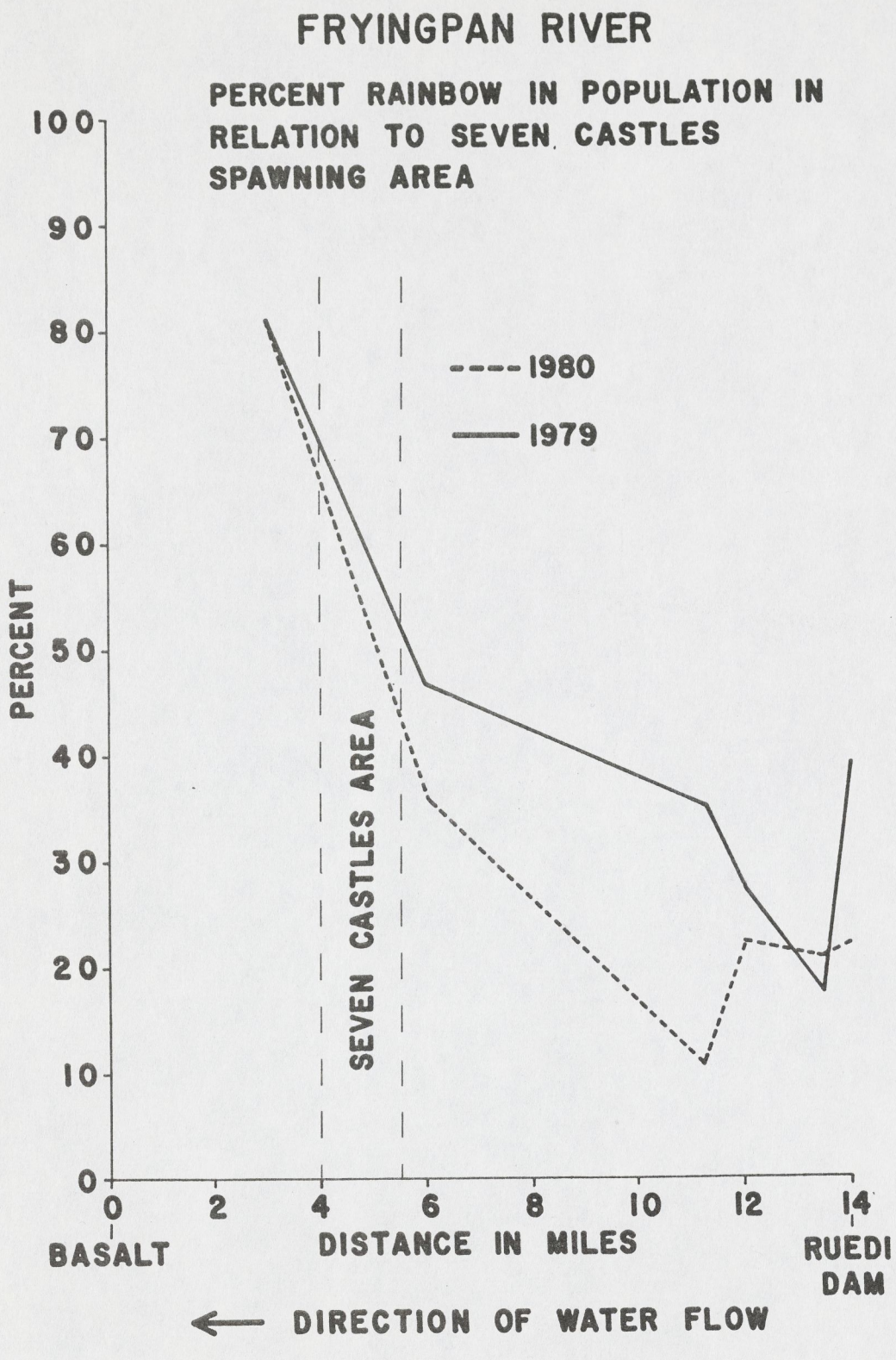


Figure IV-3. Fryingpan River percent rainbow in population in relation to Seven Castles spawning area.

