AN UNEXPLOITED POPULATION OF GREENBACK TROUT

Wesley C. Nelson
Colorado Division of Game, Fish and Parks

Presented at: Seventh Annual Meeting of the Colorado-Wyoming Chapter of the American Fisheries Society

Fort Collins, Colorado

March 3, 1972

INTRODUCTION

The watershed of the City of Boulder contains a number of lakes, some of which contain fish populations. Since the area is closed to public use, these populations are essentially unexploited. Consequently, some of them have been sampled during the course of my high lakes study in order to get data for comparisons with exploited populations in similar lakes. One of the lakes sampled--Island Lake--contains cutthroat trout, which have been characterized as an "essentially pure" population of the indigenous Platte River subspecies, the greenback or Salmo clarki stomias by Behnke (1969).

In previous years it was noted that there was a considerable spawning run which might be utilized for propagation purposes. Consequently, somewhat more intensive studies of the lake and the population were initiated in 1970. Permission to work in the area, granted by Mr. Ted Tedesco, City Manager, as well as aid and information supplied by Mr. Bob Westdyke and Mr. Tom Platt, are gratefully acknowledged. Mr. Rolf Nittmann, Northeast Region Fish Biologist, aided in formulation of the objectives of the study and participated in some of the field work.

METHODS

Standard limnological methods were used in sounding the lake, measuring temperatures and in taking and analyzing water, plankton and bottom samples. Fish were sampled from the lake by means of gill nets with mesh sizes from 7.5-55 mm. The usual statistics were taken for all fish caught. Scale, stomach and ovary samples were taken from some of the fish.

In 1970 a trap (Fig. 1) was placed in the main branch of the inlet stream and a blocking screen in the minor branch from June 17-August 31. Fish were logged up or down, weighed, measured, marked with a finclip or tag, and released. Since many fish were already upstream when the trap was installed, and others by-passed it during a washout, the area above it was sampled with seine and electroshocker on several occasions. All unmarked fish caught were treated as noted previously. Scale, stomach and egg samples were taken from some fish. On three occasions a number of fish were spawned and the eggs taken to the Bellvue Hatchery for raising. Stream flow was measured at 1-7 day intervals with a current meter. Stream temperature was recorded continuously with a thermograph.

The trap was not used in 1971. Instead, fish were caught with seine and shocker from July 14-16. These were weighed, measured, marked and released. On July 26 another sample was taken and the fish were measured, marked, spawned and released.

Population estimates were made by the single-sample, mark and recapture method using Chapman's (1951) formula. Confidence limits of estimates were derived according to Chapman's (1948) criteria using his approximations for Poisson and normal distributions but the binomial graphs given in Adams (1951).

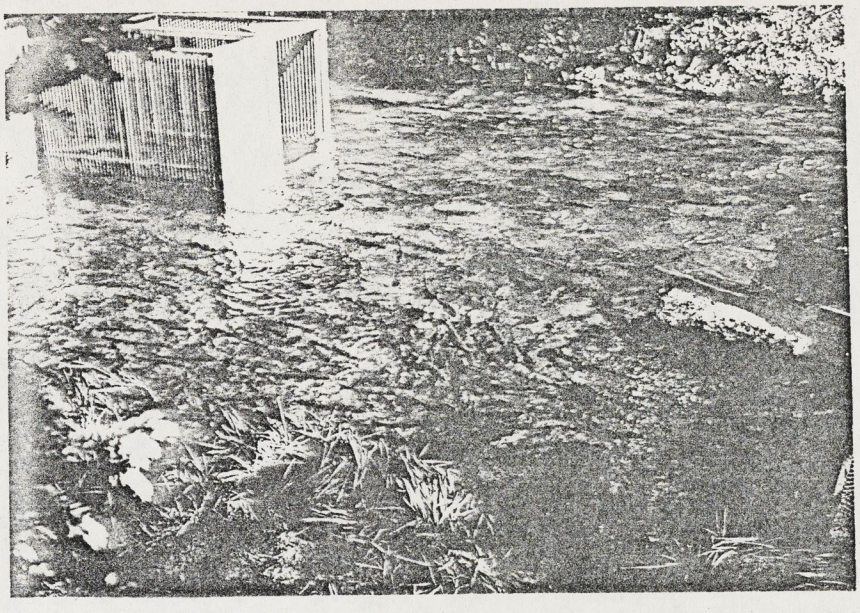


Figure 1. Trap and fish in inlet stream.

Figure 2. Aerial photo of Island Lake (bottom).

RESULTS

Location and Description of the Lake

Island Lake (Fig. 2) is located in a chain of lakes on a branch of North Boulder Creek, which has its source in the largest Colorado glacier on the Arapaho peaks. Although its depth indicates that a natural lake was present its size has been increased by a low concrete dam. The lake is at an elevation of 3,140 m and has an area of 14 ha and a maximum depth of 6 m. During the period from mid-June to late September water temperatures varied from 6-14° C at the surface and from 5-13° C at the bottom. Slight thermal stratification was observed on a few dates but it did not persist. Depth of secchi disk visibility varied from 2.5-4.3 m. Dissolved oxygen concentration varied from 7.1-9.2 mgm/1, total alkalinity from 5-8 mgm/1 and specific conductance from 8-18 micromhos. Chemical characteristics were not stratified with depth. Rooted aquatic plants as well as Characeae were present on the bottom. Bottom samples from all depths contained primarily Chironomidae larvae and pupae but oligochaetes, leeches and mites were also present. According to Mr. Platt the lake level is reduced every few years for maintenance purposes.

Lake Population

Relatively few small fish were caught from the lake (Fig. 3). Twenty-one percent of those caught in June and July 1970 were under 200 mm but less than three percent of those caught in September 1970 or 1971 were. Length-frequency distributions of fish caught in September were much like those of stream fish. The sex ratio of fish caught September 3, 1970 (169 ♂:158 ♀) was not significantly different

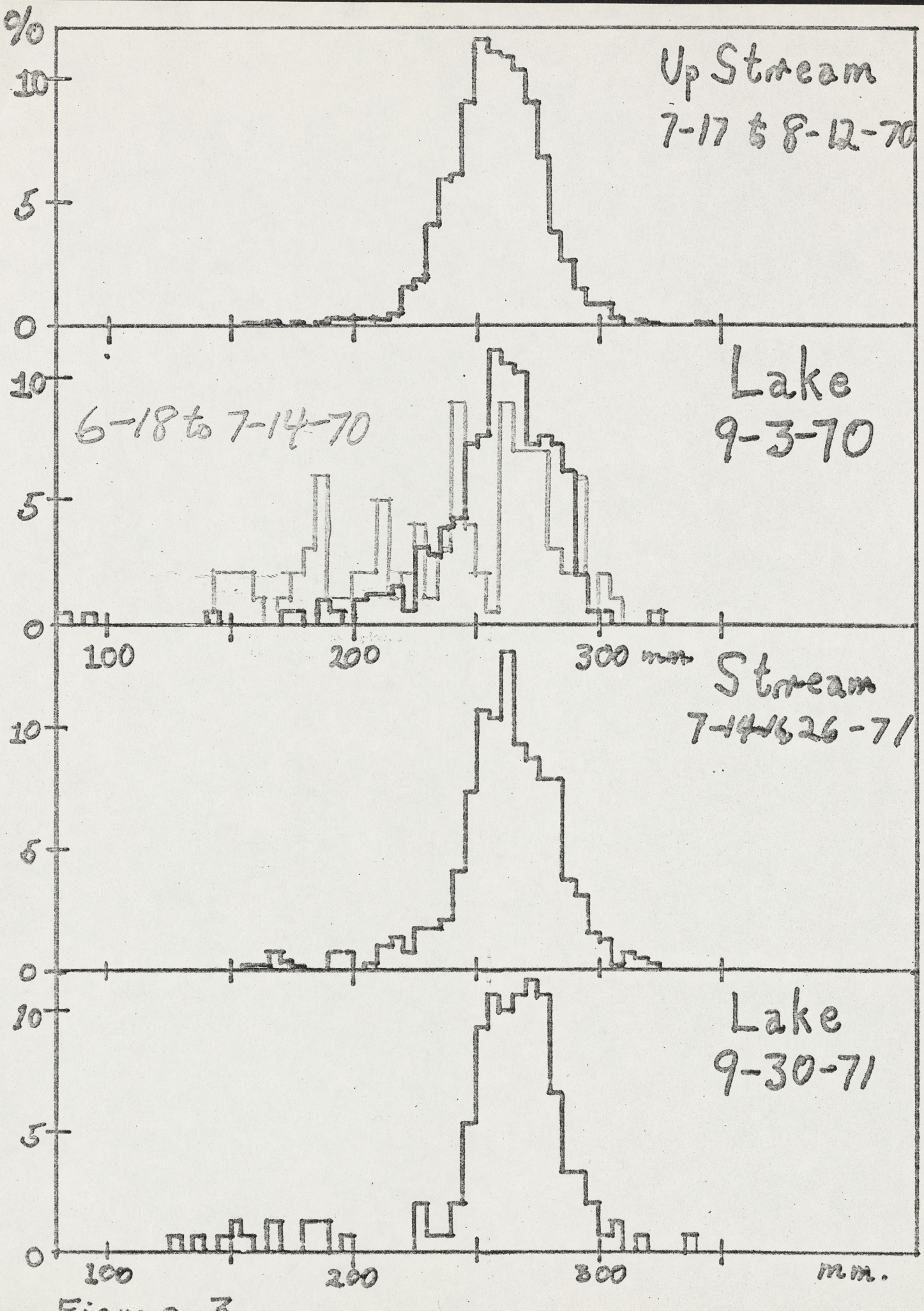


Figure 3

WCN 2-28-72

from 1:1 (X^2 = 0.72, 1 df) but that of fish caught September 30, 1971 was (X^2 = 6.82, 1 df). Ninety-four percent of the fish caught September 3, 1970 and 89 percent of those caught September 30, 1971 were mature.

So far only some of the scale samples have been examined. Fish from 81-90 mm in September had no annulus. Those with one annulus varied from 142-236 mm, those with two from 146-239 mm and those with three or more from 210-316 mm. It appeared that some of the fish might not form a scale the first summer. Furthermore, fish that spawn may not form a recognizable annulus in that year. Trojner[1] has shown that otoliths are more reliable than scales for aging cutthroat trout. Comparisons made for six Island Lake fish showed that otoliths had one or more annuli, than could be recognized on the scales.

Stomach contents of 54 fish (81-322 mm) caught from June 18-September 3, 1970 consisted of 76 percent (by wet weight) Chironomidae larvae and pupae, 10 percent Trichoptera larvae (including cases) and pupae, 6 percent leeches, traces of other aquatic organisms and 7 percent terrestrial insects. Chironomidae made up more than 90 percent of the contents from late June through July. Mean wet weight of stomach contents increased to 0.36 g in June to 0.72 g in July but was 0.18 g in September.

Spawning Runs

In 1970, 1,001 fish were logged upstream and another 618 were captured above the trap. Eight hundred and nine fish were logged downstream and another 797 were caught above the trap and put downstream.

---

[1] 1972. Unpublished M.S. Thesis, Colorado State University.

Of the total 1,606 downstream fish, 745 had been upstream and 861 had not. Overall 2,406 marked fish were released. Upstream migration was concentrated in the first two weeks of July and occurred during a period of decreasing stream flow and increasing water temperature. As a result the number of fish in the stream reached a peak in mid-July (Fig. 4). Downstream migration was concentrated in late July and early August but many fish were still in the stream by mid-August. In 1971 the inlet stream was first checked on July 1 and relatively few fish were in the stream at that time (Fig. 4). By mid-July more fish were present and 384 were caught from July 14-16. Fewer fish were present in late July but another 196 were caught. Out of the total of 580 fish, 516 were unmarked, 59 were recaptured fish marked in 1970 and 33 were recaptured fish marked in 1971. The stream was checked again on August 4 but relatively few fish were present in it then.

Length-frequency distributions of upstream fish in 1970 and those sampled from the stream in 1971 were quite similar (Fig. 3). In both years about 95 percent of the fish were between 200 and 300 mm long. On July 14, 1970, a sample of 30 fish (mean length 259 mm, mean weight 164 g) was taken for egg counts. The mean number of eggs was 315 of which 268 (85%) could be stripped. A sample of 7 fish (273 mm, 185 g) taken in July 1971 contained an average of 299 eggs. On July 1, 3 and 7, 1970 a total of 56,000 eggs was obtained from 257 females, or an average of 218 per fish. Only 4,600 eggs were obtained from the 64 females stripped on July 26, 1971. Some of these fish had already spawned and others were not yet ripe.

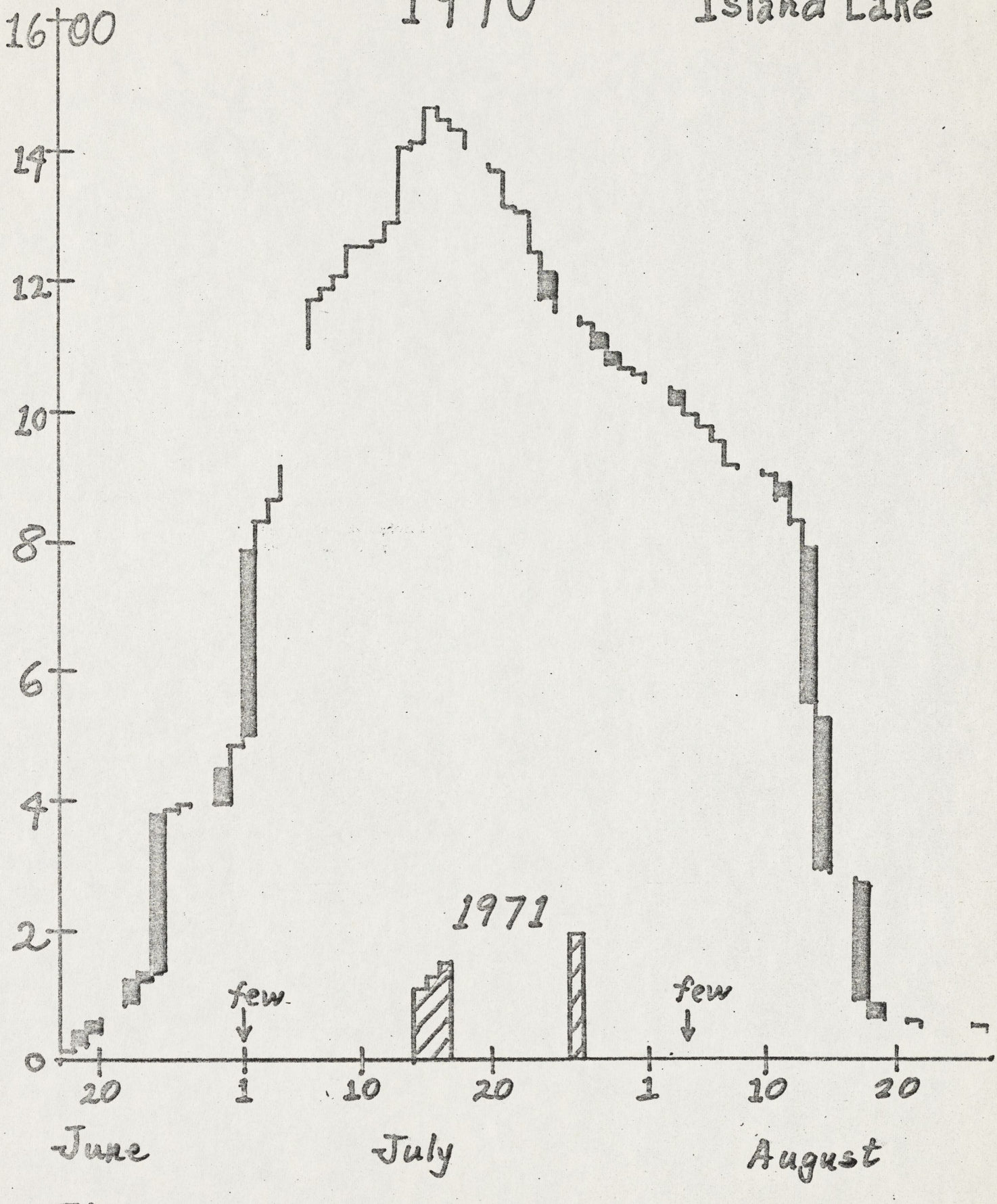
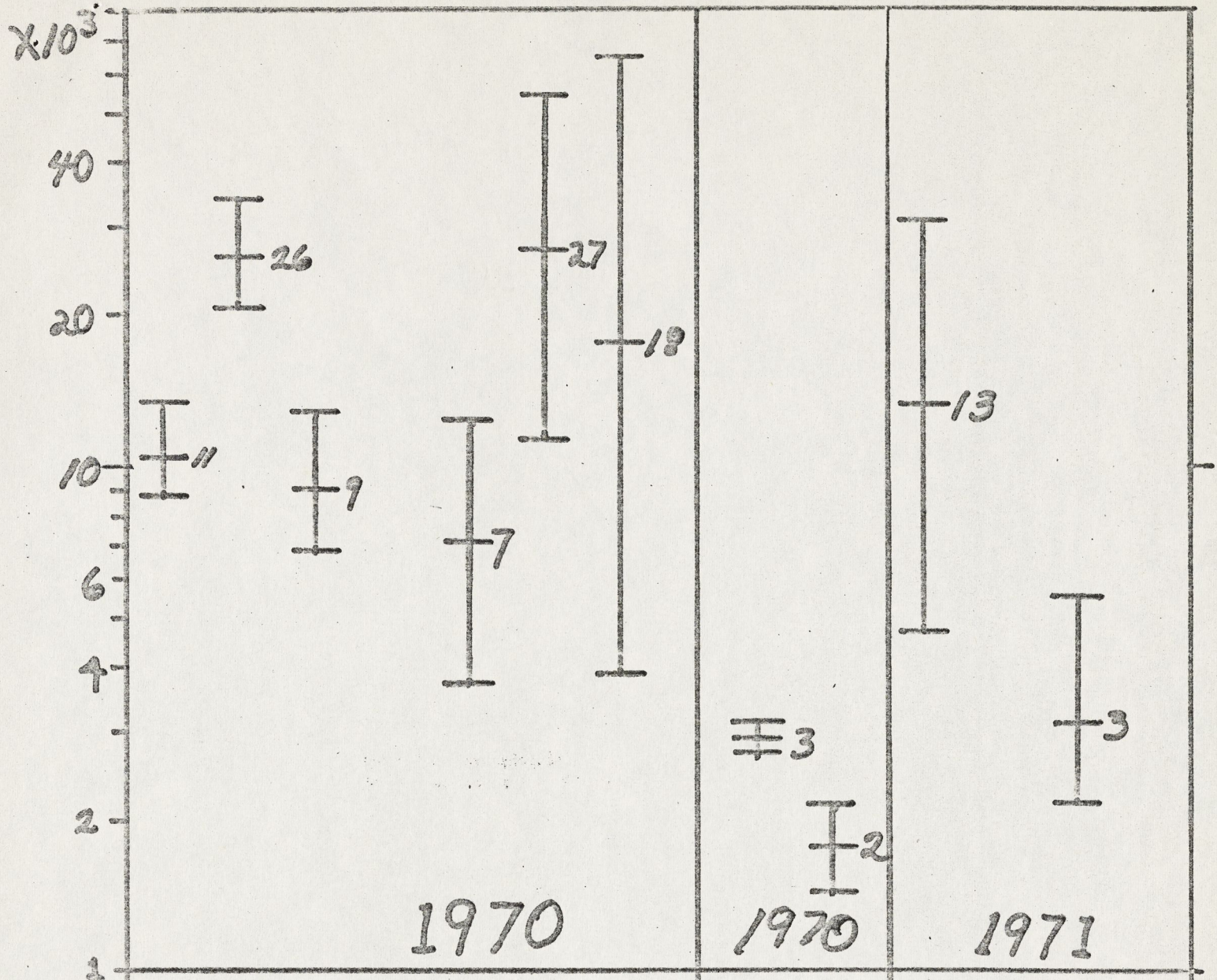

1970
Island Lake
1600
14
12
10
8
6
4
2
0
1971
few
few
20
1
10
20
1
10
20
June
July
August

Figure 4.

Population Estimates

The estimate of the population of spawner-size (200-345 mm) fish in the lake in 1970 made using all fish marked in the stream from June 17-August 31 and the September 3 lake sample was about 11,000 fish, whereas that made using fish tagged from July 13-20, 1970 and the lake sample was 7,000 (Fig. 5). Not all fish logged upstream were logged back downstream by August 31. Thus, if only those that were logged down are used as marked fish, estimates are reduced to 7,000 for all marked fish or 5,000 for tagged fish only. A re-estimate using all 1970 marked fish recovered in the September 30, 1971 lake sample was 9,000 fish whereas that using tagged fish only was 18,000 fish (Fig. 5). Since the confidence limits of these four estimates overlap, perhaps the simple mean--11,000 fish--may be taken as the best estimate of potential spawners in 1970. The estimate for the 1971 population--13,000 fish--was greater but has wide confidence limits (Fig. 5).

Estimates of the 1970 population made from recoveries of 1970 marked fish in July 1971 stream samples were similar for all marked fish and for tagged fish only--around 26,000--(Fig. 5) but much greater than estimates made from lake samples. That is, proportions of marked fish in the 1970 and 1971 lake samples (0.22-0.26) were significantly greater than in the 1971 stream sample (0.09). Numbers of the different kinds of 1970 marked fish in gill net and stream samples were not significantly different from those expected on the basis of the proportions released (X^2 = 5.33-6.74, 4-5 df, P = 0.16-0.35). Furthermore, proportions of all marked fish versus unmarked fish were not significantly different as between pairs (large and small mesh) of



Popul.	Lake						Stream		Lake	Stream
Mark	All			Tagged			All	Tag	All	All
No.	2,387			320			1,562	200	566	376
Date	6-17 to 8-31			7-13 to 20			6-18 to 8-12	7-13 to 15	7-14 to 26	7-14 to 16
Source	L	S	L	L	S	L	S		L	S
Date	9-3-70	7-14 to 8-24-71	9-30-71	9-3-70	7-14 to 26-71	9-30-71	8-13 to 24-70		9-30-71	7-26-71
No.	242	56	138	242	56	138	739		138	188
Recaps	54	50	36	12	7	2	312	84	5	21
Leng.	220 mm+ ⟶			214+		220+	200+		220+	200+

Figure 5

nets set at different places in the lake, either in 1970 (X^2 = 10.63, 9 df, P = 0.30) or in 1971 (X^2 = 3.46, 4 df, P = 0.46). Thus it is concluded that fish were well distributed about the lake, that lake sampling was random and that there was no evidence for loss of marks or of differential mortality of marked fish. Greater mortality of fish which spawned in 1970 than of those which did not is a possibility and would not necessarily be reflected in a reduced proportion of marked fish in lake samples. Failure of many 1970 spawners to run in 1971 is also a possibility. Recruitment of unmarked spawners in 1971 undoubtedly occurred but was partially compensated for by advancing the minimum size by 15-20 mm for fish from lake and stream samples. Finally, since the run occurred over a considerable period of time in 1970 the sample taken on four days in July 1971 may not have been either random or representative.

Visual observations gave the impression that far more fish were present in the stream in 1970 (Fig. 1) than in 1971 but may have been biased by the presence of the trap and more frequent observations in 1970. However, estimates of stream populations in mid-July each year do not bear this out. Utilizing all fish marked going upstream from June 17-August 12, 1970 and the trap and seine sample of August 13-17, the estimate of the stream population in mid-July 1970 was 2,900 (Fig. 5). Such an estimate may be unrealistic since proportions of marked fish were constantly changing as fish were logged up- and downstream. The estimate utilizing only fish that were tagged from July 13-15 was much less--1,700--(Fig. 5) and not much greater than the maximum cumulative number of about 1,500 on July 15 (Fig. 4). In either case it appears that a large proportion of the 1970 spawners was marked. The estimate for 1971, utilizing fish marked July 14-16 and the sample of July 26 was 3,200 (Fig. 5). Flyrod samples taken

from the stream August 4 and September 29 contained 20 (6 marked) and 18 (4 marked) fish and gave estimates of 1,700 and 2,100 fish respectively. It should be emphasized that in either year the population estimates do not represent the total number of spawners, but rather the probable maximum number present in the stream at any one time.

CONCLUSIONS

It is concluded that the greenback cutthroat trout population in Island Lake has potential as a source of spawn. The lake contains a potential supply of at least 5,000 and probably more than 10,000 mature fish. Of these, from 2,000 to more than 3,000 may actually attempt to spawn in a given year. The fish are relatively small--mean length 250-260 mm--and the egg take per fish is low--200-300. If half of the spawners are females, then the potential, annual spawn take would vary from about 200,000-500,000. The actual might well be less since some of the fish would have to be allowed to spawn naturally and since the run might not meet expectations in some years.

Since it was indicated that the magnitude and timing of spawning runs vary, it is planned to continue study at least one more year. Once better estimates of these statistics are available, spawn taking can proceed on a more rational basis.

LITERATURE CITED

Adams, L. 1951. Confidence limits for the Petersen or Lincoln index used in animal population studies. J. Wildl. Mgmt. 15:13-19.

Behnke, R. J. 1969. Rare and endangered species; the greenback trout. Colo. Coop Fish Unit, Colo. State Univ. 5 p (mimeo).

Chapman, D. G. 1948. A mathematical study of confidence limits of salmon populations calculated from sample tag ratios. Intern. Pacific Salmon Fish. Comm. Bull. 2:69-85.

Chapman, D. G. 1951. Some properties of the hypergeometric distribution with applications to zoological sample censuses. Univ. Calif. Publ. Stat. 1:131-160.

Tim has Greenback lit ?

Quarterly Report for Contract No. CX-1200-4-A043

November 1, 1984 - February 1, 1985

Effects of Brook Trout Competition on Threatened Greenback Cutthroat Trout

Principal Investigator: Kurt D. Fausch

Research Assistant: Timothy R. Cummings

Department of Fishery and Wildlife Biology
Colorado State University
Fort Collins, CO 80523

Activities to Date

Research efforts during this quarter of the project emphasized the ageing of scales collected during the summer of 1984. Greenback cutthroat trout (Salmo clarki stomias) scales were collected on June 13 and 18, July 28, August 4, and September 2. Brook trout (Salvelinus fontinalis) scales were not aged because relatively few fish were sampled.

Scales from a total of 185 greenback cutthroat trout were analyzed. Of these, only regenerated scales were collected from 28 fish, so these could not be aged. For the remaining fish, the distances from the focus to all annuli and total scale radius were recorded. A plot of total body length versus scale radius was then developed (Fig. 1).

A total of 35 fish had two annuli and were tentatively aged II+, and ranged in length from 172 mm to 293 mm. Similarly 96 fish, ranging from 108 mm to 220 mm, had one annulus and were assumed age I+. Twenty-six of the greenbacks examined did not have any annuli present, and ranged from 78 mm to 146 mm. Failure of individuals to deposit an annulus after their first year of life has previously been documented by Cope (1959, p. 609 in Carlander 1969) for cutthroat trout in Rocky Mountain National Park and Nelson (1972) for trout in high altitude Colorado lakes. Factors responsible for failure to form the first annulus have not been delineated, but fish lacking it may represent the slower growing or late emerging individuals from each cohort.

We speculate that scales of late emerging trout may be formed so late that no circuli are formed, hence no annuli can be deposited.

In order to determine which fish were missing an annulus a two-step procedure was used. First, body lengths at each annulus were back calculated for all age I+ and II+ fish using the standard Fraser-Lee method outlined by Carlander (1981). Second, to objectively add a first annulus to those fish that failed to form one, a "critical length value" was established, representing the maximum length of greenbacks at the time of annulus formation. If the back calculated length at the first annulus was greater than the "critical length", the fish most likely did not form the first annulus after its first summer, so an annulus was added. The "critical length value" represents the upper 95% confidence limit for length of age 0+ greenbacks after their first summer of growth. This length was established by examining the distribution of greenback cutthroat less than 140 mm on all sampling dates (Fig. 2). The age 0+ cohort was first sampled on July 28, ranged in size from 46 mm to 74 mm, and is easily separated from the age I+ cohort. However, lengths of age 0+ and I+ cohorts overlap in later samples. When scale samples were taken for the last time on September 2, the smallest greenback aged as I+ was 115 mm. Therefore, on the last four sampling dates fish less than 115 mm were assumed age 0+, and were used to establish a mean length for age 0+ fish in the fall season. The upper 95% confidence limit on the fall age 0+ mean length was 108.5 mm, the "critical length value".

In total, first annuli were added to 50 fish previously aged as I+, making them II+, and to 31 fish previously aged as II+, making them III+. Final data are shown in Table 1. Surprisingly no fish older than III+ were found. We suspect that relatively few fish live longer than four years (III+) due to habitat and food constraints, but those that do may fail to grow enough to add circuli and form new annuli given the high energy requirements

for reproduction and the short growing season in Hidden Valley Creek. Analysis of otoliths from fish inadvertently killed would help answer these questions, as would finclipping known age 0+ fish differently each summer for several years. Our preliminary finding that the greenback population in Hidden Valley Creek is likely composed of fewer age classes than previously thought has important implications for management of these fish.

Plans for the Next Quarter

The major emphasis of the next quarter's work will be the analysis of cutthroat trout stomach samples, and invertebrate drift samples collected during the 1984 field season. In addition, individual mark-recapture data on greenbacks will be analyzed using a maximum likelihood method of population estimation, to determine numbers of trout in Hidden Valley Creek. Finally, detailed plans for research to be done in the 1985 field season will be outlined and reviewed before meeting with Bruce Rosenlund (USFWS) and Dave Stevens (NPS) to discuss the future research.

Literature Cited

Carlander, K. D. 1969. Handbook of freshwater fishery biology. Iowa State University Press, Ames, Iowa, USA.

Carlander, K. D. 1981. Caution on the use of the regression method of back-calculating lengths from scale measurements. Fisheries 6(1):2-4.

Nelson, W. C. 1972. An unexploited population of greenback trout. Colorado Division of Game, Fish and Parks. Presented at: Seventh Annual Meeting of the Colorado-Wyoming Chapter of the American Fisheries Society.

Table 1. Age distribution of Greenback Cutthroat Trout in Hidden Valley Creek, summer 1984. Data are sample size, mean total length (mm), and range of total lengths in parentheses.

Age	Sampling date				
	6/13	6/18	7/28	8/4	9/2
0+[a]	10 113.8 (92-131)	4 109.5 (104-111)	6 131.2 (112-146)		8 99.6 (78-140)
I+	9 153.1 (119-189)	9 147.2 (108-186)	4 131.8 (122-137)	22 161.0 (113-196)	2 164.5 (152-177)
II+	7 179.3 (157-202)	3 178.7 (172-184)	14 179.5 (125-219)	21 184.4 (133-220)	9 186 (152-234)
III+	11 225.4 (183-293)	6 209.5 (200-231)	5 213.6 (172-259)	8 218.9 (201-233)	

[a]The Age 0+ fish class may include some slower growing or late emerging age I+ fish from the previous summer.

Figure 1. Scale radius vs. body length for greenback cutthroat trout in Hidden Valley Creek, 1984
Symbols refer to dates fish were sampled.

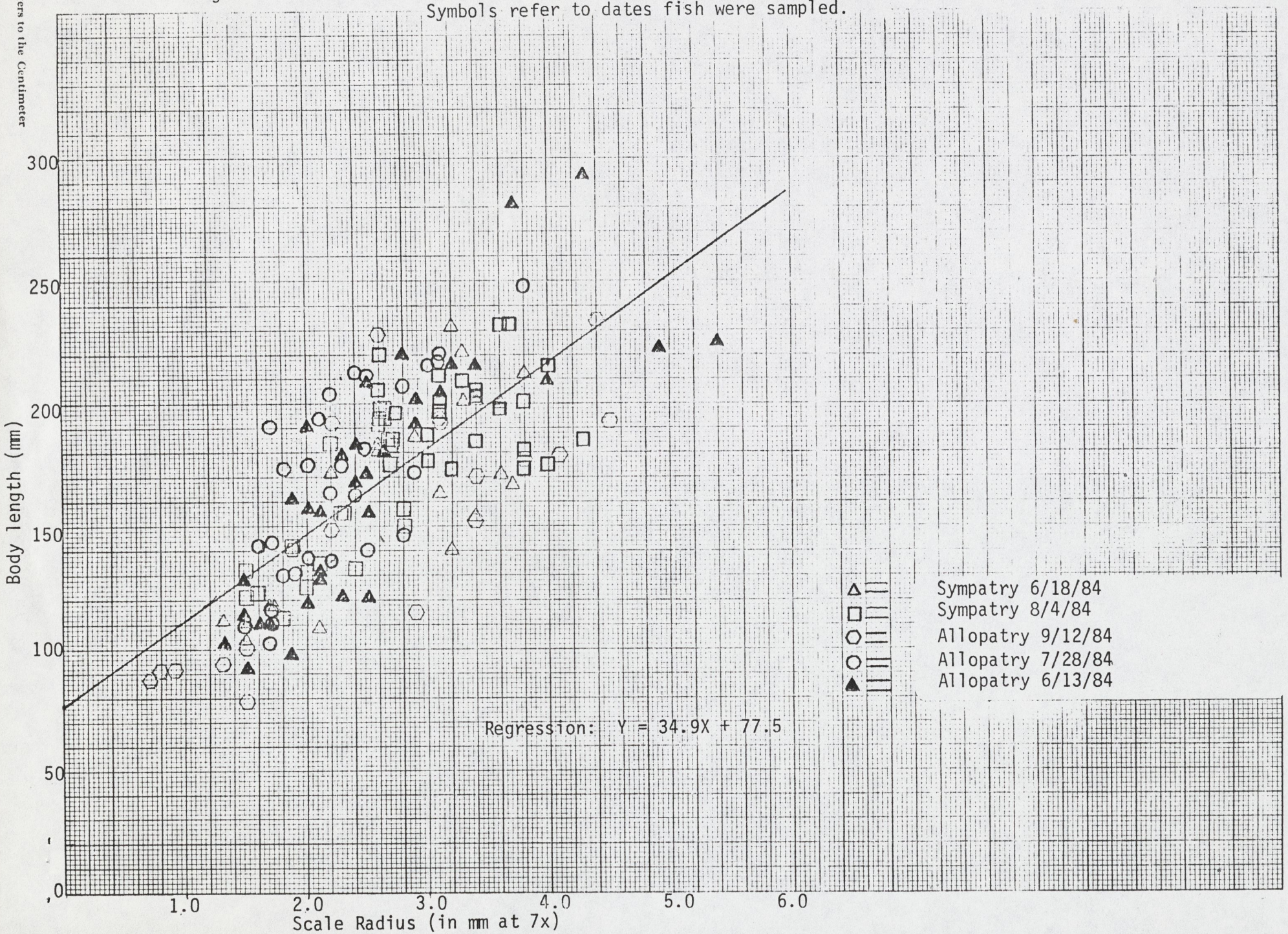
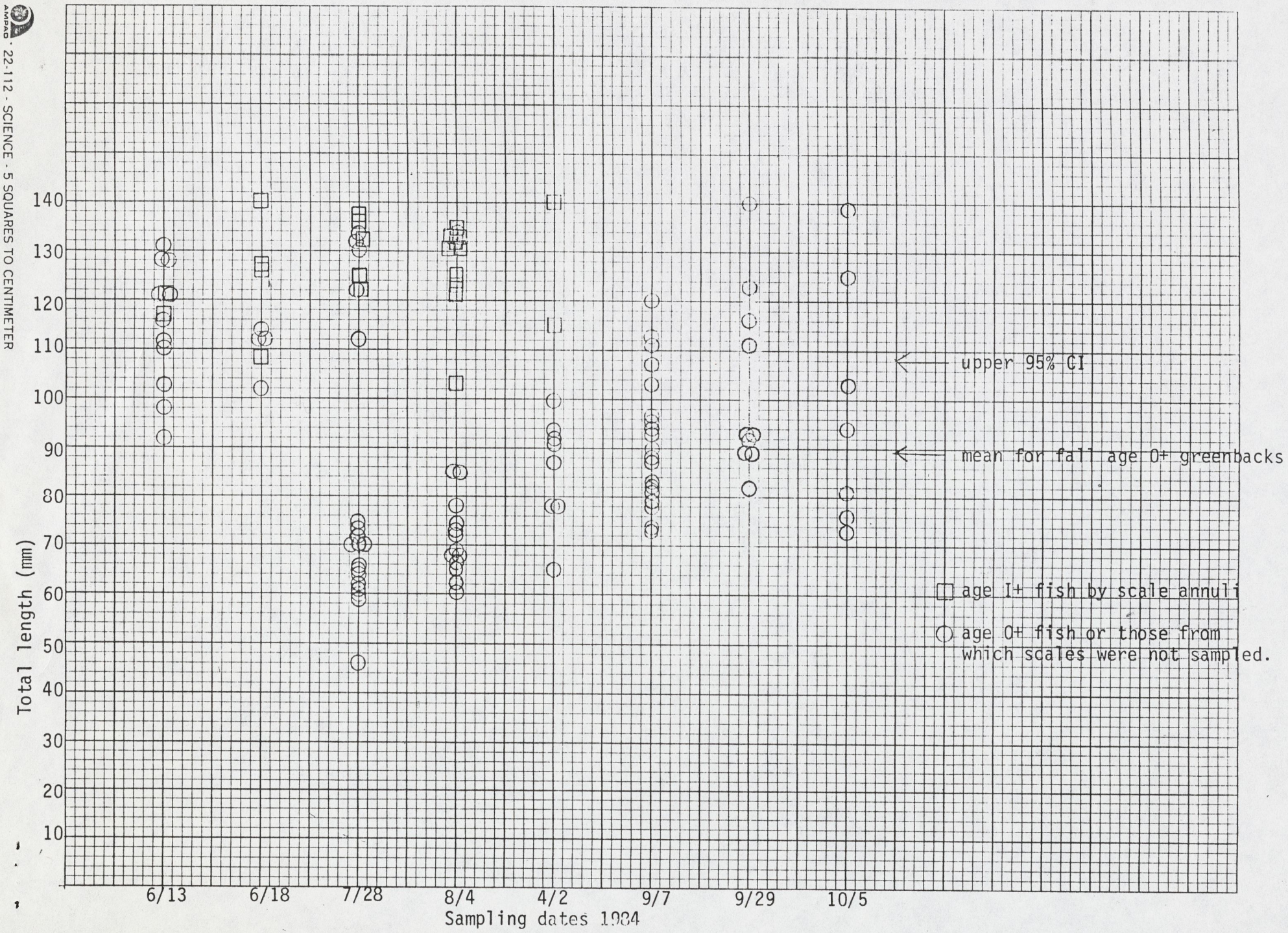
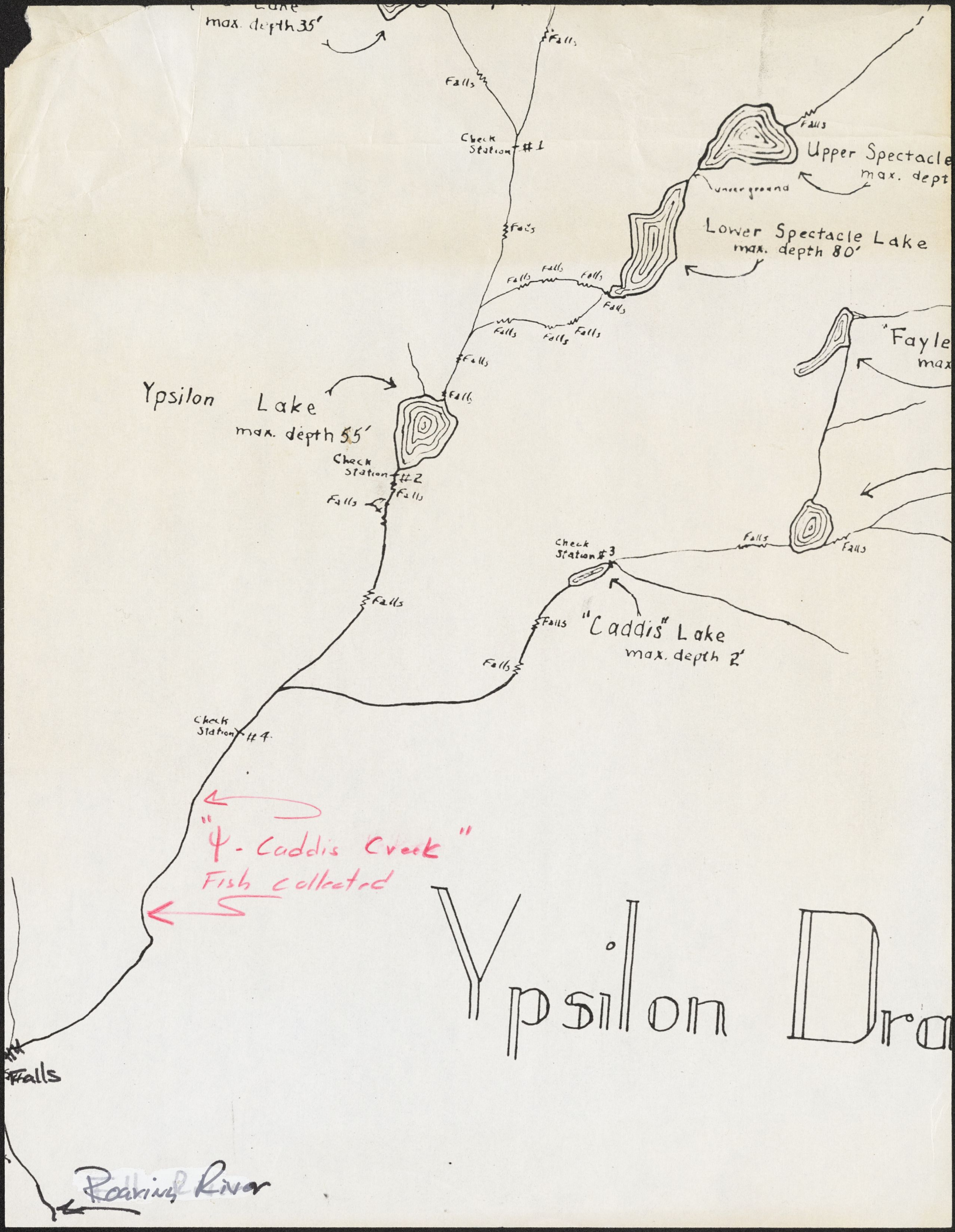


Figure 2. Distribution of fish <140 mm in Hidden Valley Creek, Summer 1984




max. depth 35'
Falls
Falls
Check Station #1
Upper Spectacle
max. dept
underground
Lower Spectacle Lake
max. depth 80'
Falls
Falls
Falls
Falls
Falls
Falls
Falls
Falls
Falls
Falls
Ypsilon Lake
max. depth 55'
Check Station #2
Falls
Falls
Falls
Falls
Check Station #3
Falls
Falls
Falls
"Caddis" Lake
max. depth 2'
Check Station #4
"Ψ - Caddis Creek"
Fish collected
Ypsilon Dra
Falls
Roaring River

1982 Greenback Cutthroat Trout Recovery Program - Arapaho and Roosevelt National Forests, Colorado

Robert J. Stuber, USDA Forest Service,
Arapaho and Roosevelt National Forests,
Fort Collins, Colorado
(Colorado-Wyoming Chapter)

ABSTRACT

Approximately 20 percent of the historic range of the threatened greenback cutthroat trout (Salmo clarki stomias) lies within Arapaho and Roosevelt National Forests. 1982 recovery efforts included monitoring one of the few remaining naturally occurring populations and its habitat, preparing stream habitat for reintroductions, and actual reintroductions into streams on the Forests.