FRYINGPAN RIVER
1980 BROWN TROUT
POPULATION & HARVEST DISTRIBUTION

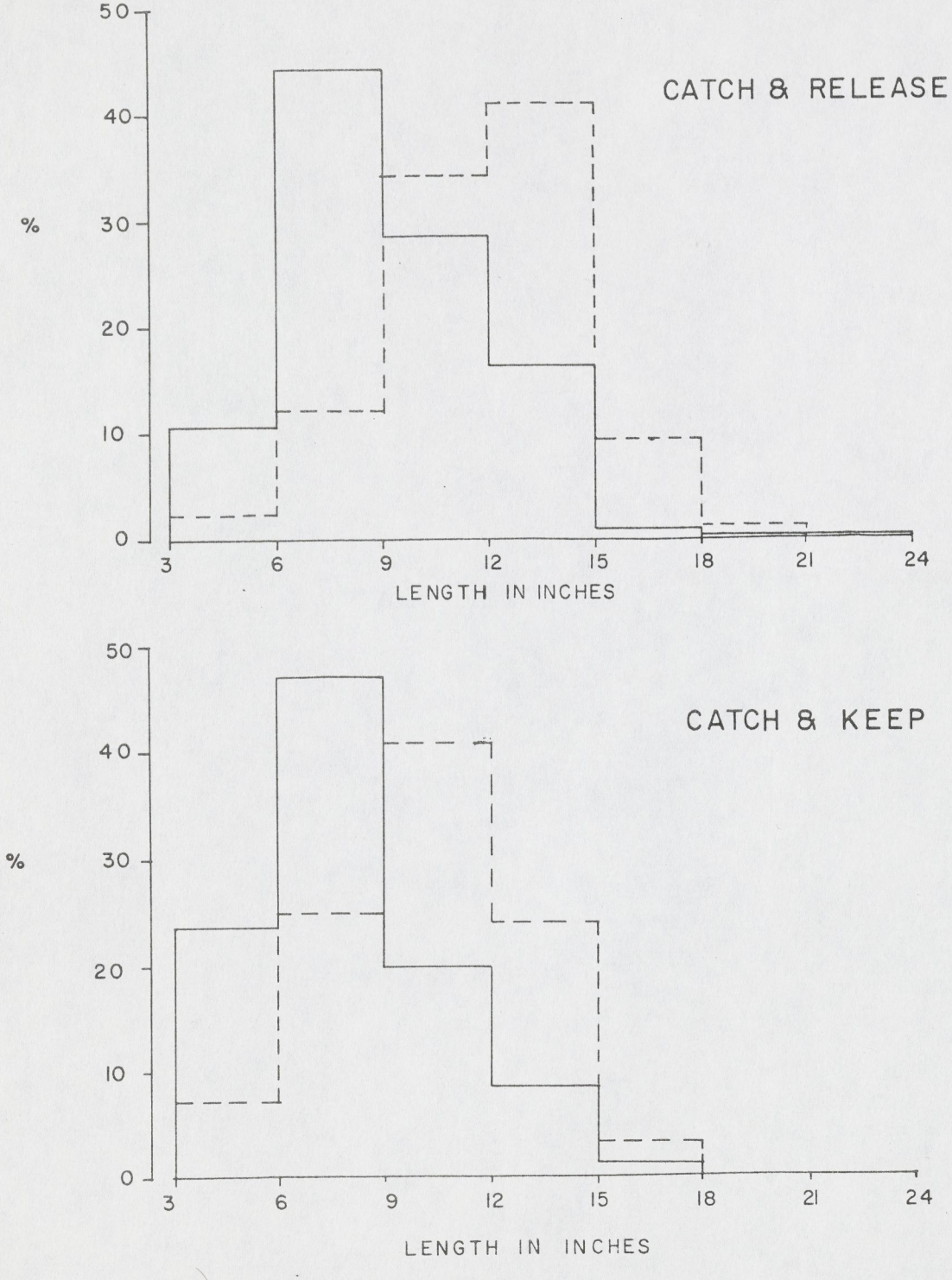


Figure IV-4. Fryingpan River 1980 brown trout population and harvest distribution.

FRYINGPAN RIVER
1980 RAINBOW TROUT
POPULATION & HARVEST DISTRIBUTION

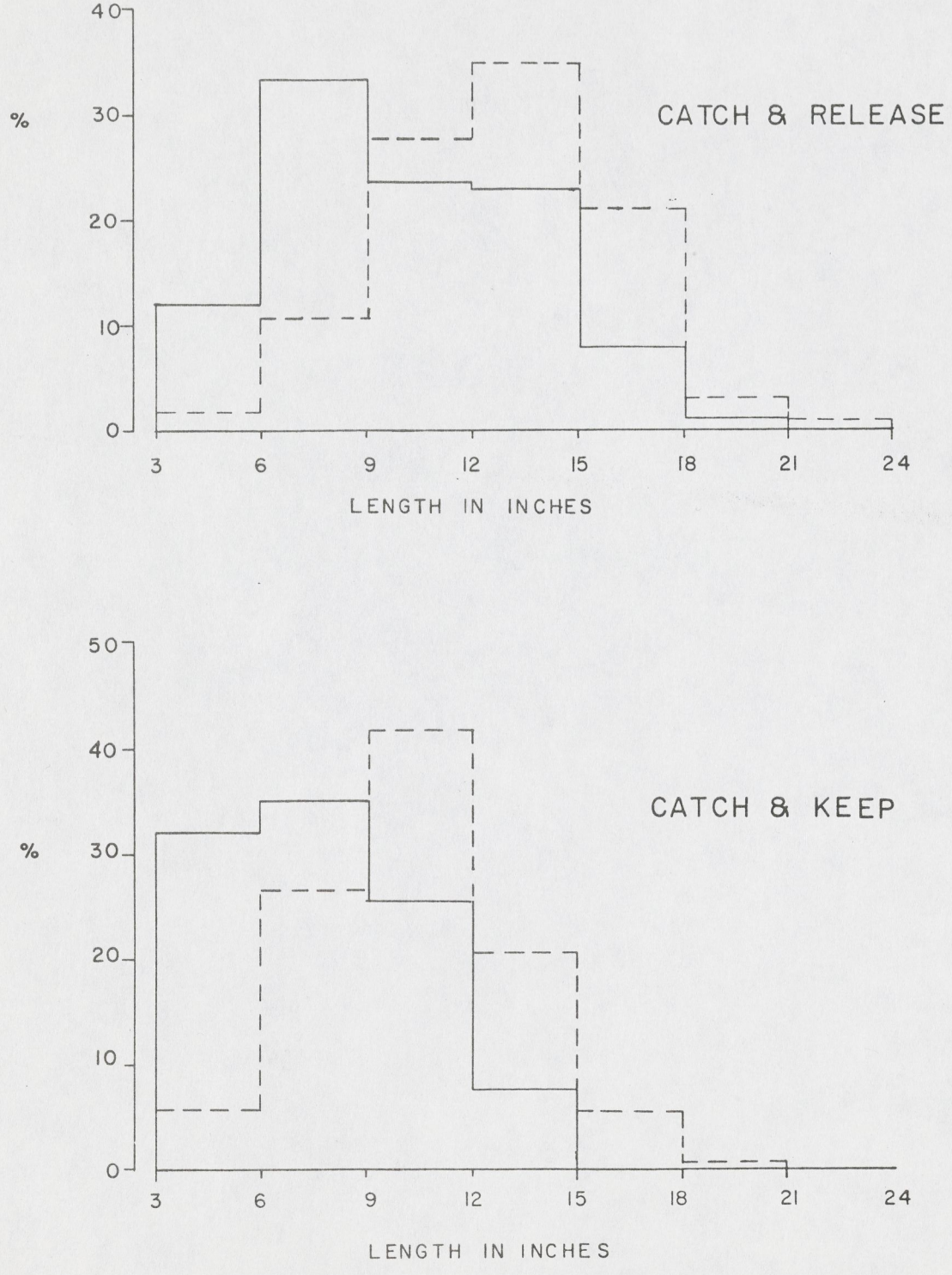


Figure IV-5. Fryingpan River 1980 rainbow trout population and harvest distribution.