The greenback cutthroat trout population in the 3.0 miles of occupied habitat at Como Creek appears to be stable. Measures have been proposed to protect and enhance this habitat. Non-native trout were removed from 12.0 miles of George and Cornelius Creeks, and a barrier to repopulation by non-native species was installed. Greenback fry will be reintroduced in 1983. Approximately 20,000 greenback fry were reintroduced into 20 miles of stream habitat (five streams) on the Forests during 1982.

INTRODUCTION

Historically, the greenback cutthroat trout was the only trout native to the South Platte and Arkansas River drainages, with the exception of the now extinct yellowfin cutthroat trout in Twin Lakes, Colorado. It's biology and ecology have been described by Behnke and Zarn (1976) and Behnke (1979). This endemic trout was classified as endangered in 1973 with the passage of the Endangered Species Act. Major reasons for its decline were over-exploitation, and competition and/or hybridization with introduced non-native trout. Recovery progress made during the 1970's led to a downlisting to a threatened status in 1978 (Greenback Cutthroat Trout Recovery Team 1982).

Approximately 20 percent of the historic range of the greenback cutthroat trout lies within Arapaho and Roosevelt National Forests (Figure 1). These Forests are only in the South Platte River portion of the historic range. The following information is a summary of the 1982 recovery efforts on these Forests. All the recovery activities have been a cooperative effort by the U. S. Fish and Wildlife Service, National Park Service, Colorado Division of Wildlife, and Forest Service.

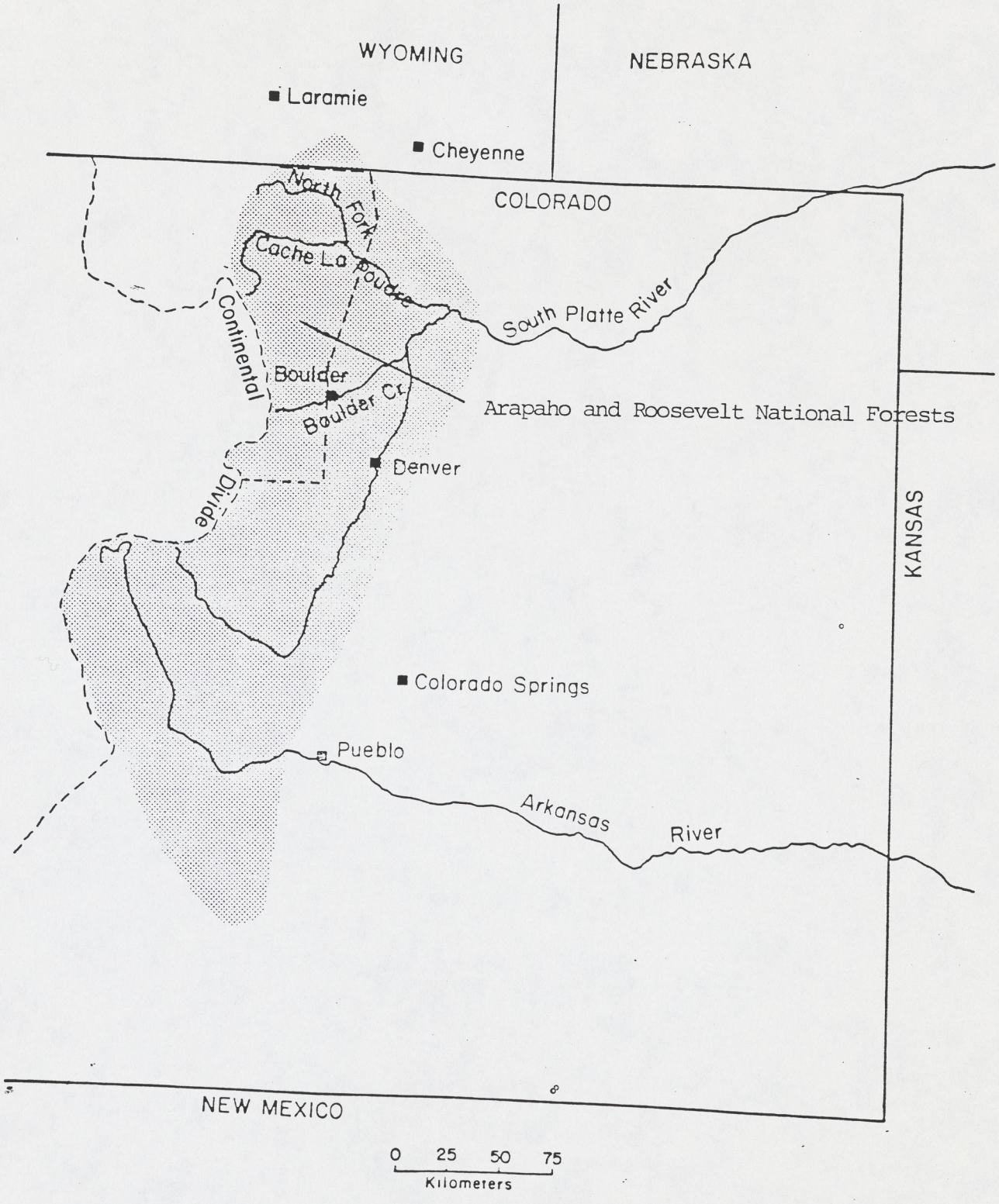


Figure 1. Historic distribution of the greenback cutthroat trout, Salmo clarki stomias (adapted from Behnke and Zarn 1976).

MONITORING EXISTING POPULATIONS

One of the tasks of the Greenback Cutthroat Trout Recovery Plan is to monitor known populations and their habitat (Greenback Cutthroat Recovery Team 1977; 1982). In 1969, one of the few remaining populations was discovered in Como Creek, a tributary to North Boulder Creek. It is a small stream with an average width of approximately 6 feet (2 m), and an average low flow of 2-3 cfs. Approximately 3.0 miles (4.8 km) of stream are inhabited by greenback cutthroat trout. A series of downstream waterfalls acts as a barrier to the upstream movement of non-native trout to that stream section occupied by greenbacks. It is felt that early settlers transplanted the greenback cutthroat trout above the barrier (R. J. Behnke, personal communication). The Colorado Division of Wildlife has established a fishing closure to protect this population. A population and habitat survey was conducted on September 7-9, 1982.

Methods. Five 100-m sections were sampled. Fish were captured with a backpack eletrofishing unit. Habitat preferences (pool versus riffle/run areas) were determined by placing a block net at both ends of each habitat type. Actual habitat characteristics (percent pools, instream cover, etc.) were measured on a transect basis.

Results. A total of 178 greenback cutthroat trout were captured (Table 1). Standing crop was estimated to be 36.8 lb./acre (41.2 kg/ha). The number present in the entire 3.0 miles of habitable stream was estimated to be 1,800. In addition, numerous young-of-the-year (YOY) were captured, which was an indication that reproduction had occurred in 1982.

Pools comprised approximately 40 percent of the stream area, whereas riffle/run areas comprised 60 percent. Greenback cutthroat trout displayed a preference for pool areas, as over twice as many (122 versus 56) were captured in this habitat type (Table 2). This habitat preference was further substantiated by testing the hypothesis that fish were randomly distributed (i.e., 40 percent should be expected in the pool areas, 60 percent in the riffle/run areas). It was demonstrated from a chi-square test that the observed distribution was significantly different than the expected distribution ($X^2 = 28.83$, $P<0.001$). Also, fish captured in pool areas were larger than those from riffle/run areas, as there was a significant difference between the respective mean lengths and weights (1.0 percent level of significance, $P=0.001$).

Recommendations. Two recommendations have been proposed based on the results of the 1982 survey. First, install approximately 8-10 log check dams (overpours) in one of the sampling stations where quality pool areas are lacking. The purpose would be to increase the amount and quality of pools. If the population exhibits a positive response (i.e., increased biomass, larger fish, etc.), more structures would be placed in other stream sections where there is a lack of quality pools. Second, the area would be managed to ensure the long-term protection of the habitat. Unimproved access roads into the Como Creek area would be closed to general vehicular traffic, as there are presently a number of stream crossings where habitat degradation has occurred. Also, a withdrawal from any future mineral entry in the Como Creek watershed would be requested.

Table 1. Numbers, size, and standing crop estimates of greenback cutthroat trout captured at Como Creek, September 7-9, 1982.

Station	Number Captured		Average length[a] (mm)	Average weight[a] (g)	Standing crop (kg/ha)	
	Total No.	No.>150mm			All Trout	Trout>150mm
One	40	12	117 (38-236)	41 (9-141)	40.3	32.9
Two	38	8	117 (71-193)	32 (18-86)	24.9	21.5
Three	42	15	126 (69-241)	36 (5-163)	60.6	49.9
Four	57	15	127 (64-211)	27 (9-109)	65.9	38.0
Five	1	0	147	27	1.5	0
Combined Data	178	50	126 (38-241)	36 (5-163)	41.2	28.3

[a] figure in parenthesis is range

Table 2. Number and size of greenback cutthroat trout captured in each habitat type at Como Creek, September 7-9, 1982.

Sta.	Pool Areas				Riffle/Run Areas			
	Amount of Area (%)	No. fish	Avg. length (mm)	Avg. weight (g)	Amt. of area(%)	No. fish	Avg. length (mm)	Avg. weight (g)
One	40	24	130	45	60	16	96	32
Two	46	22	119	41	54	16	109	23
Three	31	24	145	50	69	18	109	18
Four	47	51	127	32	53	6	119	18
Five	50	1	147	32	50	0	-	-
Combined Data	42	122	130	32	58	56	107	23

ESTABLISHING NEW POPULATIONS

Preparing Habitat For Reintroductions. Another task of the Recovery Plan is to reintroduce greenback cutthroat trout into suitable habitats throughout the historic range. The first step in this process is to identify and survey potential habitat. Once a candidate water has been selected, the habitat must be prepared for the actual reintroduction. Often the candidate water has an existing population of non-native trout. Two problems must then be overcome: (1) removal of the non-native trout population; and (2) prevention of repopulation by the non-native trout. This sequence is reversed in the actual habitat preparation. First, a barrier to reinvasion must be created. One common technique is to install a structure which forms an impassable waterfall. Another innovative method described by Rinne and Stefferud (1982) for the reintroduction of the endangered Gila trout (Salmo gilae) is to blast a vertical notch in the bedrock of a steep section of stream to create the impassable waterfall. This technique may be especially appropriate for reintroductions into streams within Wilderness Areas where the use of mechanized equipment is strongly discouraged. The second step of the sequence is to remove the non-native trout, usually by chemical treatment (i.e., rotenone, antimycin).

George and Cornelius Creeks, two small streams in the North Fork of the Cache la Poudre River drainage were selected as reintroduction sites in 1981. Cornelius Creek is a tributary to George Creek. Brook trout were present in both streams. Approximately 12 miles of stream were deemed to be suitable habitat for greenback cutthroat trout.

A rock-filled gabion barrier was constructed in July of 1981. Native rock was used to fill the gabion wire baskets. It is located in a narrow canyon section of George Creek, below the confluence with Cornelius Creek. It creates a 4-5 foot waterfall. The barrier has withstood spring runoff conditions during 1982 and 1983. The only required maintenance has been occasional debris removal.

Brook trout were removed by treating the 12.0 miles of stream above the barrier with rotenone in July of 1982 (low flow period). The applied dosage was 3.0 ppm. Rotenone was dispensed using six drip stations. In addition, shallow weedy areas and beaver ponds were treated using a backpack spray unit to ensure a complete removal. Caged live brook trout were placed immediately above each drip station to monitor the effectiveness of the next upstream drip station. The effects of the rotenone were limited to the area designated for treatment by introducing potassium permanganate ($KMnO^4$) immediately below the gabion barrier, which effectively neutralized the rotenone. The treatment was judged to be successful in terms of eliminating all of the brook trout above the barrier. Approximately 10,000 greenback cutthroat trout fry will be reintroduced in 1983.

Actual Reintroductions. Five streams on the Arapaho and Roosevelt National Forests were stocked with greenback cutthroat trout fry in 1982. A total of 19,600 fry were introduced into approximately 19.0 miles (30.4 km) of stream. Fry came from the U. S. Fish and Wildlife Service Fish Cultural Development

Center in Bozeman, Montana. Broodstock for this hatchery source were originally obtained from Como Creek in 1977. Also milt taken from wild males in Hidden Valley Creek, a greenback stream in Rocky Mountain National Park, has been used in recent years to maintain the "wildness" of this hatchery source.

Stocking was conducted in September. The weight of fry at stocking was 500 per pound (230 per kg.). Average length was approximately 1.5 in. (40 mm).

All five streams have natural gradient barriers. Some of the streams had non-native trout populations which had been introduced at some time in the past above the barriers. The fish were removed prior to the stocking of greenback cutthroat trout. A summary of streams stocked is listed in Table 3, along with drainage, historic fish population data, number of fry stocked, and miles stocked, respectively.

Table 3. Summary of greenback cutthroat trout stocking in streams in Arapaho and Roosevelt National Forests during 1982.

Stream	Drainage	Prior Fish Population	Number Stocked	Miles of Habitable Stream
Bard Creek	Clear Creek	Barren	6,900	6.5
Hourglass Creek	South Fork Cache la Poudre River	Barren	1,500	1.5
May Creek	Cache la Poudre River	Brook trout removed in 1981	2,000	2.0
Sheep Creek	Cache la Poudre River	Rainbow trout removed in 1981	7,200	7.0
Williams Gulch	Cache la Poudre River	Barren	2,000	2.0

All introduced populations will be monitored and protected. Fry will be stocked in subsequent years, whenever possible, to establish multiple age class populations. Fishing may be allowed on a limited basis (i.e., catch and release) once the Greenback Cutthroat Trout Recovery Team deems that a viable population has been established.

REFERENCES

Behnke, R. J. 1979. Monograph of the native trouts of the genus Salmo of western North America. Contract Report for USDA Forest Service, USDI Fish and Wildlife Service, Bureau of Land Management, Lakewood, Colorado. 163 p.

Behnke, R. J. and M. Zarn. 1976. Biology and management of threatened and endangered western trouts. USDA Forest Service Gen. Tech. Rep. RM-28, Fort Collins, Colorado. 45 p.

Greenback Cutthroat Trout Recovery Team. 1977. Greenback Cutthroat Trout Recovery Plan. USDI Fish and Wildlife Service, Denver, Colorado. 16 p. + appendix.

_____. 1982. Greenback Cutthroat Trout Recovery Plan. USDI Fish and Wildlife Service, Denver, Colorado. 32 p. + appendix.

Rinne, J. N. and J. Stefferud. 1982. Stream habitat improvement in the southwestern United States, Arizona, and New Mexico. Proc. of Rocky Mountain Stream Habitat Workshop, Sept. 7-10, 1982, Jackson, Wyoming.

UNITED STATES DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife
Division of Fishery Services
Vernal, Utah

Annual Project Report

FISHERY MANAGEMENT PROGRAM

Rocky Mountain National Park
Colorado

Annual Project Report
Fishery Management Program

Rocky Mountain National Park
Colorado

by
James W. Mullan
Fishery Management Biologist

Introduction

Rocky Mountain National Park consists of 410 square miles of the Rocky Mountains 64 miles northwest of Denver, Colorado. The primary objectives of the area is the conservation of the scenic, scientific, and historic heritage of the United States for the benefit and enjoyment of its people. Fishing on the 473 miles of stream and 148 lakes has long been a part of this heritage, even though many of these waters originally were, and some remain, barren of fish life. The Bureau of Sport Fisheries and Wildlife has assisted the National Park Service in the research and management of the fishery resource over the years.

During 1969 the Vernal Field Office provided the Park Service with a prospectus designed to illuminate areas in which the limited services of the Bureau could be most profitably channeled. This was followed up in September by a one week visit to the park by Bureau of Sport Fisheries and Wildlife biologists Jim Mullan and Don Bartschi. Contacts included, but were not limited, to the following National Park Service personnel: Supt. Thompson, Chief Park Ranger Jim Randall, Staff Ranger Dave Butts, and Research Biologist Dave Stevens.

Pack Trip Survey of the Headwaters of the North Fork Big Thompson River (9/15 - 18/69).

The purpose of this survey was to determine the feasibility of renovating one or more selected lakes for greenback cutthroat trout. In the previously mentioned progress report of 1969, which will serve as background for much that follows, the Fay Lakes were a suggested possibility for such work, but attention was directed elsewhere when it became clear that this choice involved many difficulties.

The headwaters of the North Fork of the Big Thompson River are reached by about 8 miles of uphill trail from the eastern boundary of the park or about 14 miles from the trailhead at Glenhaven. The trail traverses the stream over much of its course, allowing ready observation of the stream and the drainage. The latter makes up 10.5% of the land mass within the Park.

There are 35.5 miles of stream and eight lakes (51.7 surface acres) in this drainage. The eight lakes are located in more or less distinct groups in the upper basin. In one group are Rowe Glacier Lake (7.4 acres) at elevation 13,100 feet, draining northeasterly through two small unnamed lakes and then into Lake Dunraven (11.2 acres) about 2,000 feet lower in elevation. Lake Dunraven was the only one of these lakes observed directly. One experimental gill net fished 20 hours diagonal to the inlet caught nothing. The lack of fish was consistent with observations somewhat less penetrating of Bulkley (1958 survey), who reported Lake Dunraven and all unnamed lakes as barren although planted once in 1934. The limiting factor to fish life of this habitat appears primarily related to shallowness, effecting oxygen levels during prolonged ice cover, a circumstance evidently explaining the barrenness of the much higher Rowe Glacier Lake as well (Guso, 1963). Cascades at the inlet and outlet of Lake Dunraven, which undoubtedly freeze solid, appear to preclude the possibility of temporal survival in flowing water.

At the head of the main west-east canyon is Lake Louise (6.4 acres), fed by a perpetual snow field. The outlet empties into a 2 1/2 acre unnamed lake about 1,000 feet downstream, which also receives the outflow from Lake Dunraven from the south. In-common with Bulkley's earlier survey, no signs of fish life were observed even though one gill net was set for 20 hours in Lake Louise, the outlet stream killed-off with fish toxicant down to the unnamed lake, and the latter extensively sampled by angling. It is at the outlet of this unnamed lake that the North Fork of the Big Thompson River becomes an entity. An on-foot traverse below this point failed in revealing the presence of fish life down to a series of steep cascades. Below these cascades Eastern brook trout were readily observed and caught with hook-and-line.

Lake Husted (10.1 acres) and Lost Lake (9.2 acres) are separated from the other two groups of lakes by a high ridge to the north of the river. Lake Husted is landlocked for practical purposes, although there is seepage drainage into Lost Lake, while the outlet of the latter joins the North Fork of Big Thompson River below the previously mentioned cascades where the brook trout were observed and sampled. These were the lakes being considered for possible renovation for greenback cutthroat trout. Sampling gear was lost in the pack of a horse that became loose from the pack string and therefore no sampling was made of these lakes.

Lake Husted has a reported maximum and average depth of 21 and 5 feet, respectively. It was last stocked in 1944. Bulkley in 1959 reported that brook trout were spawning successfully and that the population was well balanced with fish of all sizes up to ten inches observed. More recent voluntary creel samples show that this continues to be so, and that the fishing is excellent for pan-size brook trout (Table 1).

Reported depths of Lost Lake are the same as for Husted, but biannual stocking of 2,000 fry-size cutthroat was practiced here up until 1969 when all non-native fish stocking in the Park was temporarily suspended. Lost Lake also differs from Husted in that it was raised to provide water outside the Park in the past. This dam is now non-operable permitting upstream fish passage.

Bulkley (1959) reported poor fishing in 1958 traceable to a lack of spawning gravel and stocking. Weldon reported fair to good fishing for cutthroat trout in 1961, correlated with the 1959 stocking. Comparison of these and later year creel sample statistics does seem to show a relationship between the stocking in 1959 and the catch of cutthroats in 1961. More importantly, it shows that naturally spawned brook trout have made up about two-thirds of the catch over the years, suggesting that the need for stocking may have been overrated in the earlier fishery surveys. Considering the notorious infertility of alpine lakes, it is conceivable that the stocked cutthroats survived and grew at the expense of the self sustaining brook trout.

The outfitter at Glenhaven reported that about 24 parties, averaging four persons per party, packed in per year. Trip routine was described as stopping in the meadows area of the North Fork of Big Thompson River, below the cascades mentioned, and allowing the campers to catch a mess of brook trout before proceeding either to Lost or Husted Lakes above. Fishing in Lost Lake was reported as slow, and in Husted, as fast, though the fish were "big headed". Such a resume is consistent with impressions evident in the creek sample data from both lakes, and the upper limit of productivity that might be expected from such habitat.

Lake Husted has consistently provided faster fishing than Lost Lake - 2.2 as compared to 0.41 fish per hour on average (Tables 1 and 2). The average length of a fisherman trip at Husted (4.4 hours) has been shorter than that at Lost Lake (6.4 hours), a difference that accords with the differences in catch rate. Assuming no bias in voluntary recordation between lakes, slightly more of the total trips were expended at Lost (56%) as compared to Husted (44%). This difference could be the result of closer and forested camping facilities at Lost Lake compared to Husted, located two-fifths of a mile further up the mountain and surrounded by tundra, the inducement of larger fish (10 inch average size) at Lost as compared to Husted (9 inch average), or both. Relating these data, crude as they may be, to 100 annual fishermen days on these lakes, results in a harvest estimate of 6.4 pounds per surface acre for Lost as compared to 12.6 pounds per surface acre for Husted Lake.

Fairly obviously these lakes are doing fairly well and should be left alone. Furthermore, they are not overly suitable for greenback cutthroat trout from the standpoint that spawning facilities for cutthroat are evidently lacking, and Lost Lake does not represent a discrete habitat inasmuch as brook trout could re-enter via the outlet. On the other hand, Lake Louise, the outlet stream, the downstream unnamed lake, and the one mile of the North Fork of Big Thompson River below to the cascades mentioned appears to represent an ideal ecosystem complex for experimental greenback introduction and evaluation.

First, this complex represents a variety of habitat types. Lake Louise is as deep, if not deeper, than Husted or Lost Lake. The outlet stream is substantial, two to four feet wide and up to three feet deep, and is adequately supplied with spawning gravel, deep holes, undercut banks, and a rather amazing abundance of food organisms, inlcuding caddis and midge, but particularly, fresh water shrimp.

The unnamed downstream lake is comparatively shallow, though some water over 15 feet was evident. And the one mile or so stretch of the North Fork of Big Thompson River below is typical mountain main stream, unlike the tundra-like outlet to Louise Lake. In fact, this upper reach of the river appeared to represent more favorable trout habitat than the lower river due to a better pool-riffle ratio and a lesser gradient, which resulted in the impression of larger size as well.

Second, this complex, besides representing a discrete entity, is evidently barren, requiring no eradication of non-native fish, although some doubt was cast on this point relative to third-hand reports of trout catches purportedly originating in the vicinity of the unnamed lake. Although this doubt was not fully resolved during the trip, primarily due to loss of the fish toxicant when the pack animal bolted, it is most probable that the report was erroneous in respect to location as deduced by the following: (1) the abundance of food organisms which can only be explained by the lack of fish predation; (2) that fish would inhabit the lower river portion of this water complex and not the upper area is biologically unreasonable; and (3) description terminology for this drainage basin has been misleading in the past, Bulkley, 1959, "Five unnamed lakes above Lost Lake on the North Fork of ", so the chance of this type of error is perhaps great.

Thus, it is recommended that greenback cutthroat trout of the purest strain obtainable be introduced in this complex. Preferably, one to two hundred adult and sub adult greenbacks should be flown in by helicopter and distributed as widely as possible. The expense involved in this pilot operation would be small in relation to the information gained on the feasibility of restoring this native trout to other park waters.

Survey of Black Canyon Creek (9/18/69)

Black Canyon Creek is a tributary (6.5 miles) to the Fall River which has been closed to fishing for many years above a small water supply impoundment for Estes Park. Purpose of this survey was to check out the possibility that this tributary retained native greenback cutthroat trout that had not been displaced by brook trout. Electro-shocker sampling of about 30 yards of the brush covered stream immediately above the impoundment produced 11 brook trout 4.5 to 9.4 inches in length. The stream in this area is small, perhaps 4 to 8 feet wide, but shallow (a few inches), with only a few pocket type pools present. The fish were in spawning coloration and eight were six inches or better in length. Conductivity of the stream was 22 micromhos, water temperature 48° F, and P.H. 7.2.

Limited electro-shocker survey, Fall River (9/18/69)

Purpose of this work was to familiarize ourselves with the Fall River, observe the efficiency of the packback shocker in such habitat, and if possible within the limited time available, replicate two samplings of the nine areas worked in 1965 by Peterson for comparative purposes. Table 3 depicts such a comparison. No changes are evident in these data that could not be explained within the limits of the vague sample area delineation available from the earlier survey. Furthermore, it is doubtful whether the small number of fish collected in either year constitutes a valid index trend. However, replication involving all the stations originally sampled might result in a total value that could be used as a valid trend index, assuming that various inherent errors were compensating.

Restructuring of the Fishery Program

The fisheries program at Rocky Mountain National Park is in the process of being updated relative to long-term evolution of National Park Policy stressing naturalistic resource husbandry. Webster defines a program as a plan. Stokes, Delisle and McCormick (1969) state that a plan consists of two basic elements: (1) An objective(s) and (2) a program to achieve the objective(s). Park Service objective and program currently is largely limited to species and habitat plans because of a lack of demand and use measurements and projections that can be related to the resource as a whole.

Problems encountered in developing a more reliable method of identifying fishing usage by the 1,729,485 visitor days registered in 1969, obscured the objective. A survey of inbound visitors on their intent to fish coupled with random creel sampling suggested that only 3-4,000 angler days occurred on park waters in 1969, compared to 54,000 angler days in 1968. Questioning a sample of outbound visitors in 1970 as to whether they actually fished and collating their replies with creel sample data collected systematically is expected to provide a better estimate. It would be extremely valuable if the conducted effort could be made to replicate the earlier creek censuses of Bulkley and Cope (1958,59) on the Fall and Big Thompson Rivers. Barring this possibility, it might be possible that the same long-term comparison of harvest and fishing quality could be achieved in the personal checkout interview.

In the restructuring underway the specific characteristics of the brook trout in relation to other trout species should not be overlooked. The die-off of Pacific salmon after spawning, for instance, is characteristic, not a species problem. Management aimed at circumventing such die-off obviously would be a waste. All available data shows that restrictive regulatory measures aimed at quantity and quality angling improvement with brook trout in good habitat are similarly doomed, due apparently to the short-lived, small-size characteristics of the species.

The effects of different angling regulations on a wild brook trout population have perhaps been most exhaustively studies at Lawrence Creek, Wisconsin, which contains a dense native population of this species similar to most waters in Rocky Mountain National Park.

During six continuous years, three sets of regulations were evaluated: a 6-inch size limit and bag of 10 (1955), no size limit and no bag limit (1956-57), and a 9-inch minimum size limit and limit of 5 (1958-60). The first two sets of regulations were much alike in their effect upon harvests. Few anglers were skillful enough to catch 10 or more wild brook trout and few brook trout less than 6 inches were kept when it was legal to do so. It was concluded that the harvests observed in 1955, 1956, and 1957 were largely unaffected by the presence or absence of regulations.

When the minimum size limit was raised to 9 inches (1958-60), the catch was dramatically reduced, angling success indices declined, and fishing pressure declined. Simultaneously, the growth of trout declined and instances of higher-than-normal summer winter mortality due to natural causes reduced the possibility of stockpiling enough Age Group II brook trout to provide a yield (in terms of both number and pounds) comparable to one which included a significant percentage of Age Group I brook trout as well.

It should be pointed out, however, that these remarks are predicated from the standpoint of efficient utilization of a resource, a basic tenet of fishery management, but a principle not necessarily a part of National Park policy. On the other hand, accumulating information, though inconclusive tidbit-wise, does seem to confirm the overall impression that the base fishery resource of Rocky Mountain National Park is severely limited in user potential, and that it may well have to be managed for maximum benefits if a semblance of the fishing heritage is to be perpetuated.

With an ever increasing portion of the visiting public preconditioned by artificial trout fishing and the instant amenities of urban America, the availability of limited wild trout fishing even under the best of conditions could prove more of a liability than as asset, unless a vigorous attempt is made informing the public of limitations and advantages. Along these lines the writer was forcibly impressed with the throngs of viewers at Bear Lake last fall, and the tremendous opportunity represented in selling fishery concepts were an underwater viewing facility present. Unlike Crystal Springs in Florida, there would be little to view in the underwater world of Bear Lake, but this very fact could be the catalyst for an interpretive display and program pointing up the limits of natural biological productivity in such waters.

In the foregoing we have tried to examine various problems and situations from several aspects, with the hopes that this information will aid Park Service officials in arriving at their own conclusions and decisions. This office has allotted about two weeks time in our schedule for work in Rocky Mountain National Park. This time can be devoted to the restoration of the greenback cutthroat, replicating the 1965 surveys of the Fall and

Big Thompson Rivers and/or back country survey of lakes. Lastly the Vernal Field Office would like to acknowledge the splendid cooperation of park officials during the past year.

James W. Mullan
Fishery Management Biologist

Reviewed:

Regional Supervisor
Division of Fishery Services

Date _____

Distribution:
Washington Office - 3
NPS - Estes Park - 3
NPS - Regional Office - 2
Regional Office - 5
Fishery Services Field Offices - 12
Division of Fish Hatcheries - 1
Vernal Field Office - 5

Source of Data or Literature Cited

Bulkley, Ross V. 1959. Report on 1958 fishery studies by Bureau of Sport Fisheries and Wildlife on Rocky Mountain National Park. B.S.F.W., memo, 38p.

Cope, Oliver B. 1959. Report on 1959 fishery studies by Bureau of Sport Fisheries and Wildlife in Rocky Mountain National Park. B.S.F.W., memo, 12 p.

Guse, Neal G. 1963. Lake Fishery Record, file R.M.N.P.

Hunt, R. L., O. M. Brynildson, and J. T. McFadden. 1962. Effects of angling regulations on a wild brook trout fishery. Technical Bulletin 26, Wisconsin Conservation Department, 57p.

Mullan, J. W. 1969. Progress report on fishery management program, Rocky Mountain National Park. B.S.F.W., memo, 15p.

Peterson, L. C. 1965. Progress report fishery management program, Fall River and Big Thompson River, Rocky Mountain National Park. B.S.F.W, memo, 12p.

Stokes, J. D., G. E. Delisle, and J. B. McCormick. 1969. Fish and wildlife resource planning guide. California Fish and Game, 124p.

Weldon, Robert. 1961. Lake Fishery Record, file R.M.N.P.

Table 1. Voluntary Creel Samples, Husted Lake
Rocky Mountain National Park

Year	No. Hrs. Fished	No. Fish Caught	Species Trout	Size (inches) 6	6-8	8-10	10-12	12+
1960	88	271	Brook	-	-	-	-	-
1961	76	108	Brook	2	30	59	16	1
			Rainbow			2		
			Hybrid (?)			6		
1962	66	84	Brook		45	28	4	
			Cutthroat				7	
1964	36	123	Brook		43	42	28	10
1967	5	10	Cutthroat		7	3		
Total	271	596	2.2 fish/hr.					

Addendum: Total anglers - 62; Av. day - 4.4 hrs.; Est. total harvest - 445 no., 127.2 lbs.

Table 2. Voluntary Creel Samples, Lost Lake
Rocky Mountain National Park

Year	No. Hrs. Fished	No. Fish Caught	Species Trout	Size (inches 6	6-8	8-10	10-12	12+
1960	59	23	Brook					
		12	Cutthroat					
1961	359	73	Brook	3	13	34	15	8
		55	Cutthroat		5	27	18	5
1962	108	48	Brook	40	7			1
		9	Cutthroat	6				3
1963	50	8	Brook		3	4		1
1964	68	24	Brook		14		5	5
		4	Cutthroat			2	1	1
1965	52	12	Brook		8	3		1
		16	Cutthroat		15			1
1966	32	4	Brook		2	2		
		10	Cutthroat			5	5	
Total	728	298	0.41 fish/hr.					

Addendum: Total anglers - 113; Av. day - 6.4 hrs.; Est. total harvest - 147 no., 58.8 lbs.

Table 3. Comparison of the Number and Length of Fish Collected from Two Areas of the Fall River in 1965 and 1969

	Station Five						Station One					
	8/16/65			9/18/69			8/16/65			9/18/69		
Size (inches)	Brook Trout	Brown Trout	Suckers	Brook Trout	Brown Trout	Suckers	Brook Trout	Brown Trout	Suckers	Brook Trout	Brown Trout	Suckers
2.0- 2.9				2						3		
3.0- 3.9	4			4						2		
4.0- 4.9	13		4	9			5			5	1	
5.0- 5.9	33			15			2	1		6	2	1
6.0- 6.9	13			10	1		5	3		2	1	1
7.0- 7.9	2		6	5		2		1	1	4	2	3
8.0- 8.9	1		14			4		2	2			1
9.0- 9.9			14			4			2			6
10.0-10.9			3			1		1	1			5
11.0-11.9			13						2			2
12.0-12.9	—		1	—	—	—	—	—	—	—	—	—
Total	66		55	45	1	11	12	8	8	22	6	19

GREENBACK CUTTHROAT TROUT FROM HUNTER'S CREEK, ROCKY MOUNTAIN NATIONAL PARK

Robert Behnke
June, 1985

ABSTRACT

Seven specimens collected in Hunter's Creek, tributary to North Fork St. Vrain River in Rocky Mountain National Park are identified as pure greenback cutthroat trout, *Salmo clarki stomias*. I assume that the population in Hunter's Creek represents St. Vrain River greenback trout, transplanted into Hunter's Creek at an early date before hybridization with rainbow trout occurred in the St. Vrain. The Hunter's Creek population is the fourth known sourceof pure *S. c. stomias*.

IDENTIFICATION

Seven specimens from 178 to 261 mm TL collected June 13, 1985, by Bruce Rosenlund (USFWS, Colo. Field Office) were taxonomically examined and compared with criteria for greenback cutthroat trout, *Salmo clarki stomias*.

The specimens are consistently uniform in spotting pattern and phenotypic appearance. The strikingly pronounced, large spots on the body and red-pink spawning coloration of males indicate the sample was drawn from a pure population of *S. c. stomias*.

Table 1 lists diagnostic meristic characters of the seven specimens and compares them with data from *stomias* populations from Como Creek and the headwaters of the Little South Poudre River.

Table 1. Character analysis.

	Gillrakers	Pyloric caeca	Scales above l.l. and in lat. ser.	Basibranchial teeth
Hunter's Crk. N = 7	18-22 (19.9)	27-35 (31.6)	48- 57 (51.6) 187-212(195.7)	7-12 (8.9)
Como Crk. N = 18	17-21 (19.0)	24-42 (29.4)	46- 53 (48.4) 174-205(189.3)	1 of 18,no teeth 17 w/ 3-12 (6.0)
Little So. Poudre N = 18	19-23 (21.3)	27-50 (35.2)	53- 60 (56.7) 205-236(216.5)	2-17 (11.1)

In all of the diagnostic characters, the Hunter's Creek specimens are intermediate between the Como Creek population and Little South Poudre population. All specimens have nine pelvic fin rays (typically 10 in rainbow trout and hybrids). The uniform spotting pattern, high scale counts, low caecal counts, well developed basibranchial teeth, and number of pelvic fin rays, all agree that no hereditary material from rainbow trout occurs in the Hunter's Creek population. The first gill arch of the specimens possess posterior gillrakers, a character typical of *S. c. stomias* but absent in rainbow trout.

Considering possible sources of non-native (to South Platte drainage) cutthroat trout that may have been stocked into Hunter's Creek -- Colorado River cutthroat, S. c. pleuriticus, and Yellowstone cutthroat, S. c. bouvieri -- the spotting pattern, coloration, caeca scales and basibranchial teeth counts of Hunter's Creek specimens eliminate Yellowstone cutthroat and the spotting pattern and a mean value of more than 50 scales above the lateral line, rule against pleuriticus as a founder of the population.

Although only seven specimens were examined, the evidence is convincing that Hunter's Creek has a pure populationof S. c. stomias. As such, it becomes only the fourth known source of pure populations of this taxon -- that is, the Hunter's Creek population represents 25% of the known interpopulational genetic diversity of S. c. stomias.

ORIGIN

The topography of the Hunter's Creek watershed, draining through a bench, high above the North Fork St. Vrain River, which isolates upper Hunter's Creek from access to fishes from the St. Vrain, makes in relatively certain that the Hunter's Creek greenback was stocked by man. This situation is similar to the other known greenback populations in the Little South Poudre, Como Creek and Cascade Creek -- all were introduced above impassable falls where they were isolated and protected from non-native trouts.

It is unlikely that hatchery trout were used to stock Hunter's Creek. The only early propagation of greenback trout occurred at the Leadville federal hatchery from 1890 to 1896. The Leadville greenbacks were propagated from spawners from Twin Lakes. The Twin Lakes greenback possessed the lowest scale counts I have found in stomias specimens (42-53 (46.2) above lateral

line and 170-202 (186.0) in lateral series, based on 20 specimens collected in 1889 and 1903). From the 1890's to 1940's the predominant cutthroat trout propagated in hatcheries and stocked in Colorado were Colorado River cutthroat, Yellowstone cutthroat and various hybrid mixtures.

Around the turn of the century, irrigation companies constructed many water storage reservoirs in the headwaters of Boulder Creek, St. Vrain and Big Thompson drainages in what is now Rocky Mountain National Park. These headwater areas were barren of fish due to impassable falls. The workmen probably transported trout from the nearest sources into the originally barren waters. Many of these reservoirs still contain greenback x rainbow trout hybrids. The trail to Sandbeach Lake crosses Hunter's Creek. Workmen regularly using this trail probably made a transplant of greenback trout from the North Fork of the St. Vrain to Hunter's Creek. Such a transplant must have occurred prior to hybridization of greenback and rainbow trout in the St. Vrain.