SOUTH PLATTE RIVER
1980 BROWN TROUT
POPULATION & HARVEST DISTRIBUTION

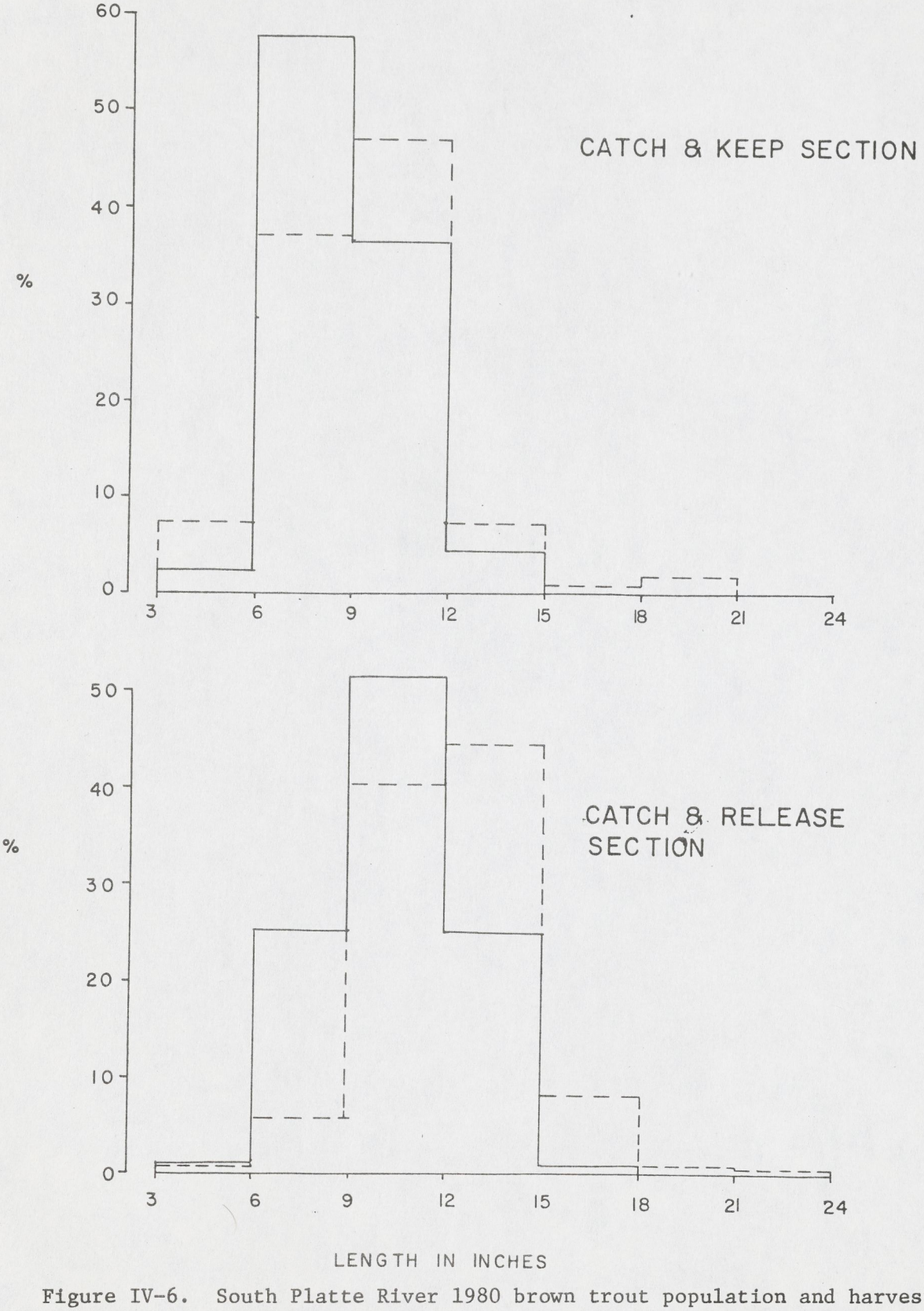


Figure IV-6. South Platte River 1980 brown trout population and harvest distribution.