Keplinger Lake is at the headwaters of Hunter's Creek and a barrier falls occurs on Hunter's Creek about one-half mile above the Sandbeach Lake trail crossing. Keplinger Lake is barren of fish and Hunter's Creek above the above-mentioned falls is barren of fish (Bruce Rosenlund, personal communication). Thus, it can be assumed that if Keplinger Lake was ever stocked with non-native trout, they did not become established in Hunter's Creek, as no fish are found above the falls where adequate trout habitat exists.

BIOLOGICAL NOTES

The specimens consist of four females (178, 191, 200, 217 mm TL) and three males (198, 204, 261 mm TL). They are in excellent condition with

abundant fat deposits around pyloric caeca, especially in the largest male. The three largest females had not yet spawned. One had released the eggs into the body cavity and would have spawned, probably within a day or two. The smallest female had only immature eggs but two empty egg shells in her body cavity indicated she had spawned. The testes in the two smaller males were less turgid than in the largest male, suggesting partial spawning. Based on this limited sample, it appears that spawning had not yet peaked by June 13, 1985.

Although a detailed parasitological examination was not made, the 191 mm female speciman contained several small nematodes of from 8-10 mm associated with the pyloric caeca and intestine. The nematodes were not encysted and may have exited from the stomach or intestine after the specimen was preserved in formalin.

I examined scale samples but accurate aging was not possible. I "estimate" that most of the specimens were completing their third or fourth year of life, perhaps the fifth year for the largest specimen, but distinct annuli could not be discerned.

SUMMER 1999

ROCKY MOUNTAIN
STREAMSIDE

TROUT UNLIMITED • COLORADO COUNCIL

•In This Issue•

TROUT UNLIMITED

The Upper Arkansas River of Issues

By Steve Craig

You might have "been there and done that" with respect to the coldwater resources in this country, but I'll venture that you haven't accomplished or observed as great a variety as is available within the Upper Arkansas River watershed. And I won't even count winter activities here. Heading up near the Continental Divide at just about the dead center of Colorado, the Arkansas River then flows more or less south east across Kansas, Oklahoma and Arkansas until joining the Mississippi River several hundred miles later. The Upper Arkansas, by a loose definition, is that portion from the headwaters to Pueblo, Colorado, about 150 miles. For coldwater resource purposes and trout fishing recreation, we're talking about the 100 or so miles from the Royal Gorge on up. Think of a major TU issue, with the exception of salmon/steelhead and maybe acid rain, and you'll find it here. And if not now, then before. In spite of this, the Arkansas is a pretty darn good brown trout fishery. But first, a little history. Trust me, it's useful to understand the fishery.

Well before westward expansion the Upper Arkansas Valley was used by the Utes for summer hunting and later by fur trappers. Some time after the mid-nineteenth century, and no doubt prompted by the discovery of gold further west, mining activities commenced near Leadville. This went off and on, or boom and bust, for the rest of the century. About the same time the railroads pushed through and farming and ranching became firmly established. I think the area's oldest water right was decreed with a priority date of 1868, but don't quote me on that. The first major water projects were put in place around 1900, primarily designed to store water from snowmelt runoff at high altitude for release later during the growing season to benefit farming 200 miles east.

Subsequent projects provided storage for Front Range cities' needs, and trans-basin diversions brought West Slope water into the Arkansas River basin. Fortunately there are no dams on the main stem of the Arkansas, and even though the river is a pipeline for the various legal users, it does act very much like a natural system. This is helped somewhat by a better-late-than-never recognition by those in charge that moderation in flow regimes is no vice and that aquatic resources would benefit. The Collegiate Peaks Anglers Chapter of TU, established in the mid 1980's, played no small part in encouraging folks to see that benefit.

Somewhere along the way, the Greenback Cutthroat almost disappeared from the Upper Arkansas watershed. Most of the other resource-related changes took place early on. Deforestation of entire mountains for mine shaft timbers, the railroad bed and infrastructure, and diversion of stream flows to support agriculture were all done before 1900. The first three quarters of this century saw a major water project put into operation (Frying Pan-Arkansas) and the decline of almost all mining activity. Some ranching remains. Of course the effects of these activities will be with us forever in the form of tailings piles, water quality degradation, and decreased stream flows. Some of this can be corrected with a lot of effort. But where can you dump a 100-yard square by 30-foot high tailings pile? Leadville lays claim to the highest incorporated town in the U. S. but has been challenged in this assertion by Alma, a community on the other side of the Mosquito Range. Hey, if the water wars are on hold, let's argue about something else! And I'll bet you didn't know that the Valley around Buena Vista was once a major lettuce producer and even had annual Lettuce Festivals up until World War II.

Continued on page 3

Visit the CTU website at cotrout.org

Send your comments and suggestions for *Streamside* to tkrolden@aol.com or call 303-839-9300.

Welcome to Colorado.
Welcome to Reality.

The President's Line

By Dave Taylor

The world of Trout Unlimited comes to Colorado August 19-21 for the 1999 TU Convention. The venue is Copper Mountain Resort, which boasts a new and world-class conference center. TUers from across the U.S. gather to discuss, debate and approve the next year of Trout Unlimited's resource agenda. It is a rather remarkable grassroots process and a lot of work for the many National Resource Board delegates.

TU's Board of Trustees will also meet at the convention to oversee and discuss the business and fiscal side of the organization, and integrate it with the resource agenda. In addition, TU affiliate members from Canada and New Zealand will attend and discuss issues affecting their trout resources.

It's quite an event. I encourage interested members in Colorado to attend the many seminars, the NRB meeting, or the special events or fundraisers, including the banquet and auction on Saturday, Aug. 21.

It is most fitting the convention is in Colorado this year. Our state is experiencing tremendous growth, and more pressure is being exerted on our coldwater and wild trout resources than ever before. Within one hour of Copper are blue ribbon trout streams, burgeoning resorts, large-scale residential and commercial developments, multiple use public lands, huge mining operations, a stressed interstate road system, abandoned mine sites, Superfund sites, transmountain diversions, wild trout, hatcheries, whirling disease plagued rivers, native cutthroat trout and wilderness areas. In other words, while TUers will experience the magic of our Rockies, they can also witness – if not experience — virtually every environmental and conservation issue our organization faces.

This should all add up to some fascinating dialog and outcomes. Come meet your fellow TU members, your national and state staffers and your organization's volunteer leaders. I think you will enjoy the experience. And I think you will be impressed with TU.

Continued from page 1

The Upper Arkansas River of Issues

Now the Upper Valley is undergoing a transition to a recreation-based economy. The leading money-getter by far is the commercial whitewater rafting community. This burgeoning business started in earnest about 1985 and reached a chaotic, crowded state a few years later. So most of the Upper Arkansas River corridor was incorporated, for recreation management purposes, into the Colorado State Parks system as the Arkansas Headwaters Recreation Area. But not without a whole bunch of confrontation, animosity and politics among the various user groups, primarily rafters and anglers. The main disagreements centered on which sections of the river would be managed for rafting and which for angling. What brought the conflict to a head in the early nineties was the decision to release stored water (known as augmentation) after the annual natural runoff subsided about mid-July. This augmentation was desired by rafters to extend their season further into summer, to keep the river at a minimum of 700 cfs until August 15. The angling community, with fears of the thriving brown trout fishery being threatened by higher flows during fingerling summertime development, objected. Colorado Trout Unlimited, the state council for Trout Unlimited, filed suit to prevent the Bureau of Reclamation from making augmentation releases. The suit was thrown out on a technicality and without prejudice. The judge also ordered that a comprehensive Water Needs Assessment study be accomplished. The WNA has just recently been completed and will be released to the public later this year. The Executive Summary is available now.

During the intervening years, user groups concluded that confrontation was not in the best interest of anyone and that the health of the river affected all.

So voluntary flow regimes were implemented and, although augmentation is still in place, the status quo appears to be working. The Water Needs Assessment is being perused closely by all concerned. There are no surprises. For example, the fishery needs flows in the 400-500 cfs range while rafters prefer 1500-2000. Where we go from here within the context of Colorado's legal system and water user's infrastructure is yet to be determined.

With that background, let's look at the fishery and the fishing. The Arkansas from Royal Gorge to the headwaters is primarily a brown trout fishery. Colorado River rainbow fingerlings stocked many years ago are not self-sustaining. No catchables have been stocked in the mainstem for many years. The higher tributaries have a mix of mainly brook, brown and cutthroat trout. There are many waters within a 20-mile radius up and down the watershed where a Colorado Grand Slam, one of each major species, can be caught. You won't catch many monster trout in any of these moving waters. Theories of why this is so vary depending on to whom you talk, but heavy metals contamination and lack of forage base (as in sculpins) tend to keep the browns under 18-20 inches. I've even been told that once Salida's sewage treatment plant came on line may years ago, the bug life dropped off and the trout started trending smaller. Cost of progress I guess. The mining contamination might be coming under control, more sculpins we'll never have. Nevertheless, the numbers of fish seem to be holding their own, in spite of increasing pressure.

Where to fish? Just about anywhere. Public access along the Arkansas is probably the best of any stream in Colorado. Access points are not hard to find, although private property lines are not always marked, so check them out. Get yourself a copy of the Chaffee County Fishing Guide, published by Collegiate Peaks Anglers and distributed through many outlets in the Valley. Stop by Browner's Orvis Shop in Swissvale or Buena Vista, or the Arkansas River Fly Shop in Salida and get their latest information. Both shops also offer float fishing trips which can be an excellent way to learn a lot about the river in a short time. And if you're in the area on Wednesday, August 18th, join in with the tour offered by Trout Unlimited as a part of the 40th Annual Meeting at Copper Mountain. The history, complete with ghosts and the fishery of the Upper Arkansas River Valley, await you.

***Steve Craig** is the current President of Collegiate Peaks Anglers and a TU National Resource Board Director. He was formerly Executive Director of Colorado Trout Unlimited. He lives in Chaffee County, Colorado.*

❖ ❖ ❖

And now a word for our sponsors . . .

When you read through your copy of Streamside, don't forget to notice who's helping to make it possible - and make it a point to use their products and services. And while it seems like we have plenty of advertising, we still need a little more to secure our future. Streamside ads don't have to be fishing related, either. We all drive, eat, work around the house, hire contractors, vacation in condos and B&B's, buy homes and go to the bank. Some of us even have money to invest.

So if you know anyone whose business could stand to reach more than 6,000 Colorado sportspeople, many of whom are affluent buyers, put them in touch with Dave Nickum or Tom Krol, editor of Streamside. He can be reached at 303-839-9300 or via email at tkrolden@aol.com.

The Greenback Comeback

Greenback Recovery In Rocky Mountain National Park

by Paul B. Downing
Alpine Anglers Chapter

First light silhouettes rugged peaks. Birds fill the morning with song. The glassy lake is disturbed by repeated rises. Finally, the right fly at the right spot produces a take. Vibrant reds and oranges are evident as the fish comes to net. The most beautiful of trout, this is a greenback cutthroat trout, the state fish of Colorado which was once thought extinct. Thanks to widespread recovery efforts in Rocky Mountain National Park and in the upper Arkansas drainage, this magnificent fish can once again be caught (and released) by flyfishers.

Decline and Recovery

The greenback was one of the first fish to be placed on the Endangered Species List. Through the efforts of an inter-agency task force headed by Bruce Rosenlund of the United States Fish and Wildlife Service (USF&WS) in cooperation with the Colorado Division of Wildlife and key chapters of TU, greenbacks have been reintroduced to a few of the waters they lived in before European settlers arrived.

The decline in the greenback can be traced to two factors; over-harvesting and competition from non-native trout. Recreation and meat fishing in the 1800s killed huge numbers of greenbacks. The population crashed. Non-native trout were introduced in large numbers. Rainbows interbred. Brown trout ate the young. Brook trout out-competed the greenbacks. The combination virtually eliminated the specie.

Several remnant populations discovered in protected high mountain areas have provided the genetic material for recovery. To be successful, a recovery site must have a barrier to prevent reintroduction of non-native trout, must allow natural reproduction and winter survival, and must be small enough to treat effectively. A recovery project can take 3 to 5 years.

Success and Failure

As with any experimental recovery project, early efforts generated mixed results. Hidden Valley Creek in RMNP was an early project which demonstrates the need to remove all the brookies. Treatment proved incomplete and efforts to control the brook trout population in the 1980s proved unsuccessful. The brookies took over. In 1998 USF&WS and the Alpine Anglers Chapter removed over 3000 brook trout from the stream and stocked them in lakes outside the Park. Only 6 greenbacks were found and none were young. The greenback population had crashed. Consequently, this project will be redone starting this year.

Dream Lake has been a recent success. Non-native trout were removed, and in 1997 a unique restocking project was undertaken. The fish were collected from Upper Hutcheson Lake by TU members and USF&WS personnel who flyfished for them. (It's a tough job, but somebody had to do it!) Greenbacks that were not quite ready to spawn—300 of them—were then transferred to Dream Lake by helicopter. They spawned that year. Dream Lake is on the way to recovery and is now open to fishing.

Fishing For Greenbacks

Greenback fishing in the Park is often spectacular; both the fishing and the scenery. Expect fish from 10 to 14 inches. Here are some of the more popular fishing locations.

Lily Lake. Next to Highway 7, this is the only drive up greenback fishery in the Park. Stockings in the early 1990s produced exceptional fishing but the lack of reproduction and no subsequent stocking saw a decline in fish and catch rates. In 1998, 900 fingerlings from the Upper Hutcheson/Dream Lake project were released. Catch rates should be up this year.

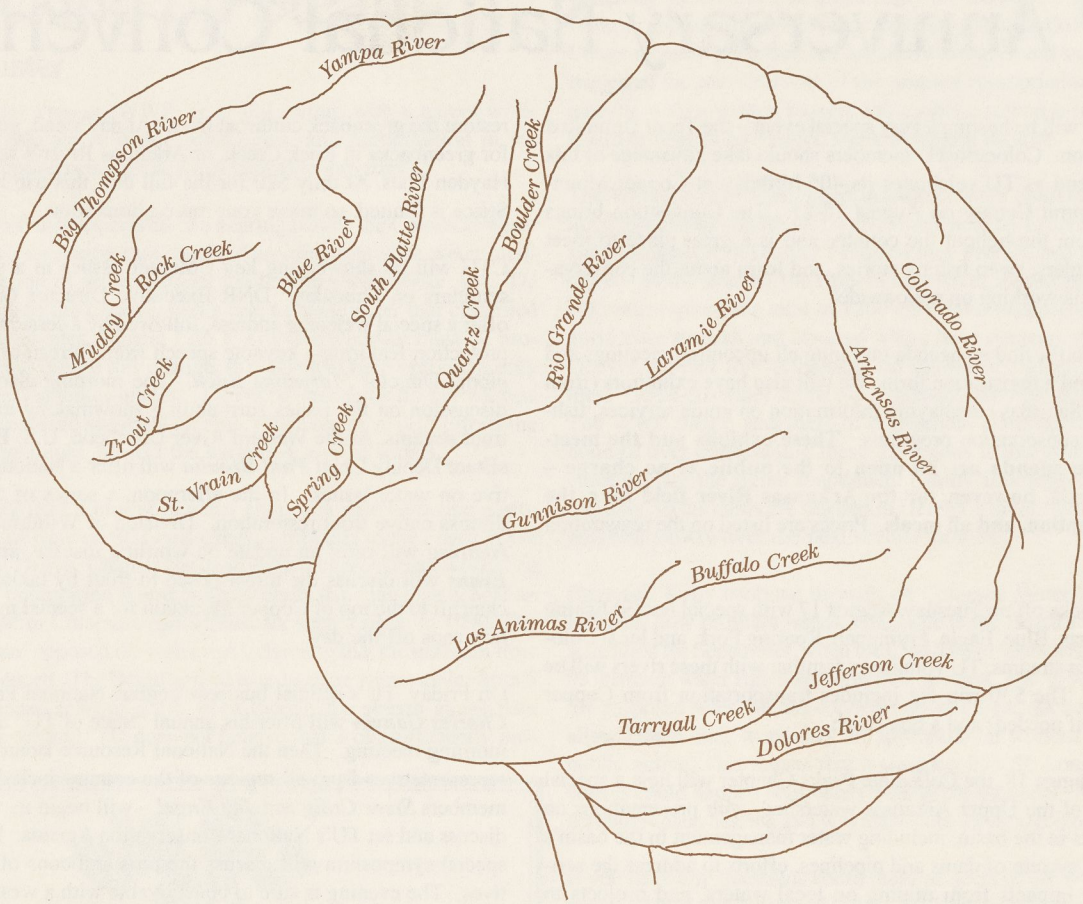
Lily Lake is one of the most scenic spots in the Park. Alpine Angler Chapter volunteers monitor the fishing and provide on-site education on greenbacks, catch and release, and flyfishing throughout the season.

Fern and Odessa Lakes. Two and three hour hikes above the Fern Lake trail head get you to these two beautiful lakes. Both are full of willing greenbacks. Fish from shore or wade to rising trout. Favorite flies are pheasant tails behind parachute Adams.

Roaring River and Lawn Lake. A half hour to one hour hike above the Lawn Lake trail head puts you into the beautiful, fast, cold Roaring River. Fish are numerous but steady pressure has educated them. Still, 30 fish days are not unusual. To escape the crowd, hike another hour and a half to Lawn Lake. Try the inlet. Greenbacks are usually stacked up and willing.

Overnight high country locations include Ouzel Creek and Lake, Pear Lake, Coney Creek and the Hutcheson Lakes. Apply for a permit and be prepared for this high country.

Successful projects have allowed down-listing of the greenback from endangered to threatened. But there still are problems. Last year brookies were discovered in Ouzel Lake and Creek. Perhaps they will get up into other areas in spite of the barriers. Whirling disease has entered the lower areas of the Park, both on the east and west slopes. Fortunately none has been found in greenback or Colorado River cut populations in the Park. Some greenback populations show signs of birth defects resulting from a narrow genetic stock, and stocking from different gene pools may be necessary. Still, there is cause for optimism. USF&WS biologist Chris Kennedy is again spending the summer in the Park working with Alpine Angler volunteers to further the recovery projects for greenbacks and Colorado River cutthroats. Plans for the next few years include several re-introductions in the Park and in the Arkansas basin. With this continued cooperative, inter-agency/TU effort, de-listing greenbacks may be possible. In the meantime, flyfishing for this unique and spectacular trout in some of the best scenery in the world is a treasure you will hold close for the rest of your life.



Our thoughts keep meandering to the same thing.

ANGLERS ALL

5211 South Santa Fe Drive, Littleton, CO 80120, (303) 794-1104

Colorado Trout Unlimited Hosts 40th Anniversary National Convention

This August, CTU will be hosting a very special event – the Trout Unlimited National Convention. Colorado TU members should take advantage of this opportunity to attend as TU celebrates its 40th birthday at Copper Mountain Resort in Summit County on August 18-21. The Convention brings together TUers from throughout the country and is a great place to meet other dedicated anglers, swap fishing stories, and learn about the conservation programs TU is working on nationwide.

Inside this issue, you'll find an agenda outlining all upcoming meetings and special activities and a registration form. We will also have exhibitors (from Thursday through Saturday) displaying information on guide services, fishing products, and conservation programs. **These exhibits and the meetings listed on the agenda are all open to the public at no charge – tickets are required, however, for the Arkansas River field tour, the mountaintop reception, and all meals**. Prices are listed on the registration form.

The Convention kicks off on Tuesday, August 17 with special hosted fishing trips on the Arkansas, Blue, Eagle, Fryingpan, Roaring Fork, and local Colorado River cutthroat streams. TU volunteers familiar with these rivers will be hosting the trips. The $30 trip fee includes transportation from Copper Mountain Resort (if needed) and a box lunch.

On Wednesday, August 18, the Collegiate Peaks Chapter will host a special full-day field trip of the Upper Arkansas watershed, with presentations on conservation issues in the basin, including water management in the basin's highly-engineered system of dams and pipelines, efforts to address the serious water quality impacts from mining on local waters, and projects to restore the greenback cutthroat trout. At day's end, you'll enjoy fishing for greenbacks in Rock Creek, or Arkansas River's wily brown trout at Hayden Flats. At only $20 for the full day, this trip is a great bargain. Space is limited, so make your reservations soon.

CTU will be showcasing key Colorado issues in a series of resource seminars on Thursday. DNR Executive Director ***Greg Walcher*** will offer a special welcome address, followed by a session on instream flow protection featuring a keynote speech from Bureau of Reclamation Regional Director ***Maryanne Bach***. The morning also features a panel discussion on the issues surrounding snowmaking and its impacts on trout streams. At the Western River Luncheon, U.S. Forest Service Assistant Deputy Chief ***Paul Brouha*** will offer a National Forest perspective on water issues. In the afternoon, a series of top scientists will discuss native trout restoration. Division of Wildlife researcher ***Barry Nehring*** will offer an update on whirling disease, and CTU's own ***Jo Evans*** will discuss the threat posed to trout by takings legislation. A chairlift to the top of Copper Mountain for a special mountaintop reception caps off the day.

On Friday, TU's official business begins. National President and CEO ***Charles Gauvin*** will offer his annual "State of TU" address during the morning meeting. Then the National Resource Board –with grassroots representatives from all regions of the country including Colorado TU members ***Steve Craig*** and ***Jay Engel*** – will begin its annual meeting to discuss and set TU's National Conservation Agenda. In the afternoon, a special symposium will discuss the pros and cons of watershed initiatives. The evening is sure to be enjoyable with a western barbecue and entertainment provided by cowboy minstrel ***Rick Devin***.

Saturday, August 21 opens with the annual Grassroots Breakfast where TU members ask questions and offer comments to National staff. Then, the National Resource Board will finish its deliberations on the National Conservation Agenda and on other resolutions or initiatives. Finally, on Saturday evening, we will host the National Banquet featuring a delicious sit-down dinner and a huge auction with an incredible array of equipment, flies, trips, and some non-fishing items as well. This truly is a once-in-a-lifetime opportunity for Colorado Trout Unlimited to host TU's premier national event. Even if you can't attend the full convention, I hope you can join us for at least one or two days. As a veteran of five National Conventions, I can assure you – you'll be glad you did.

Western Water Project Picking Up Steam

By Kelly Custer

The Western Water Project (WWP) is in full swing, with a recent water quality success, two active water court cases, and participation in the Colorado Water Conservation Board instream flow program.

In March, the WWP was successful in a hearing before the Colorado Water Quality Control Commission that involved an important state water quality issue, certification of projects under the federal Clean Water Act. TU proposed a change to the Commission's rule to make clear that classified uses (such as "Coldwater Aquatic Life 1") of water bodies must be protected and enforced. Before this change, the state had been enforcing only numeric standards for water quality. (Numeric standards do not address such impacts as increased sediment loading.) As a result of TU's efforts the state should, in the future, protect the classified uses of waters.

In April, the WWP filed a protest in water court in a case involving a proposed instream flow right on St. Louis Creek, a tributary to the Fraser River on which the West Denver Chapter has done stream improvement work. The Colorado Water Conservation Board, the only entity that may legally hold an instream flow right in Colorado, had applied for such a right in 1990. The Denver Water Board opposed the water right, claiming that the instream flow right should be reduced. The Board agreed to reduce the winter claim from 5 cubic feet per second (cfs) to 3 cfs, even though the stream gauge data support the larger amount. TU does not believe that 3 cfs sufficiently protects the stream. (The state's own analysis shows that at 3 cfs none of the R2Cross criteria are met.) The water referee approved the lower amount, accepting the draft decree prepared by the Board. TU protested, essentially filing an appeal to the water judge to review the case. Dave Nickum and Kelly Custer recently presented our argument to the Board staff and attorney and requested the reinstatement of the original appropriation. We followed the meeting with a written request and expect a response in early June. If the Board refuses to reconsider, we will prepare for trial.

The WWP recently took action in another water court case, this one involving decades-old conditional water rights held by Denver. The water rights are associated with Denver's Eagle-Piney Project, and involve Gore Creek (a gold-medal stream), the Upper Eagle River, and several tributaries. Denver holds rights for a total of 1200 cfs on the streams, several of which are good trout streams and some of which have decreed instream flow rights. Denver applied for "diligence" on the water rights, attempting to keep these 1950s-era water rights alive although they have never been diverted. The WWP filed a statement of opposition, claiming that Denver's likelihood of ever constructing these diversions is low and requesting that the court declare the rights abandoned. Courts almost always grant diligence requests, so the cards are stacked in Denver's favor. We expect the case will progress slowly over the next several months.

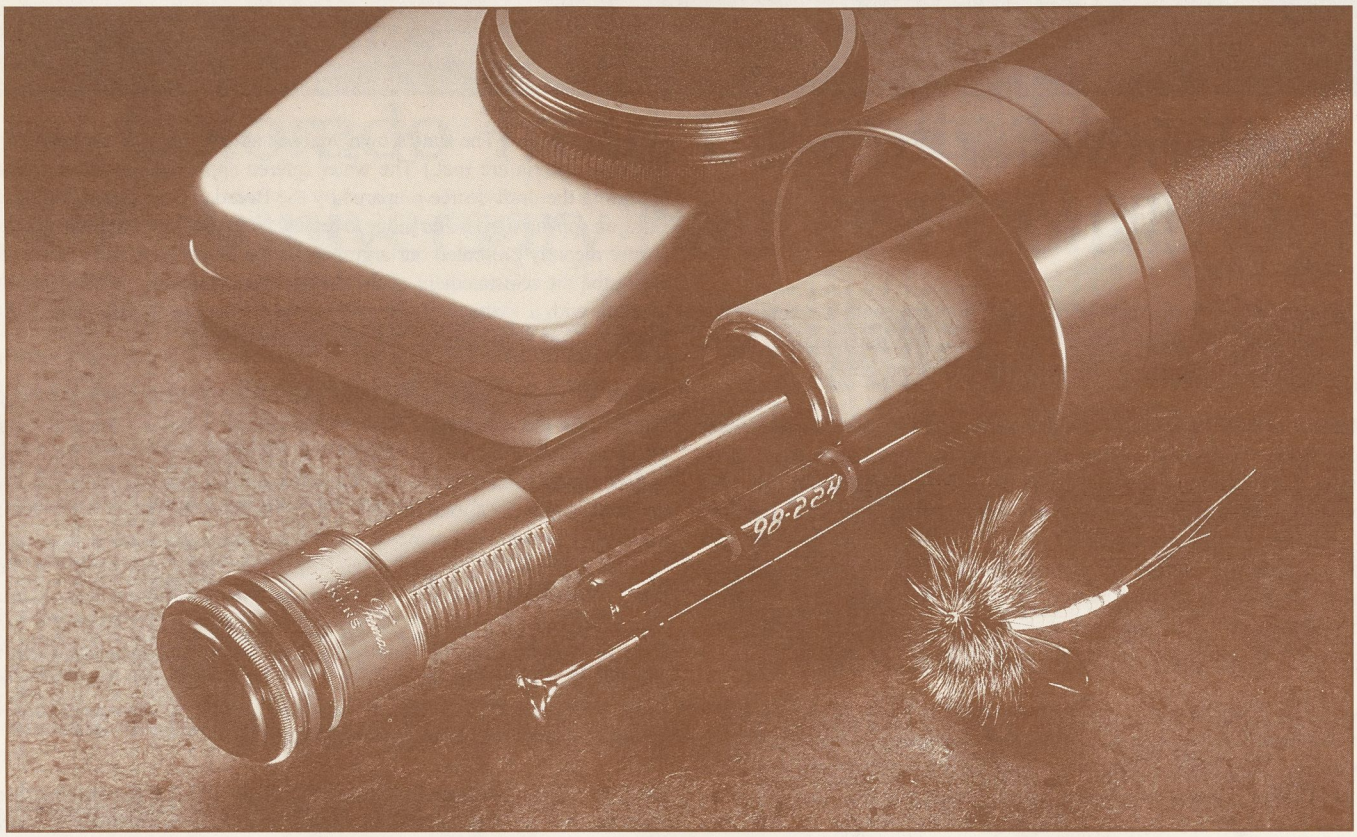
Dave and Kelly continue to work on Colorado Water Conservation Board instream flow program issues. One issue is the Board's rulemaking hearing scheduled for September, when the CWCB will consider new rules governing its instream water rights appropriation process. The WWP supports some of the proposed rules but has concerns about others, such as one which would allow Board staff to modify an appropriation without Board approval or public notice. This means that a situation like St. Louis Creek (discussed above) could happen completely behind closed doors. We will be a party to the rulemaking hearing and will make sure these concerns are heard.

If you have any questions about these projects or the WWP in general, call or email Dave or Kelly at (303) 440-2937, dnickum@tu.org, kcuster@tu.org.

Kelly Custer is a staff attorney for the Western Water Project.

Convention Hotel Reservations

We reserved a block of rooms for convention attendees at the Copper Mountain Resort. Hotel rooms and studios are available for $85 per night, condominiums (1-2 bedrooms) for $100 and $145 respectively, and luxury condominiums in the new Copper Springs Lodge for $150 (1 bedroom) and $225 (2 bedroom). The room block will be reserved for attendees through July 18. After that time rooms can be reserved on an as-available basis. For reservations, call Copper Mountain Resort at 800-458-8386 (800-I-LUV-FUN), extension 1, option 4, and be sure to mention that you're with the Trout Unlimited National Convention.



Give a man a fish,

and you feed him for a day;

teach him how to fish,

and he wants a T&T rod.

THOMAS & THOMAS

FINE FLY RODS

The rod you will eventually own.

Visit your nearest T&T retailer or write for a copy of our 1999 full-color catalogue

Thomas and Thomas • 2 Avenue A • Turners Falls, MA 01376 • (413) 863-9727 • Fax: (413) 863-9692 • www.thomasandthomas.com

• TROUT UNLIMITED •
1999 NATIONAL CONVENTION

Celebrating 40 years of TU!

Copper Mountain Resort
Summit County, Colorado

Tuesday, August 17 **Hosted Fishing Trips**

TU volunteers will be hosting fishing trips on some of Colorado's finest rivers. Choose from among the Arkansas River, Blue River, Eagle River, Fryingpan River, Roaring Fork River, or local Colorado River cutthroat streams. Reservations will be taken on a first-come, first-served basis and space for each trip is very limited. A $30 fee includes transportation to the river from Copper Mountain Resort (if needed) and a box lunch.

Wednesday, August 18 **Upper Arkansas Field Tour**

The Collegiate Peaks Chapter will be hosting this special full-day tour of the Upper Arkansas basin, highlighting major conservation issues in the watershed and offering opportunities to fish. The tour costs $20 (includes box lunch and barbecue dinner) and is limited to 40 participants on a first-come, first-served basis.

8:30 a.m.	Depart Copper Mountain for Fremont Pass; repre sentative from Climax Mine will be on bus to discuss the mine's history and water quality impacts.
10:00 a.m.	Depart Climax Mine with historian who will discuss Leadville and its mining history
11:00 a.m.	Visit the ASARCO water treatment plant (treats mine waste water)
12:30 p.m.	Box lunch at Crystal Lake. Bureau of Reclamation presentation on water management in the Upper Ar kansas Basin.
2:00 p.m.	Riverside tour or restoration project focused on ame liorating the effects on the river of extensive heavy metal deposits from mining operations
3:30 p.m.	Leadville National Fish Hatchery tour and presenta tion on greenback cutthroat trout restoration
4:00 p.m.	Fishing for greenbacks (Rock Creek) or wild browns (Hayden Flats)
6:30 p.m.	Barbecue at Leadville National Fish Hatchery

Thursday, August 19 **Regional Resource Seminars**

8:30 a.m.	Welcome and Opening Remarks Greg Walcher (invited), Executive Director, Colorado Department of Natural Resources

Resource Seminar: Instream Flow Protection

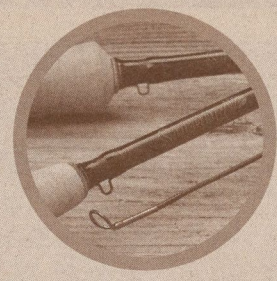
9:00 a.m.	Keynote: Maryanne Bach, Regional Director – Great Plains Region, U.S. Bureau of Reclamation
9:30 a.m.	David Gillilan, attorney and author of Island Press book, *Instream Flow Protection*
10:00 a.m.	Melinda Kassen and Laura Ziemer, attorneys for TU Western Water Project
10:30 a.m.	Break
10:50 a.m.	Panel discussion: snowmaking and mountain streams Moderator: Mark Obmascik (invited), *The Denver Post* Jim Spenst, Copper Mountain Resort Harris Sherman, Arnold and Porter Rocky Smith, Colorado Wild Dan Merriman (invited), Colorado Water Conserva tion Board Charles Olchowski (invited), TU National Resource Board – New England

Continued on page 10

Continued from page 9

• TROUT UNLIMITED •
1999 NATIONAL CONVENTION
Celebrating 40 years of TU!

12:30 p.m.	Western Rivers Luncheon Guest speaker: Paul Brouha, Assistant Deputy Chief for National Forest System, U.S. Forest Service
Resource Seminar:	*Native Trout Restoration in the Rockies*
2:00 p.m.	Michael Young, U.S. Forest Service, Rocky Mountain Research Station
2:25 p.m.	Amy Harig, Colorado State University
2:50 p.m.	Bruce Rosenlund, U.S. Fish and Wildlife Service
3:15 p.m.	Break
Resource Seminar:	*Emerging Threats to Trout*
3:40 p.m.	Barry Nehring, Colorado Division of Wildlife – whirling disease
4:10 p.m.	Jo Evans, environmental lobbyist – takings legislation
3:30 p.m.	Regional Vice Presidents meeting
5:30 p.m.	Heart of the Rockies mountaintop reception (atop Copper Mountain, weather permitting)
Friday, August 20	**Annual Meetings**
8:00 a.m.	Annual Membership Meeting: "The State of TU"
9:30 a.m.	National Resource Board Meeting: TU's National Conservation Agenda
12:00 p.m.	NRB Luncheon
1:30 p.m.	NRB Meeting (continued)
2:30 p.m.	NRB Symposium: The use of watershed approaches/councils in watershed restoration Moderator: Steve Born, Chairman, NRB Speakers: Lee Elder, River Network Jeff Curtis, TU West Coast Conservation Director Rick Hammel, Sage Country Chapter TU Jim Dubiz, Kettle Creek Watershed Committee Joe Williams, Washington State Department of Ecology Sara Johnson, TU Director of Volunteer Operations Laura Hewitt, TU Kickapoo Project Manager
6:30 p.m.	Wild West Barbecue Entertainment provided by **Cowboy Minstrel Rick Devin**
Saturday, August 21	**Annual Meetings**
7:30 a.m.	Grassroots Breakfast
9:00 a.m.	NRB Meeting: TU's National Conservation Agenda
12:00 p.m.	Annual Awards Luncheon
1:30 p.m.	NRB Meeting (continued)
2:30 p.m.	Council Chairs Meeting
6:30 p.m.	National Banquet and Auction



Have you noticed that fly rods and sport utility vehicles are quite the status symbols these days?

Neither have we.

It seems that you come across two rather distinct kinds of people on rivers these days. There are "**fly fishermen**" And there are fly fishermen. We make rods for the latter. For those a bit more concerned with the proper presentation than, say, the proper logo. Take our Legend Ultra series. A lightweight, beautifully appointed line of rods featuring crisp, fast actions that deliver high line speeds for effortless casting and the accuracy to split the tightest feeding lanes. Each taper is meticulously designed and balanced. Each rod individually hand-assembled. You might think they sound a lot like other premium-performance fly rods. They are. That is, until you see the price. Catalog? 1-800-826-7042.

SiC stripper guides | Uplocking, titanium-finished aluminum reel seats | Wisconsin-grown bird's-eye maple inserts | Super-grade specie cork handles | Unconditional lifetime warranty

ST.CROIX ROD

Lightweight, high-modulus SC^{IV} graphite blanks | Non-glare matte finish | Titanium-plated single-foot guides

National Banquet Auction Offers a Boatload of Choices

The National TU Banquet on Saturday night, August 21, will feature a remarkable array of merchandise, including:

- A Clackacraft driftboat
- One week fishing for two at Northland Steelhead Lodge, BC (on the Bulkley River)
- One week fishing for one in Alaska with the Painter Creek Lodge
- Fishing trips on favorite Rocky Mountain rivers including the Arkansas, Bow, Colorado, Gunnison, and Yellowstone
- Rods from Sage, Powell, Thomas & Thomas, Winston, Scott, Hardy, Orvis, LL. Bean, and more – one of our best selections of rods ever!
- An incredible selection of flies tied by some of the region's finest tyers
- A fine array of fishing and other outdoor-related artwork
- PLUS: reels, vests, waders, landing nets, and more!

Tickets to the National Banquet are $40 ($75 for two) and include a delicious plated dinner and dessert. Call (303) 440-2937 to reserve your seats.

1999 TROUT UNLIMITED NATIONAL CONVENTION

REGISTRATION FORM

AUGUST 17

Hosted fishing trips (circle one)	$30	$_____
Arkansas Blue Eagle Fryingpan Roaring Fork Cutthroats		

AUGUST 18

Upper Arkansas Field Tour	$20	$_____

AUGUST 19

Western Rivers Luncheon	$23	$_____
Heart of Rockies Mountaintop Reception	$15	$_____

AUGUST 20

National Resource Board Luncheon	$23	$_____
Wild West Barbecue	$30	$_____

AUGUST 21

Grassroots Breakfast	$17	$_____
Awards Luncheon	$25	$_____
Annual Banquet	$40 ($75 for 2)	$_____

Or:

all events – August 21	$75	$_____
all events August 19-21	$155 (by 7/25)	$_____
all events August 19-21	$170 (after 7/25)	$_____

AUGUST 27-28

10th Annual Superfly Contest	$500 (per two-person team)	$_____

TOTAL ENCLOSED $_____

❑ **Check here if you'd like vegetarian meals.**

Your Name: _____

Your Chapter & Position/Title: _____

Address: _____

City: _____ State: _____ Zip: _____

Telephone: _____ Email: _____

Payment method: ❑ Check ❑ Visa ❑ Mastercard

Credit Card #: _____ Exp. Date: _____

Mail, phone, or fax registration and payment to: Colorado Trout Unlimited, 1900 13th Street, Suite 101, Boulder, CO 80302; phone (303) 440-2937; fax (303) 440-7933.

• 10TH ANNUAL SUPERFLY CONTEST •

By Dave Nickum

Colorado's original "one fly" fishing competition celebrates its tenth anniversary this year. The Colorado Superfly contest takes place on August 27 and 28 in Gunnison, Colorado. Greg Asbury of the Gunnison Angling Society (a Trout Unlimited chapter) and Scott Ratcliff of Colorado Trout Unlimited created Superfly in 1989 as a way to have a good time while raising money for both organizations. During the last decade, Superfly has generated considerable funds for use in conserving Colorado's coldwater fisheries and their watersheds.

Superfly contestants enter in teams of two anglers who fish together on two assigned beats; one for three and a half hours in the morning and another for the same time in the afternoon. Beats traditionally are on reaches of the Gunnison, East and Taylor Rivers and Spring Creek, are drawn at random. Each team is accompanied by a guide who measures and records all fish caught. Contestants may use only one fly for the duration of the contest, which must be tied on a barbless hook. All flies are inspected prior to the day's fishing. A second fly, identical to the first, may be used if the first fly is lost. The second fly can be used to compete for largest Rainbow or Brown Trout caught, but fish caught after the first fly is lost do not count toward prizes for total inches. Kokanee salmon caught are not counted toward prizes. Contestants are not allowed to carry any tools or material to repair their fly other than head cement. They are, however, permitted to repair their flies with any natural materials found along the stream. Leader and tippet may be retired as often as contestants desire, under supervision of a guide.

The winner of the contest is the individual who catches the most inches of trout and is thereby designated as "Top Rod." The team with the most inches receives the honor of being the "Top Team." Top Rod and Top Team prizes are engraved rods and reels. Awards are also given for the largest Brown and rainbow caught. Several other awards are given, including the Scott Radcliff sportsmanship award. Each contestant receives a top-grade fishing shirt and cap with the Superfly logo and a "goody bag" of fishing trinkets.

Teams arrive on Friday evening to register, meet their guide, receive beat assignments and enjoy drinks and snacks. During this get-together, rules and procedures are explained and questions answered. On Saturday morning, contestants register flies, have a delicious buffet breakfast, pick up a healthy box lunch, and meet their guides at their morning beat. After the day's fishing, all return for cocktails and a banquet during which the awards and prizes are presented.

The Superfly entry fee is $500 per team and covers shirt, cap, goodies, fishing, prizes and all meals and drinks. Accommodations must be arranged individually, but Gunnison Angling Society can offer many suggestions. To enter, contact Gunnison Angling Society at P.O. Box 1032, Gunnison, CO 81230; (970) 641-4243 or (970) 641-7482. Proceeds support the conservation efforts of the Gunnison Angling Society and Colorado Trout Unlimited.