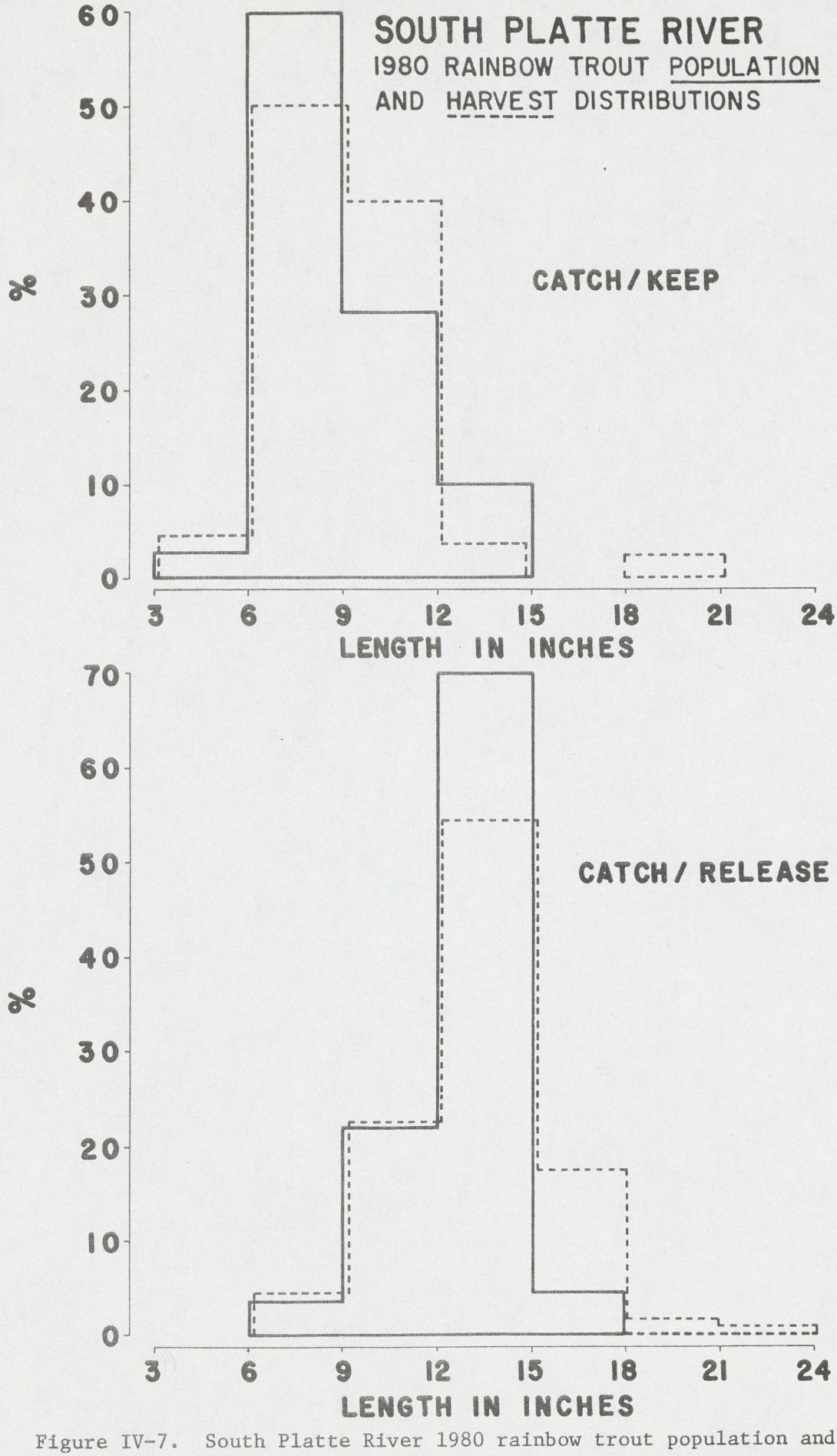
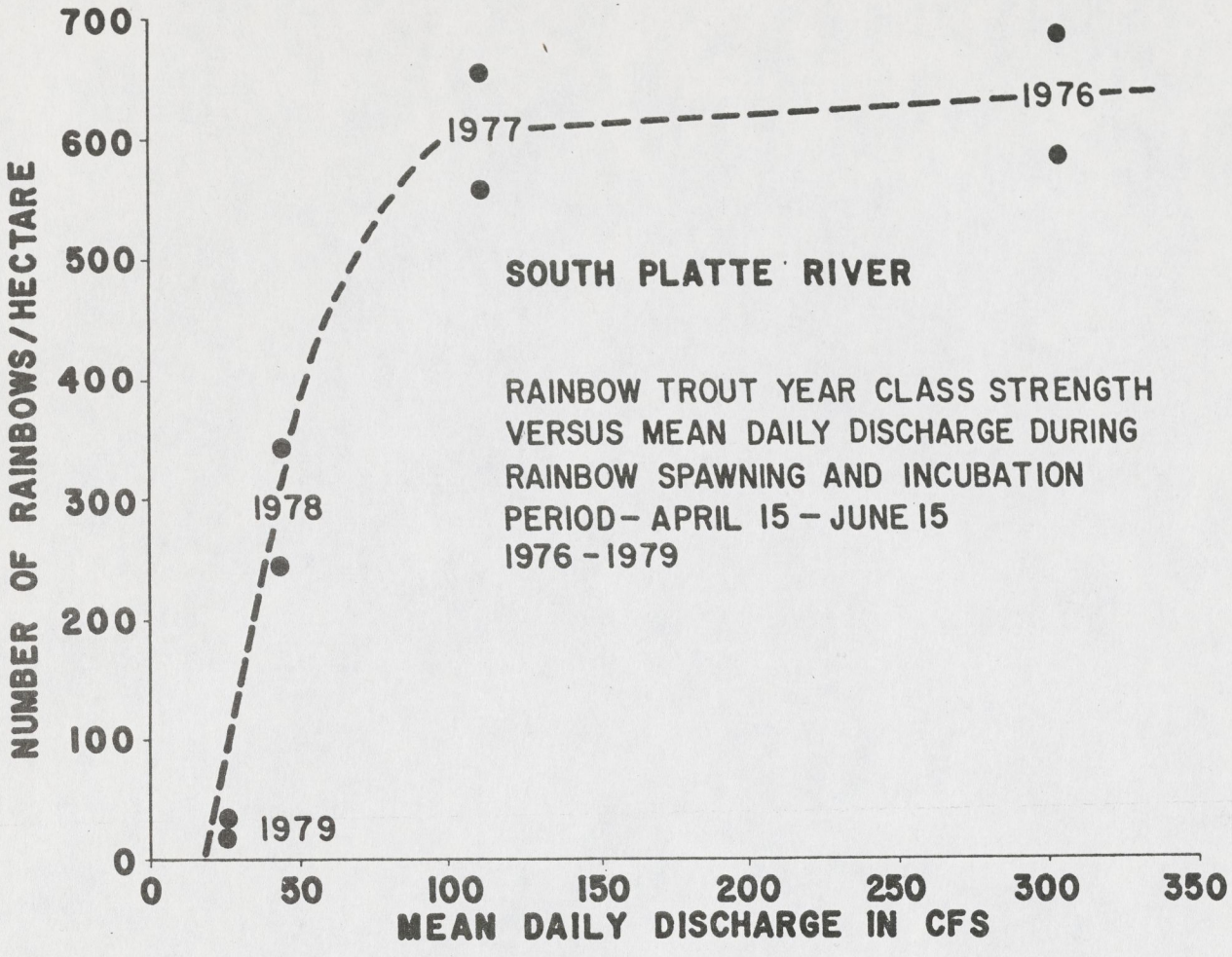


Figure IV-7. South Platte River 1980 rainbow trout population and harvest distributions.