Cabin Fever? See Us.

FRONT RANGE ANGLERS

Your store for friendly service, fine tackle, gifts, fine art and associated merchandise:

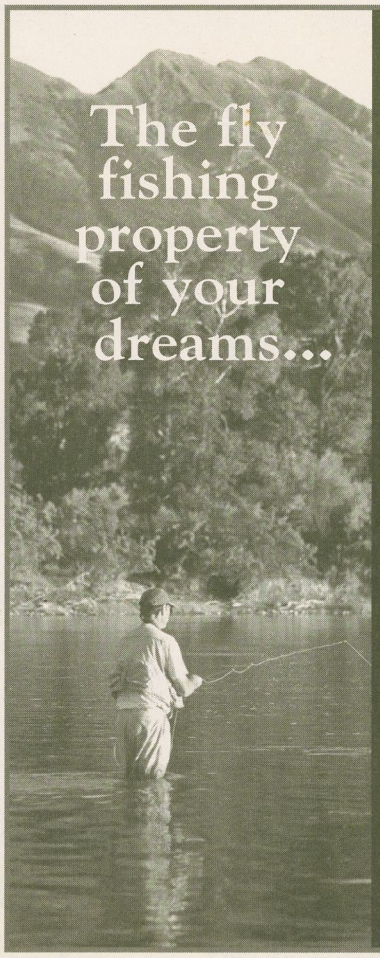
ABEL	*Bucksbags*	*Cortland*
Hoffman	*Metz*	*Rio*
Ross	*Sage*	*Scientific Anglers*
Scott	*Simms*	*Umpqua*

"FRONT RANGE FISHING EXPERTS."

FRONT RANGE ANGLERS

629 B S. Broadway Boulder, CO 80303

494-1375



Trout Unlimited

C/O Newsletters Ink
3855 South 500 West, Suite H
Salt Lake City, Utah 84115

PRSRT STD
US POSTAGE
PAID
PROVO, UT
PERMIT #333

DR. ROBERT BEHNKE PH.D.
3429 E PROSPECT RD
FORT COLLINS CO 80525-9739

Address Service Requested

Weldon

U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF SPORT FISHERIES AND WILDLIFE
DENVER, COLORADO

REPORT ON 1959 FISHERY STUDIES BY THE BUREAU OF SPORT FISHERIES AND WILDLIFE IN ROCKY MOUNTAIN NATIONAL PARK

by

Oliver B. Cope
Fishery Research Biologist

October 15, 1959

Contents

Introduction

The Bureau of Sport Fisheries and Wildlife began fishery investigations in Rocky Mountain National Park in 1957, at the request of the National Park Service. The original problem concerned the status of the green-back trout, Salmo clarki stomias Cope, which had been rediscovered after its apparent disappearance several years before. The results of the 1957 work were summarized in "Report on 1957 studies on the green-back trout in Rocky Mountain National Park", issued by the National Park Service and the Fish and Wildlife Service. This report emphasized the results of stream and lake surveys done in the Park the first year.

The program in 1958 was expanded to deal with the following objectives: (1) to secure material for more positive identification of Salmo c. stomias; (2) to capture adults for a brood stock; (3) to appraise stream and lake habitats which show promise as sanctuaries for Salmo c. stomias in Rocky Mountain National Park; (4) to learn the characteristics of the fishery on the east side of the Continental Divide; and (5) to collect ecological information on lakes and streams so that the National Park Service can best manage its waters where fishing opportunities may be available. The results of the 1958 studies were published by the Bureau of Sport Fisheries and Wildlife on January 15, 1959, in a report by Ross V. Bulkley entitled "Report on 1958 fishery studies by the Bureau of Sport Fisheries and Wildlife on Rocky Mountain National Park."

In 1959 the work emphasized the restoration of the green-back trout and the estimation of harvest and fishing effort on the east side of the Continental Divide. Nothing was done on biological surveys of Park waters.

Acknowledgements

Bureau of Sport Fisheries and Wildlife personnel who participated in the studies were Glenn Davis, Charles Gish, and Ralph Nelson, Fishery Aids; W. R. Bridges and O. B. Cope, Fishery Research Biologists. Superintendent James V. Lloyd of Rocky Mountain National Park continued to give administrative support to the program, and Park Ranger Foster Freeman assisted the staff in many ways throughout the season. Creel census data from isolated areas were furnished by Park Ranger Steve Mindock, Mr. Frank McGraw, Mr. Bill Robinson, and Mr. Kermit Pierce. Mr. James T. Morgan, Superintendent of the Fall River Hatchery of the Colorado Department of Game and Fish was most cooperative by holding and transporting green-back trout. Personnel of the 7625th Operations Squadron, U. S. Air Force, provided indispensable aid by making two fish plants by helicopter.

Creel Census

The creel census of 1959 covered the same waters studied in 1958 (Figure 1), and the methods used were the same. An intensive census was conducted in the Fall River and Big Thompson drainages, and a semivolunteer census was carried on in the Wild Basin, Lawn Lake, and North Fork of the Big Thompson River areas within the Park. The details of the census method are described in the 1958 report.

Table 1 shows some results of the 1958 census, and Table 2 contains comparable information for 1959. These data show that fishing success in the five most heavily fished waters on the east slope was better in 1959 than in 1958, considering all species. Even though visitation to the Park was 4.3 percent higher in 1959 than in 1958, with 1,389,703 visitors through September 15, 1959, fishing pressure was reduced from 29,466 man hours of fishing to 26,787 hours. The total catch was almost identical (16,210 and 16,344) in the two years, and the catch-per-hour increased from 0.551 to 0.615 from 1958 to 1959.

In both years, brook trout dominated the catches in all five waters, and comprised 71 percent of the total catch in 1958 and 82 percent in 1959. Relatively fewer rainbow were caught in 1959 than in 1958 (22 percent of the total catch in 1958 and 16 percent in 1959), probably because of changes in planting schedules. Brown and cutthroat trouts were caught in smaller numbers in 1959; in fact, cutthroat were censused in only one of the five waters in 1959, while they were taken from three in the former year.

Table 3 summarizes creel information for seven waters covered by the semivolunteer census. In four waters, fishing success was better in 1959 than in 1958; the opposite was true for the other three. Lawn Lake yielded a particularly high harvest, but the North St. Vrain River supplied less to the creel than in 1958. The reliability of the semivolunteer census does not approach that of the waters treated in Tables 1 and 2, but these data are very useful for comparative purposes.

It was pointed out in the report on 1958 studies that the 40,000 rainbow fingerlings planted in Fall River in 1957 entered the creel in 1958 in small numbers. This plant contributed 21.72 percent of the rainbow harvest in the stream in 1958, and the 1,152 of these fish caught represented only 2.88 percent of the 1957 plant. In 1959 our estimate of 353 rainbow caught in Fall River indicates that the fingerlings planted in 1957 contributed less to the 1959 creel than to the 1958 creel. The same trend appears to have operated in Big Thompson River.

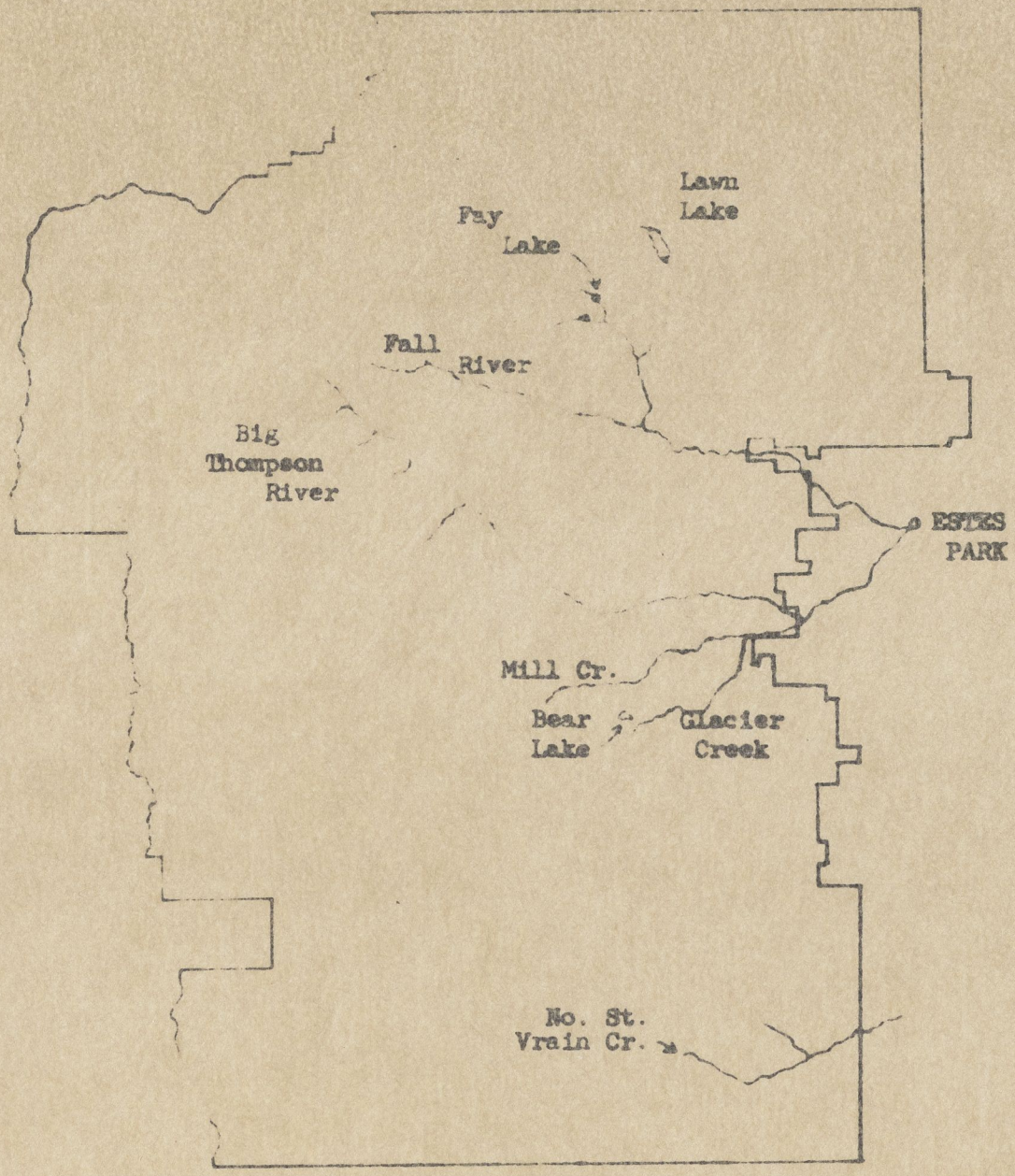


Figure 1. Rocky Mountain National Park, with some important fishery landmarks.

Table 1. Estimated fishing pressure, fishing success, and harvest from intensive creel census area, 1958.

Area	Total fisherman hours	Mean catch per hour	Harvest				
			Rainbow	Brook	Brown	Cutthroat	Total
Big Thompson River	8,924	0.665	952	4,567	287	129	5,935
Fall River	8,453	0.627	1,152	3,926	200	26	5,304
Glacier Creek	8,039	0.538	1,341	2,525	66	395	4,327
Bear Lake	3,728	0.159	114	477	0	0	591
Mill Creek	322	0.165	0	53	0	0	53
Totals	29,466	0.551	3,559	11,548	553	550	16,210

Table 2. Estimated fishing pressure, fishing success, and harvest from intensive creel census area, 1959.

Area	Total fisherman hours	Mean catch per hour	Harvest				
			Rainbow	Brook	Brown	Cutthroat	Total
Big Thompson River	5,616	0.680	458	3,132	229	0	3,819
Fall River	5,006	0.640	353	2,819	32	0	3,204
Glacier Creek	7,905	0.819	1,361	5,060	0	61	6,482
Bear Lake	6,028	0.360	413	1,757	0	0	2,170
Mill Creek	2,232	0.299	74	595	0	0	669
Totals	26,787	0.615	2,659	13,363	261	61	16,344

Table 3. Creel census estimates obtained from some lakes and streams in 1959 by semivolunteer census.

Area	Mean catch per hour	Harvest				
		Rainbow	Brown	Brook	Cutthroat	Total
No. St. Vrain R.	1.11	160	310	245	20	735
Sandbeach Lake	0.71	660	0	0	0	660
Pear Lake	0.65	23	0	0	198	221
Upper West Creek	1.61	0	0	141	18	159
Cow Creek	1.43	0	4	144	0	148
Lawn Lake	1.39	0	0	1,910	570	2,480
Crystal Lake	0.51	0	0	0	350	350

Green-back trout

The restoration of the green-back trout received considerable attention in 1959, and the accomplishments thus far have followed the schedule established two years ago. It will be recalled that the first step in the establishment of a suitable sanctuary for this rare fish was the survey work of 1957. Several drainages were examined with a view toward use for this purpose, and it was decided that the Fay Lake drainage, tributary to Roaring River, would be satisfactory for a beginning. Accordingly, in the summer of 1958 this drainage, which comprises three small lakes, some small tributaries, and the main stem above the cascades near the mouth, was chemically treated to remove all resident fish. The operation was successful, and by the Spring of 1959 the waters were free of fish and had become detoxified.

The 1959 effort was devoted to the capture of green-back trout for transfer to Fay Lake. The fish were taken in the Big Thompson River in Forest Canyon by hook and line, by electric shocking, and by treatment with cresol. They were then carried out of Forest Canyon by pack horse and taken by truck to the Fall River Hatchery of the Colorado Department of Game and Fish. The fish were held in ponds at the hatchery until enough had been accumulated for transport to Fay Lake.

Two helicopter plantings of green-back trout were made during the summer. On the first trip, on August 6, 97 fish were dropped into Fay Lake. Observers at the site watched the planting and examined the waters for some hours afterward. No dead or distressed trout were seen, and it was concluded that the stocking was a complete success. On September 4, an additional 112 green-back trout were transported to Fay Lake; this planting was also successful, with no damage to any fish detected.

Table 4 presents a length-distribution of green-back trout dropped into Fay Lake in 1959, and includes both plantings.

An additional 83 fish were moved by truck to the U. S. Fishery Station at Leadville, Colorado, in September to serve as a brood stock for the culture of green-back trout.

Mr. Thomas French, Hatchery Manager at Leadville, obtained spawn this year from green-back trout collected in 1957 and 1958. Efforts to take spawn in 1958 were not successful, so it is encouraging to know of Mr. French's accomplishment in 1959.

Table 4. Length distribution of green-back trout planted by helicopter in Fay Lake, 1959.

Length group, in inches	Number of fish
4.25-4.75	1
4.75-5.25	0
5.25-5.75	4
5.75-6.25	16
6.25-6.75	25
6.75-7.25	42
7.25-7.75	51
7.75-8.25	35
8.25-8.75	24
8.75-9.25	8
9.25-9.75	2
9.75-10.25	1

Future Studies

1. The fate of the green-back trout planted in Fay Lake in 1959 should be studied. The survival of planted fish and the results of spawning done in the drainage in 1959 should be measured.

2. The stocking of lakes should be carried on in accordance with the recommendations on page 21 of our 1958 report. Emerald, Dream, Odessa, and Lost Lakes should be surveyed in 1960 to measure the success of the 1959 plants and appropriate action recommended for 1961.

3. Creel census and survey work should be done on the west side of the Continental Divide in 1960.

4. Detailed studies should be made of the fate of hatchery-reared trout in the Fall and Big Thompson Rivers and the importance of natural reproduction in these streams.

Recommendations

On the basis of currently available information, it is recommended that:

1. The Fay Lake drainage be closed to fishing in 1960 so that the 1959 plant of green-back trout will not be disturbed;

2. The culture of green-back trout at Leadville, Colorado, be continued. Fingerlings should be planted in Fay Lake;

3. The largest rainbow trout consistent with National Park Service policy be planted in Fall, Big Thompson, Mill, and Glacier Creeks, and Bear Lake. On the basis of the successes of past plants in these streams and elsewhere, it would seem unwise to plant rainbows under 3 inches in length in the streams. (40,000 divided up)

Too California?

Bear Lake — planted every year.

not for Fall river — Thompson etc.

Three q yr.? — Early - May - Early June.
late April

Hague Cr.
Barren about falls 8.9

REPORT ON 1957 STUDIES ON THE GREEN-BACK TROUT IN ROCKY MOUNTAIN NATIONAL PARK

Introduction

The green-back trout was discovered in 1870 on the eastern slope of the Rocky Mountains in the Arkansas and Platte River systems in Colorado. The fish was originally described by E. D. Cope as Salmo stomias, but is now recognized as a subspecies of the cutthroat trout, Salmo clarki. After the discovery of this fish, it was found in many other streams and tributaries in northern Colorado east of the Continental Divide. As the years passed, however, it became less abundant, and for many years was thought by biologists to have become an extinct subspecies.

In 1955 reports reached Dr. Howard Tanner, Colorado Cooperative Fishery Research Unit, Fort Collins, Colorado, of the capture of a fish which he suspected might be the green-back trout. The fish had been collected in Albion Creek, a tributary of Boulder Creek, which drains into the South Platte River. This location is within the original known range of the green-back trout. Dr. Tanner secured specimens of trout from this locality and forwarded them for identification to Dr. Robert Miller, Curator of Fishes, University of Michigan. Dr. Miller did not have sufficient material to completely verify that these fish were S. clarki stomias, but he indicated that there was a strong possibility that they were this subspecies.

At the request of Biologist James E. Cole and Superintendent James V. Lloyd of Rocky Mountain National Park and C. Gordon Fredine, Principal Naturalist, Biology, of the National Park Service, fishery biologists of the Rocky Mountain Sport Fishery Investigations, Fish and Wildlife Service were assigned to make preliminary surveys of the habitat of the green-back trout in the summer of 1957 in Rocky Mountain National Park. Accordingly, Dr. Oliver B. Cope and Mr. Ross V. Bulkley worked with Mr. Cole in reconnaissance studies in and around Rocky Mountain National Park. Throughout the course of the work, considerable assistance was rendered by Mr. Wayne Seamans, Dr. Howard Tanner, and Mr. J. T. Morgan of the Colorado Game and Fish Department, Mr. Thomas French of the Fish and Wildlife Service at Leadville, Colorado, and Dr. William Osborn of the University of Colorado.

Objectives

The objectives of the 1957 work were threefold: (1) to secure additional specimens of fish so that positive identification could be made; (2) to secure live specimens to serve as a brood stock for cultural and study purposes; (3) to appraise stream and lake habitats with a view toward establishment of sanctuaries in Rocky Mountain National Park.

Results

The first objective, obtaining specimens for identification, was accomplished by collection of trout in the following waters: Albion Creek, Big Thompson River, Hague Creek, and Ypsilon Creek, all in the South Platte River drainage; Tonahutu Creek, a tributary of the Colorado River. These specimens have been sent to Dr. Miller at the University of Michigan, and we are awaiting identifications. Specimens from Hague Creek were also sent to Mr. W. I. Follett, Curator of Fishes at the California Academy of Sciences. Specimens are also being retained at the museum at Rocky Mountain National Park.

The second objective, obtaining fish for brood stock and life history study purposes, was achieved by the capture of 26 adult trout in Albion Creek. Fifteen of these were transported to the U. S. Fishery Station, Leadville, Colorado, on August 13, 1957, and 11 others on October 8, 1957. The first lot at Leadville are taking food and appear to be progressing satisfactorily.

The third objective, stream and lake surveys, was approached during August by Cope and Bulkley of the Fish and Wildlife Service, and Cole and Brown of the National Park Service. The results of the surveys are contained in the following report prepared by Mr. Ross V. Bulkley:

Survey of waters in Rocky Mountain National Park
for re-establishment of green-back trout,
Salmo clarki stomias Cope

Location: Fall River

Date: July 30 to July 31, 1957

The area of Fall River covered by the survey comprised that portion of the stream lying above Chasm Falls. Chasm Falls provides a natural barrier for any upstream movement of fish.

There are 4.2 miles of stream in this area with sufficient water (at the present time) for fish production. Surface runoff from melting snow provides almost all of the water in the stream. This drains into the main channel from numerous tiny freshlets coming down from each snowdrift. Later in the season many of these freshlets will undoubtedly dry up. In the upper section, much of the ground still remains waterlogged and will provide some runoff later in the summer. At the present time, the stream in the upper section is well within the banks of the channel, but the lower end is still under high water.