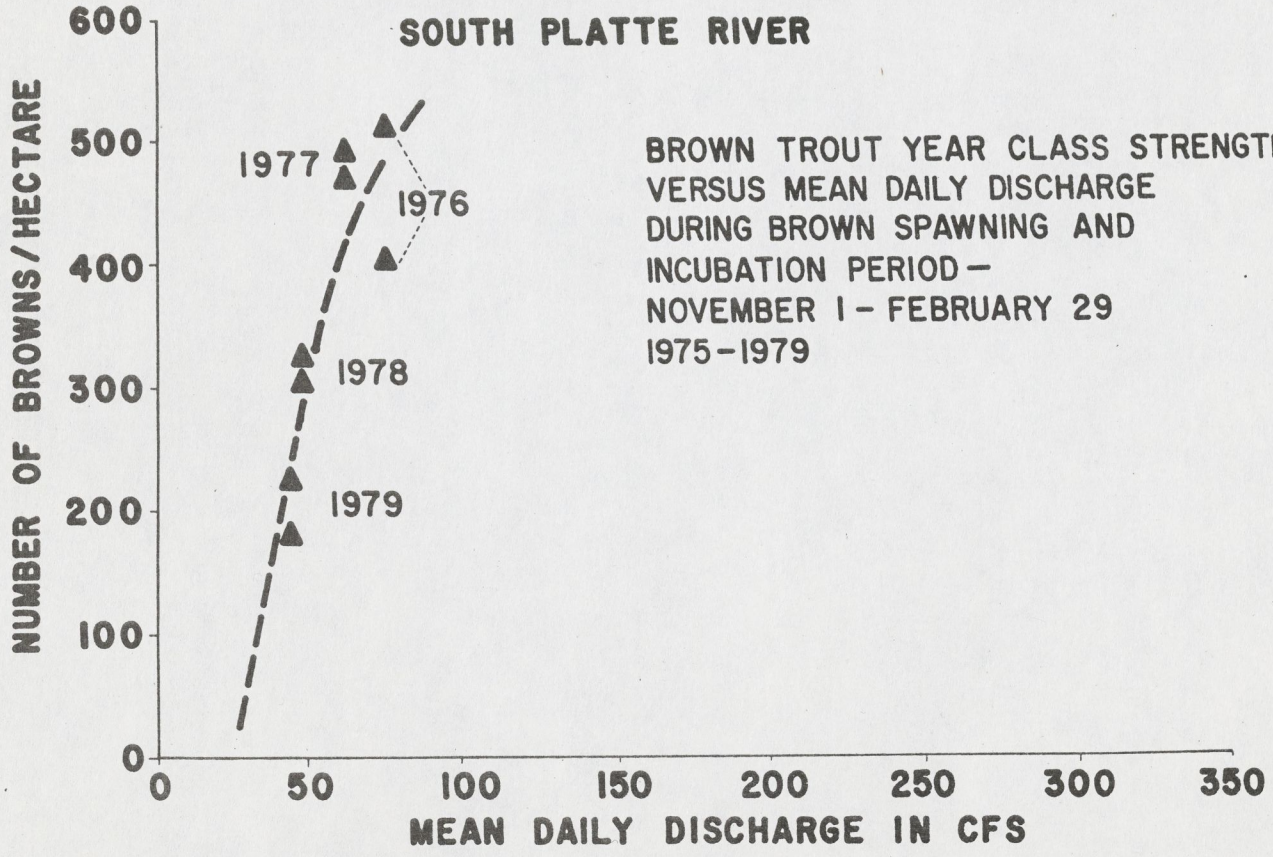


Figure IV-8. South Platte River rainbow trout year-class and brown trout year-class strength versus mean daily discharge during spawning and incubation period.

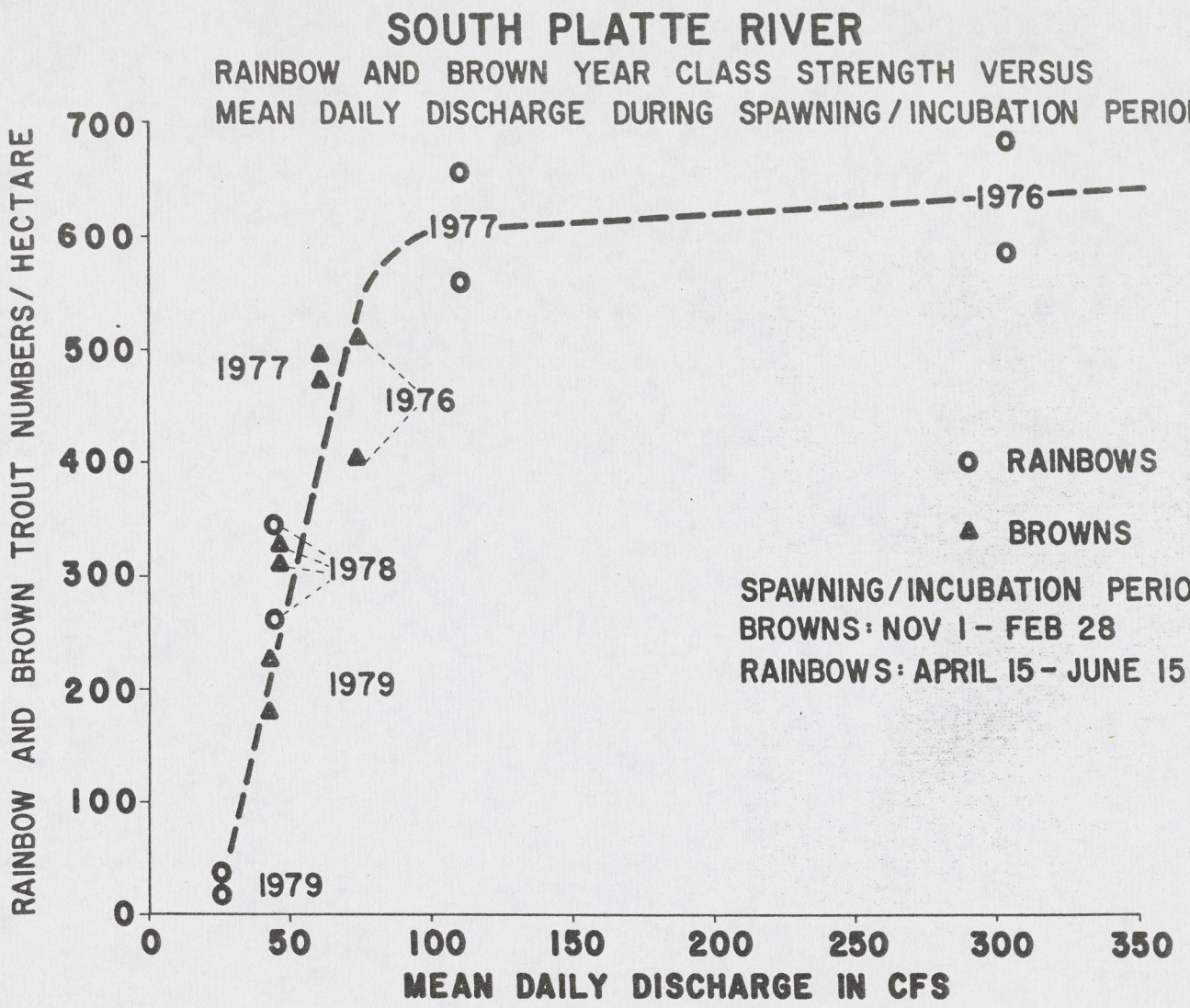


Figure IV-9. South Platte River rainbow and brown year-class strength versus mean daily discharge during spawning/incubation period.

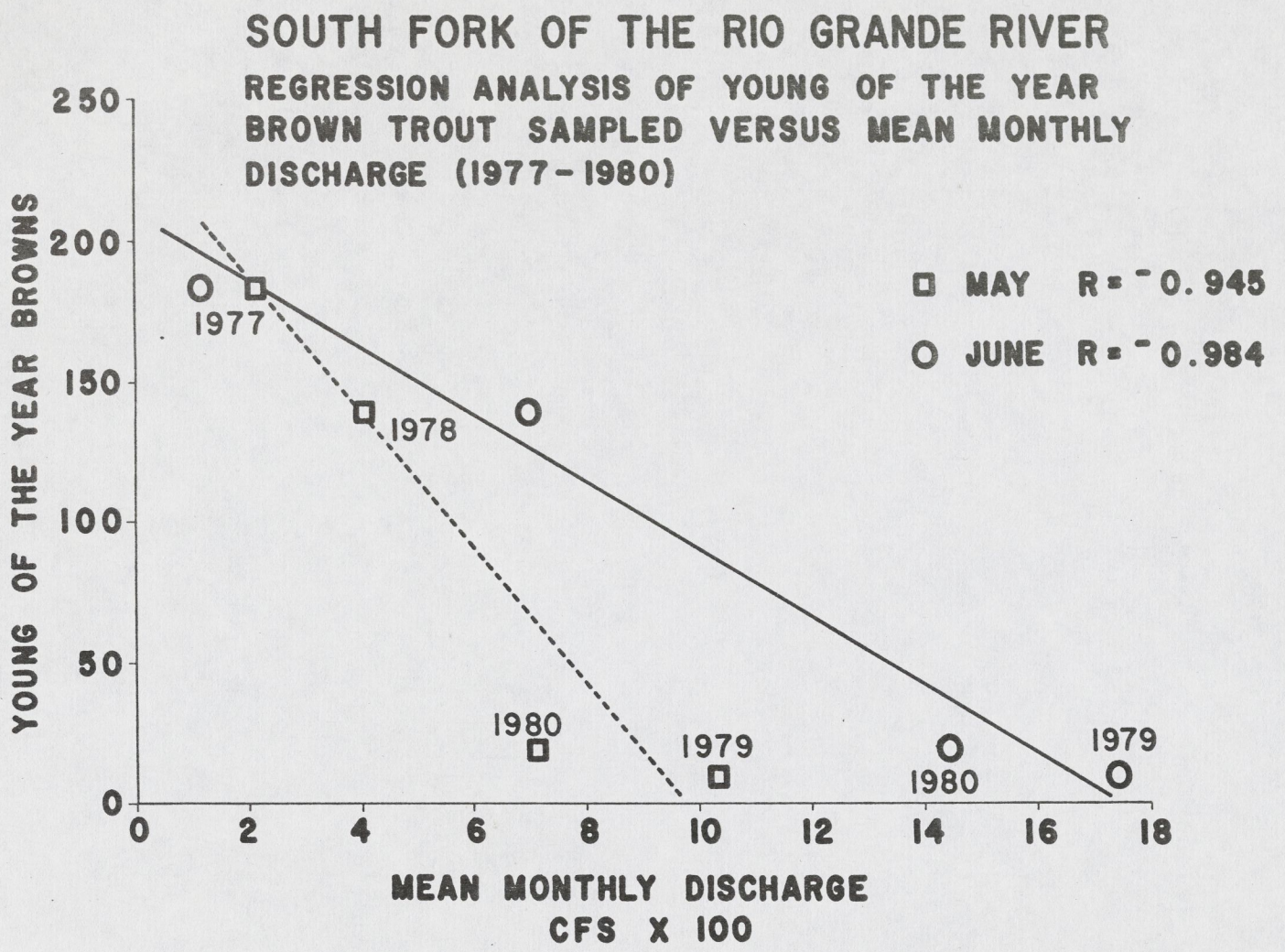


Figure IV-10. South Fork of the Rio Grande River regression analysis of young of the year brown trout sampled versus mean monthly discharge (1977-1980).

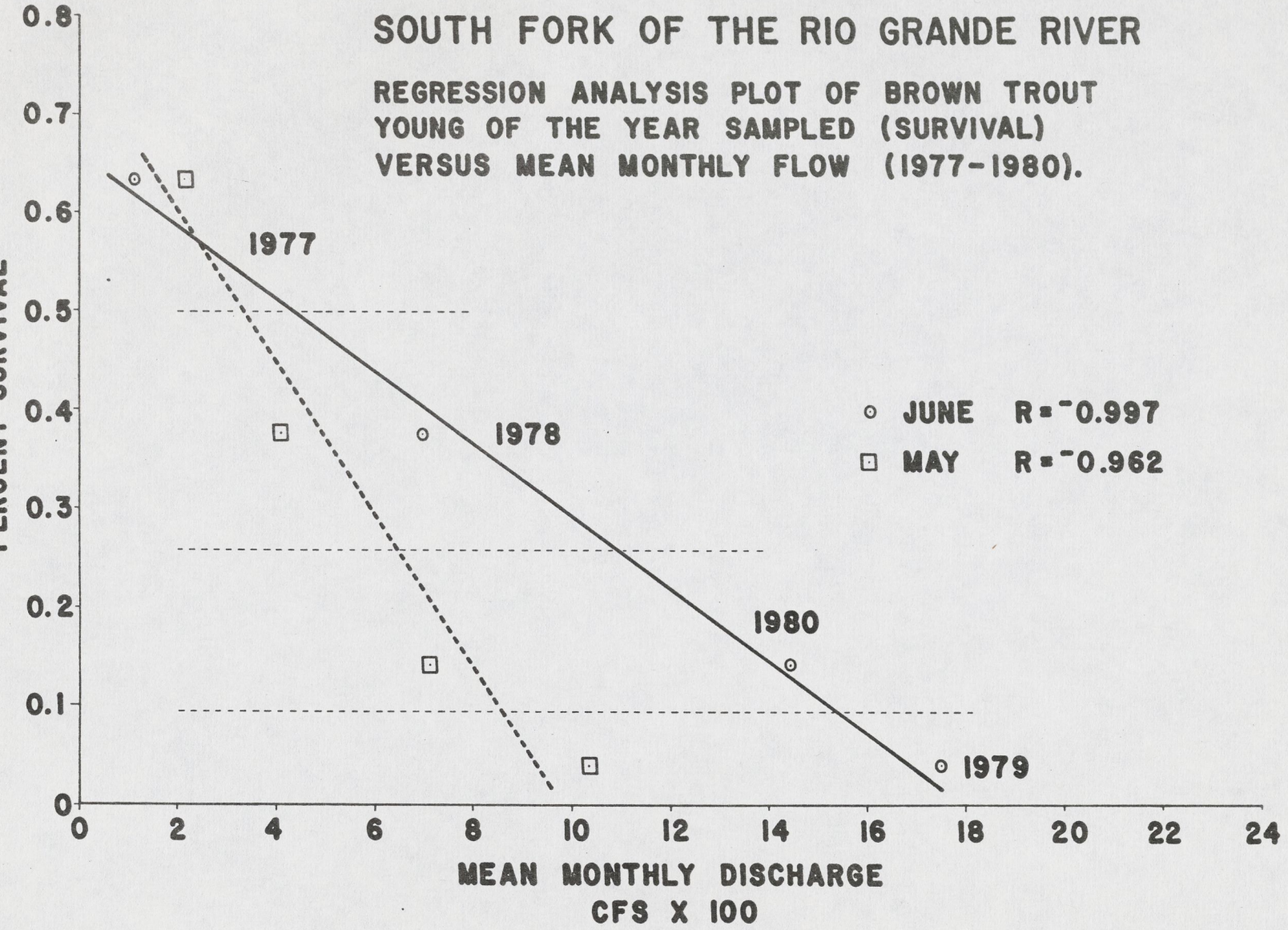


Figure IV-11. South Fork of the Rio Grande River regression analysis plot of brown trout young of the year sampled (survival) versus mean monthly flow (1977-1980).

APPENDIX V

Creel Census and Fisherman Harvest Statistics

Table V-1. Comparison of creel census methods on the Arkansas River, summer 1980.

Statistic	Upper Arkansas River			Lower Arkansas River		
	fisherman count/ interview system		postcard mailback system	fisherman count/ interview system		postcard mailback system
	estimate	S. error	estimate	estimate	S. error	estimate
Total hours	9,672	1,146	9,484	14,003	2,589	12,924
Total catch	6,736	797	6,542	6,268	918	7,028
Brown catch	6,736	797	6,302	6,230	917	6,831
Total CPMH	0.696	0.084	0.690	0.448	0.102	0.544
Brown CPMH	0.696	0.084	0.664	0.445	0.101	0.529
Creel catch	3,870	475	--	4,131	727	--
Rainbow catch	--	--	--	2	--	--
Cutthroat catch	--	--	--	36	--	--

Table V-2. Fryingpan River creel census data - Section 1 (Water Code #27602), summer 1979-80.

Statistic	Count/Interview System				Card return
	May-Sept. 1979		May-Oct. 1980		
	mean	95% C.I.	mean	95% C.I.	mean 1980
Total hours	3,325	704	3,991	1,183	3,194
Total catch	2,405	1,184	2,295	1,007	1,816
Total CPMH	0.723	0.386	0.575	0.276	0.566
Creel catch	2,058	1,155	1,272	522	--
Creel CPMH	0.619	0.370	0.319	0.157	--
Rainbow catch	2,263	1,152	1,727	763	1,210
Cutthroat catch	--	--	68	104	--
Brown catch	142	113	484	535	590
Brook catch	--	--	17	32	--
Rainbow creeled	1,954	1,121	1,110	504	--
Native creeled	--	--	19	37	--
Brown creeled	104	105	126	86	--
Brook creeled	--	--	17	32	--
Rainbow CPMH	0.681	0.374	0.433	--	0.377
Brown CPMH	0.043	0.035	0.121	--	0.184
Catch >15 in.	--	--	--	--	91

Table V-3. Fryingpan River creel census data - Section 2 (Water Code #27614), summer 1979-80.

Statistic	Count/Interview System				Postcard Method
	May-Sept. 1979		May-Oct. 1980		May-Oct. 1980
	mean	95% C.I.	mean	95% C.I.	mean
Total hours	6,967	1,014	7,530	2,651	5,331
Total catch	4,131	1,412	3,110	1,033	3,401
Total CPMH	0.593	0.220	0.413	0.176	0.638
Creel catch	3,154	1,033	2,013	828	--
Creel CPMH	0.453	0.161	0.267	0.145	--
Rainbow catch	2,285	768	1,917	858	2,127
Native catch	--	--	7	14	0
Brown catch	1,821	877	1,147	461	1,193
Brook catch	25	39	38	76	0
Rainbow creeled	1,769	621	1,318	806	--
Native creeled	--	--	7	14	--
Brown creeled	1,368	654	688	380	--
Brook creeled	16	23	0	0	--
Rainbow CPMH	0.328	0.120	0.255	--	0.399
Brown CPMH	0.261	0.131	0.152	--	0.224
Catch >15 in.	--	--	--	--	169

Table V-4. Fryingpan River creel census data - Section 3 (Water Code #27626), summer 1979-80.

Statistic	Count/Interview System				May-Oct. 1980
	May-Sept. 1979		May-Oct. 1980		
	mean	95% C.I.	mean	95% C.I.	mean
Total hours	5,533	882	6,486	2,349	5,334
Total catch	3,067	541	4,131	1,334	3,454
Total CPMH	0.554	0.129	0.637	0.270	0.648
Creel catch	2,155	561	1,698	774	--
Creel CPMH	0.389	0.118	0.262	0.133	--
Rainbow catch	2,737	567	2,615	1,034	1,892
Native catch	0	0	14	26	--
Brown catch	312	136	1,483	644	1,475
Brook catch	18	25	19	37	--
Rainbow creeled	2,045	554	1,110	487	--
Native creeled	0	0	14	26	--
Brown creeled	100	58	575	398	--
Brook creeled	10	19	0	0	--
Rainbow CPMH	0.495	0.127	0.403	--	0.355
Brown CPMH	0.056	0.025	0.229	--	0.277
Catch >15 in.	--	--	--	--	132

Table V-5. Fryingpan River creel census data - Section 4 (Water Code #27638), summer 1979-80.

Statistic	Count/Interview System				Postcard Method
	May-Sept. 1979		May-Oct. 1980		May-Oct. 1980
	mean	95% C.I.	mean	95% C.I.	mean
Total hours	7,180	883	9,548	2,662	8,441
Total catch	8,302	1,287	10,786	3,616	8,106
Total CPMH	1.156	0.227	1.130	0.367	0.960
Creel catch	1,000	417	--	--	--
Creel CPMH	0.139	0.061	--	--	--
Rainbow catch	5,948	920	6,140	2,311	5,070
Native catch	0	0	40	42	0
Brown catch	1,376	330	2,272	1,028	1,524
Brook catch	978	321	1,884	902	1,568
Rainbow creeled	803	315	--	--	--
Native creeled	0	0	--	--	--
Brown creeled	105	78	--	--	--
Brook creeled	91	72	--	--	--
Rainbow CPMH	0.828	0.163	0.643	--	0.601
Brown CPMH	0.192	0.051	0.238	--	0.181
Brook CPMH	0.136	0.047	0.197	--	0.186
Catch >15 in.	--	--	--	--	--

Table V-6. South Platte River creel census data - Deckers section (Water Code #11825) summer 1979-80, 8 fish/day bag area.

Statistic	Postcard Method		Count/Interview System			
	May-Sept.1979	May-Oct.1980	May-Sept. 1979		May-Oct. 1980	
	mean	mean	mean	95% C.I.	mean	95% C.I.
Total vehicles	5,845	4,949	5,845	485	--	--
Total fishermen	11,439	9,046	11,439	1,280	--	--
Total hours	37,594	32,628	39,601	3,654	38,621	8,841
Total brown	13,535	14,183	11,049	3,030	13,905	9,177
Total rainbow	15,384	8,522	23,415	18,948	10,237	3,810
Total trout	29,197	22,705	34,532	17,920	24,142	11,009
Brown CPMH	0.360	0.434	0.279	--	0.360	--
Rainbow CPMH	0.409	0.261	0.591	--	0.265	--
Total CPMH	0.777	0.696	0.872	--	0.625	0.319
Total creel catch	--	--	--	--	13,778	7,140
Total creel CPMH	--	--	--	--	0.357	0.202
Rainbow creel catch	--	--	--	--	7,930	3,599
Brown creel catch	--	--	--	--	5,848	4,453
Rainbow creel CPMH	--	--	--	--	0.205	--
Brown creel CPMH	--	--	--	--	0.151	--

Table V-7. South Platte River creel census data - Cheesman Canyon section (Water Code #11837) summer 1979-80, catch and release area.

Statistic	Postcard Method May-Sept.1979 mean	Postcard Method May-Oct.1980 mean	Count/Interview System May-Oct. 1980 mean	Count/Interview System May-Oct. 1980 95% C.I.
Vehicles	3,473	3,694	--	--
Fishermen	5,553	6,124	--	--
Total hours	25,550	29,954	28,397	4,978
Total catch	25,402	27,861	32,488	13,248
Brown catch	6,514	9,872	9,692	3,452
Rainbow catch	18,798	18,533	22,796	10,025
Catch >15 in.	3,864	4,385	--	--
Total CPMH	0.994	0.930	1.144	0.508
Brown CPMH	0.255	0.330	0.341	--
Rainbow CPMH	0.736	0.619	0.803	--

WILD trout SYMPOSIUM
JAN 15 80
ATTENDANCE

NAME	ORGANIZATION	LOCATION
DICK MOORE	USFS	DENVER
Jack Grab	DOW	"
Ralph HOUDA	BAU	"
Bob Behnke	C S U	FT COLLINS
Erickson	Private Consultt	Longmont
Leo Lentsch	C.S.U - D.O.W.	Ft. Collins
Dale Wills	USFS	Denve
JACK CAPP	USFS	DENVER
JOHN PETERS	WPRS, PO Box 25007	DENVER 80225
JIM ERICSON	Camp Dresser & McKee	Denver
Dave Cook	USFS	Durango
Rod Von Olsen	Div of Wildlf	Ft. Collins
Dave Rosgen	USFS	Ft. Collins
Fred Wild	USFS	Delta
JIM CRUSE	USFS	FT. COLLINS
ROLF NITHMANN	DOW	COLLINS
Ernest Kaska	Dow	Colo Springs
Paul Santensney	F.S.	Delta, Colo
Jim BEWSEY	T.U.	Denver
Doug Burton	Colo Springs Flyfishers TU/FFF	Colo Springs
Dennis Febinger	CU	Boulder
JIM M BOWER	TU	BOULDER
J.T. WINDELL	U. of Colorado, E.P.O. Biology	Boulder
Larry Zuckerman	USFS Rocky Mountain Forest Range Exp Stn / CSU	Ft Collins
CLIFF Hawkes	"	Ft. Collins
JOE POGUE	USFS	MONTE VISTA
Tom Powell	DOW	Ft. Collins
DON WEBER	DOW	Ft. Collins
Bruce D. Rosenlund	USFWS	DENVER Col
John G. HALE	USFWS	" "
ALAN SANDVOL	FWS	DENVER
Wes Nelson	Colo DOW	Ft. Collins
A.F.C. "Pete" Greene	Colo. DOW	Denver

NAME	ORGANIZATION	LOCATION
Robert A Jones	Division of Wildlife	Denver
Chris Crosby	United Sportsmans Council	Eng (Denver)
Ray Evans	U.S.F.S.	Pueblo Co.
Richard Enriquez	USFS	Routt NF Steamboat Spgs Co
Skip Kowalski	USFS	White River N.F.
Jim Marvin	TU & FFF	Denver
Doug Miller	TU	Littleton
Ed Exum	TU & FFF	Denver
Stan Butt	FFF.	Denver.
John Woodling	D.O.W.	Denver
Neal Lees	Gazette Telegraph	Colo. Spgs.
WC Shuster	USFS Mancos R.D	Mancos Colo
Gerald Bennett	DOW	Granby
John Baughman	WY. G & F	Cheyenne
Dennis Scarnecchia	Colo. Coop Fish. Res. Unit	Ft. Collins.
Bill Weiler	CDOW	Montrose
Don Horak	CDOW	Ft Collins
Wally Gallaher	FS	Denver
Jeffry Light	CU	Boulder
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Date June 11, 1981