The stream gradient is high throughout the entire section, creating a fast, relatively-shallow stream. Over the 4.2 miles of stream, the elevation drops from 10,700 feet at Willow Park to 9,100 feet at Chasm Falls. The stream bottom is typically a mixture of boulders, rubble, and sand--suitable spawning areas are available. Relatively few pools of any depth or width are found on the upper section of the stream. The lower section has adequate pools. Invertebrate numbers are also limited. Smaller species of stonefly larvae were common throughout the stream, but other insects were scarce. Larvae of Ephemeroptera, Trichoptera, and Diptera (Chironomidae, crane flies, etc.) were present in small numbers.

Four stations were set up along the stream to record flow. Station No. 1 was located 0.1 mile above Chasm Falls. Information obtained from this and other stations is recorded in table 1. A single beaver dam is located on a feeder stream in this area. One cutthroat and one brook trout were taken from this streamlet, but no other fish were captured or observed in this area. The small size of the stream, limited cover, no planting, and easy access to the stream by fishermen would seem to be the reasons for lack of fish.

Station No. 2 was located 1.8 miles (road measurement), above Chasm Falls. Station No. 3 was established 3.85 miles above the falls. There are several drops in this area which seem to be definite barriers (at least at the present time) to upstream movement of fish. A number of fine pools are found above and among these miniature falls. Several fish were observed in this area, and four cutthroat were captured here on worms, after extensive fishing. Almost all fish observed struck readily and appeared hungry. Failure to capture more fish seemed due to a lack of fish rather than poor presentation of lures.

Station No. 4 was located at Willow Park near the Guard Station about one mile from the head of the stream. Above the Guard Station, the stream is a typical mountain torrent with a relatively-straight, flat chute, with no pools.

The old Fall River road closely parallels the entire stream, and is never more than one-fourth mile away. Although this road is closed to all motor travel, access to the upper area is relatively easy from the summit of Trail Ridge Road. The entire stream is within easy walking or riding distance. Many hikers enjoy the hike from the summit down to Chasm Falls.

Limited suitable stream cover coupled with easy access would create a problem in overfishing unless suitable regulations or controls were established. Fall River differs from Albion Creek in that it is a slightly smaller stream and has no lake or impoundments. Poisoning of this stream would not involve large numbers of fish, as the total population of the stream is undoubtedly in the very low hundreds.

Although Fall River appears to be a suitable habitat for stocking under present water conditions, it does not seem to fit the requirements as a refuge in which to re-establish green-back trout.

Table 1
Flow Measurements on Fall River

Station	Date	Depth (Average)	Width (Average)	Flow ($ft.^3/sec.$)	Description
1	7/30/57	7.5"	17.2'	30.47	0.1 mile above Chasm Falls
2	7/30/57	8.25"	10.25'	27.56	1.8 miles above Falls
3	7/31/57	6.5"	10.16'	21.26	3.85 miles above Falls
4	7/31/57	4.25"	10.50'	9.21	Willow Park, in front of Guard Station

Location: Ypsilon Drainage

Date: August 5 - August 15, 1957

Ypsilon drainage, which includes Ypsilon stream above its confluency with Roaring River, contains several lakes: Chiquita Lake, Upper Spectacle Lake, Lower Spectacle Lake, Ypsilon Lake, Faylene, Fay and Caddis Lakes. The streams connecting this system of lakes often run deep under rock slides, over falls, and down steep cascades. In effect, the drainage is a system of small isolated segments with no means of fish movement between segments. Downstream movement can be effected in some places by dropping over falls, but often even downstream migration is not possible.

Chiquita Lake — Chiquita Lake, lying on the west side of this drainage, is typical of the lakes in the Ypsilon area. It was formed by a glacial cirque. Chiquita lies at the base of a large cliff at an elevation of 11,500 feet. Very little aquatic flora was observed at the lake. Aquatic fauna also appeared limited, with the exception of aquatic beetles and mosquito larvae in the shore pools. Maximum depth recorded on August 6, 1957, was 35 feet. The water temperature on this date was 44° F. at 1:00 p.m. Air temperature was 52° F. The bottom drops down steeply, which greatly restricts the littoral zone. The small inlet to the lake, falling off a steep cliff, is fed from a snowdrift which still extended down into the lake at the above date. Some floating ice was still present. The outlet from Chiquita sinks down into the rocks, effectively blocking movement of fish, either up into the lake or down out of the lake. A talus slope fills the valley floor and the stream moves down through it. No fish were either observed or captured in Chiquita Lake.

Upper Spectacle Lake — Upper Spectacle Lake at an elevation of approximately 11,400 feet lies just below the "Y" on Ypsilon Mountain. It too, as well as Lower Spectacle and Ypsilon Lake, is in a glacial cirque. Upper Spectacle is surrounded on three sides by sheer cliffs rising over 1800 feet above the water. The lake was partially sounded August 7, 1957. On that date part of the lake was still covered with snow and ice, and a complete measurement of the lake was not possible. An estimate of total volume was made, therefore. A snowdrift reaches down into the upper end of the lake, which probably doesn't melt in ordinary years, and definitely will not melt this year. Water temperature on the day of observation registered 37° F. near the glacier and 44° F. at the lake outlet. Air temperature was 66° F. (2:00 p.m.). The visible bottom was composed of rubble and sand. Trichoptera and Chironomidae larvae were very abundant in the shallow water. Higher aquatic plants were not present in the lake. No fish were observed or captured from this lake. The lake inlet falls directly down from the cliff face providing no upstream movement. The outlet is also blocked to fish movement as it sinks down through rocks and gravel before flowing into Lower Spectacle.

Lower Spectacle Lake — Lower Spectacle lies approximately 30 yards downstream from Upper Spectacle Lake. In contrast to the upper lake, it has very little bottom less than 15 feet deep. The bottom drops off sharply on most sides to a maximum recorded depth of 80 feet. There are a few shallow rocky shelves several yards in size near the mouth and outlet to the lake. Trichoptera larvae were particularly abundant in these shallow areas. Two species of adult Trichoptera were also flying about. No higher aquatic flora was observed.

Two large cutthroat trout (16" and 18") were observed throughout the day in one of the small, shallow areas near the outlet. Although neither of the fish could be captured by angling, close observation was possible. Spawning colors were conspicuous on the two fish.

The water level of the lake seemed slightly higher than normal, as some lichen-covered rocks were under 6-12 inches of water. The outlet of Lower Spectacle is blocked by a rock bridge, and 50 yards below the lake the stream drops over a 30-foot falls. The stream at this point separates into two channels for the steep plunge down into Ypsilon Creek. There are a number of falls on both of these channels which act as barriers to upstream movement of any type. The drainage from both Chiquita Lake and Spectacle Lakes runs into Ypsilon Creek above Ypsilon Lake. Measurement of the main stream one-half mile above Ypsilon Lake and one-eighth mile above the confluence of Spectacle Lake drainage, and the main stream revealed a stream flow of 4.36 cubic feet per second on August 6. After the drainage from Spectacle Lakes runs into Ypsilon Creek, the creek drops over a series of falls and cascades before emptying into Ypsilon Lake. The lowest impassable cascade is only a few yards above the lake, thus cutting off all spawning grounds in the stream to the lake fish.

Ypsilon Lake --- Ypsilon Lake appears to have more littoral zone than the three previous lakes examined and is at a much lower altitude (10,550). The south end of the lake drops off into a deep hole approximately 56 feet deep, but the north, north-east, and west ends of the lake are comparatively shallow. The bottom, where visible, is silt, with a few large boulders scattered about. There are some rubble areas. Water temperature measured August 6, 1957, was 48° F. at 9:00 a.m. The air temperature at the time was 63° F. There was no evidence of any fish present in the lake. No fish were observed during the several trips around the lake by boat, and no fish activity was observed during the four days camp was established on the lake shore. A 150-yard gill net was set near the lake inlet at 8:00 p.m. August 5, and pulled at 8:00 a.m. August 6. No fish were captured. Adult caddis flies were abundant around the lake during the evenings and numerous terrestrial insects were seen floating on the water, but no feeding fish were observed.

The outlet of Ypsilon Lake is tightly jammed by numerous driftwood logs. Within one-fourth mile of the outlet, the stream drops down a cascade, effectively barring any upstream movement. The stream below the lake contains many fine pools, but is periodically broken up by low falls and cascades. Stream flow 200 yards below the lake measured 20.2 cubic feet per second with an average stream width of 12 feet. The water temperature here was 50.5° F. at 7:30 p.m. August 7. No fish were observed or captured in the stream.

Faylene Lake --- On August 15, 1957, Faylene Lake was surveyed and sounded. This particular lake was formed by a terminal moraine blocking the normal drainage. Maximum depth was recorded at 19 feet, but most of the lake was less than five feet deep. The visible bottom was of sand and pebbles.

Three small, mossy brooklets run into the lake at the north end. The nature of the streams made accurate flow measurements impossible, but total flow was estimated at three cubic feet per second. All three streams were open to upstream fish movement for a distance of several hundred yards.

The stream bottoms were silty clay and thus were not particularly suitable for spawning. The lake outlet was also open and no stream barriers were present between Faylene and Fay Lake. Much of the lake bottom was visible, but no fish were observed. It is doubtful if fish are present in the lake. Some snow still extended down into the lake in several places, and the lake showed evidence of extreme winter conditions. It is possible that the lake is completely filled with snow in the winter.

Ephemeroptera and Trichoptera larvae were common in the lake, but not overly abundant. Adult Chironomidae were also observed. No higher aquatic flora was present.

Fay Lake -- Fay Lake, also measured on August 15, had a maximum recorded depth of 26 feet, although almost one-half of the lake was less than five feet deep. A good littoral zone is present in Fay Lake, but no higher aquatic plants were observed here either.

Trichoptera larvae were fairly common among the rocks on the bottom, and adult midges were numerous over the lake. No fish were captured by angling nor were any observed in the lake, but fisherman reports indicate that cutthroat trout are present.

Both the inlet and outlet to Fay Lake are open, with easy access to the stream by lake fish. The stream between Fay and Faylene Lakes has limited spawning area as the stream bottom is clay and silt. There are no definite barriers, however, to movement of fish between the two lakes. Flow in the main stream, 50 feet above Fay Lake, was approximately 5.5 cubic feet per second on August 15, 1957. Average stream width was four feet with an average depth of seven inches. Stream flow into the lake from the right drainage was approximately two cubic feet per second, but accurate flow measurements were difficult to make because of the nature of the streams. Fish are unable to move up into the right inlet. Hence, it is of little value to the fishery.

In general, the branch of the stream coming down through Fay Lake drains part of Mount Fairchilds, which is less steep than Ypsilon Mountain. The stream gradient is thus much lower than the part of Ypsilon Creek around Ypsilon Lake. Hence, there is a more continuous stream in the Fay Lake area. The outlet from Fay Lake drops down over cascades for about 200 feet before entering the meadow and timber above Lower Fay Lake (Caddis). The stream section above Lower Fay Lake appears ideal as a spawning site for fish from this lake. Much sand and small gravel cover the stream bottom. Thirty yards above Lower Fay a stream flow of 9.24 cubic feet per second was measured on August 8, 1957. The water temperature was 47° F. at 10:00 a.m. with an air temperature of 62° F. The average stream width was 9.5 feet, with an average depth of six inches.

Lower Fay Lake (Caddis) -- Lower Fay is an extremely shallow lake, being of different origin than the other lakes examined in the drainage. It lies at an elevation of 10,675 feet. Maximum depth was recorded at 2.5 feet, with an average depth of about one foot. In contrast to the other lakes, Lower Fay has a clear inlet with easy access to the stream above for spawning. Several cutthroat trout (12-15 inches) were observed near the lake inlet in

the lake proper, and two specimens were captured on worms. Limited spawning evidently takes place, as a single trout fry (one and one-half inches) was observed in the lake shallows. The lake outlet is also open and fish can move up into, and down out of, the lake. The lake bottom is composed of sections of gravel along with sections of silt and organic debris. Trichoptera and Ephemeroptera larvae were abundant in the rubble.

One-fourth mile below the lake cascades drop approximately 60 feet, making upstream movement doubtful. However, easy passage downstream would be possible. Another cascade three-fourths of a mile below the lake also restricts upstream passage. There are many fine pools in this section of stream down to its junction with Ypsilon Creek, as well as below the junction in the main stream. Below the junction there is sufficient water to make fine, deep pools. The stream flow one-half mile below the junction of Fay drainage and Ypsilon Creek was measured August 8, 1957. At that time the flow measured 34.9 cubic feet per second with a water temperature of 54° F. and air temperature of 70° F. (2:00 p.m.). Approximately one mile below the junction another series of falls bars upstream migration as the stream drops down into Roaring River.

In general, the Ypsilon drainage consists of small streams without cover which can be easily fished. Many of the lakes have blocked inlets and outlets, which restricts the lake fish from spawning in the streams. The streams are repeatedly broken up with falls and cascades (and underground sections, at higher elevations). This restricts free movement of fish throughout the system, but also would restrict upstream movement of undesired species from below. The number of fish present in the whole drainage appears to be very limited. Fish in the lakes appear to be restricted in numbers to a few adults of large size, which effectively remove the young. Only cutthroat trout were observed in the drainage.

Main access to the drainage is by horse trail from Fall River Lodge. The trail from the lodge to Ypsilon Lake is approximately five miles up a steep hogsback. There is no trail to Chiquita Lake or Spectacle Lakes, and the climb is quite strenuous because of the high altitude. Spectacle Lakes are effectively isolated at the top of a steep chasm, which is difficult to climb. Fay Lake is easily reached from the campsite at Ypsilon Lake by hiking around the ridge. The entire drainage is sufficiently remote to eliminate a large percent of present-day fishermen, and should be a suitable place for planting, if the streams are still of adequate size in normal years.

It is concluded that the Faylene-Fay-Caddis Lake drainage is the most suitable habitat for stocking. There are fewer barriers to movement through this part of the drainage and fish on the three lakes can move into the stream to spawn. The lakes are shallower than lakes in the Ypsilon area and hence have more productive littoral zone. Their smaller volumes would also mean less expense for chemical removal of the present fish population.

Table II
Stream Flow Measurements - Ypsilon Drainage
Flow Measurements - Ypsilon Drainage

Stream	Flow Cubic Feet Per Second	Aver. Width (feet)	Aver. Depth (inches)	Temperature Water	Temperature Air	Date	Location
Ypsilon	4.36	4	4.25	44	61	8-6-57	One-half mile above Ypsilon Lake
Ypsilon	20.20	12	6.06	50.5	56	8-7-57	200 yards below Ypsilon Lake
Fay Creek	9.24	9.5	6	47	62	8-8-57	30 yards above Lower Fay Lake
Ypsilon	34.90	8	10.4	54	70	8-8-57	One-half mile below junction of Fay drainage and Ypsilon Creek

Table III
Lake Survey Data - Ypsilon Drainage

Lake	Surface Area (acres)	Volume (acre feet)	Maximum Depth (feet)	Temperature (degrees F.) Water	Temperature (degrees F.) Air	Elevation (feet)	Date Examined
Chiquita	4.044	71.550	35	44	52	11,500	8- 6-57
Upper Spectacle	13.812	448.244	62	37	66	11,400	8- 7-57
Lower Spectacle	11.696	368.120	80	47	58	11,400	8- 7-57
Ypsilon	8.528	166.476	56	48	63	10,550	8- 6-57
Faylene	4.348	27.392	19	45		11,100	8-15-57
Fay	3.724	29.934	26	46		10,850	8-15-57
Caddis	1.312	1.312	2.5	51	62	10,675	8- 8-57

Hague Creek — On August 19 and 20, 1957, fish specimens were collected from Hague Creek in the Cache La Poudre River drainage. Hague Creek was examined as a possible source of green-back trout, Salmo clarki stomias, as well as a possible area to re-establish this subspecies.

At an elevation of approximately 10,800 feet, there is a falls on Hague Creek which restricts all upstream fish movement. Although the area above the falls was examined and fished carefully, no fish were found. On the above date sufficient water was present to provide a suitable habitat for fish, but no fish were present. Bill Robinson, of the Fall River Lodge, reported that fish had been planted above the falls, but the plant obviously did not take.

Below the falls, both cutthroat and brook trout were present. Brook trout were exceedingly abundant and some emaciated specimens were captured. Competition appeared severe, and fish were small in size. Cutthroat specimens taken in the stream from an elevation of 10,000 to 10,800 feet were preserved.

There are several barriers in upstream migration in the Hague drainage, but a possible crossing of several subspecies could have occurred. The Fort Collins irrigation ditch drains streams on the east side of the Never-Summer Range, which originally drained into the Colorado River. Hence, Colorado River cutthroat could be present. Each September the irrigation reservoir is emptied into the Cache La Poudre River. Headwaters of the Cache La Poudre River are thought to have contained green-back trout at one time. The lower reaches of the Cache La Poudre have been stocked with Yellowstone cutthroat in recent years. Hence, it is doubtful if the specimens collected are a pure strain.

It would be worthwhile to examine the upper Hague drainage in normal years, as a possible site to re-establish green-back trout. The area is highly inaccessible and supports a large number of small fish (below the falls) at the present time. Pools are numerous and food seems adequate for a good fish population.

Twelve specimens were preserved from Hague Creek. Five were taken by Mrs. Millie Cole to the California Academy of Science and seven were retained in possession.

Park Biologist James E. Cole was present on the survey.

Tonahutu Creek - Colorado Drainage — On August 22 and 23, 1957, fish specimens were collected from Tonahutu Creek above Granite Falls, as possibly of the Colorado River cutthroat, Salmo clarki pleuriticus. Tonahutu Creek is in the original range of this subspecies of cutthroat. There is no record of any planting in the section of Tonahutu Creek above Granite Falls. This seems substantiated by the fact that no brook trout are present above the falls, although they are present several miles downstream, at an elevation of approximately 9,600 feet. Granite Falls lies at an elevation of about 10,000 feet.

The population of cutthroat above Granite Falls is relatively small, but they are abundant below the falls, down to the area where brook trout are present. Below the falls a wide range of color and spot variation was present in the fish captured. Specimens taken ranged from 7 to 14 inches in length.

Food was abundant in the stream and the fish captured all had distended stomachs from eating. Nine specimens from above the falls were captured and preserved.

Mr. James Cole, Park Biologist, assisted in the survey.

Albion Creek — Albion Creek was first observed and fished on July 29, 1957, with the assistance of Dr. Bill Osborn of the Colorado Biological Research Station. On that date 11 specimens thought to be Salmo clarki stomias were captured on worms and flies. Only one specimen was taken near the old Albion townsite. The remainder were captured about one-half to three-fourths mile below the townsite on the stream. Most of the fish taken were still ripe and had brilliant spawning colors. Ripe males were more numerous than females in the collection. Four fish obtained in a small glacial streamlet appeared to be spawning at the time of capture. Elevation of the stream at the collection site is approximately 11,100 feet.

On August 1, ten specimens were captured on worms in Albion Creek, near the area stated above. These were preserved also, as the number was considered insufficient to merit shipping them to the Leadville Hatchery.

In order to obtain fish in sufficient numbers for hatchery production, it was deemed wise to attempt the electrical shocking of fish in Albion Creek. Dr. Howard Tanner of the Colorado State University had previously found that direct current was unsatisfactory in such pure water. Hence, alternating current was utilized. Mr. Rex Talliaferro, Colorado Fishery Biologist, provided a 500 watt, 220/110-volt generator, but this machine was unsatisfactory also. A total of 26 fish were captured by angling on this date. Fifteen specimens were transferred to the Colorado State Hatchery at Fall River and 11 fish were taken to the Federal hatchery at Leadville by Mr. Tom French.

Color photographs were taken of the stream and captured specimens. A color movie was made also, by Mr. Norman Herkenham, Park Naturalist.

Big Thompson River - Forest Canyon — On August 27 and 28, 1957, the headwaters of the Big Thompson River were examined as a probable source of green-back trout, Salmo clarki stomias. Above the junction with Fern Creek, a series of falls and cascades on the Big Thompson River provides an effective barrier to any upstream movement. The difficult terrain, coupled with a complete lack of trails, has apparently protected the area above the falls from heavy fishing pressure, and in turn fish stocking. There is no record of any fish stocking in this area, and some doubt exists as to whether pack horses could be brought down into the drainage for stocking purposes. Hence, the cutthroat trout present in the stream appear to be native to the area. The only possible source of contamination would be from any plantings in the Gorge Lakes drainage, which runs down into the Big Thompson.

Twelve specimens captured in the headwaters of the stream (elevation 10,200 to 10,500 feet) were preserved. Most of these fish were in spawning condition, with the males in spawning colors. As was found in Albion Creek, the males remained in spawning condition longer than the females.

Many fingerling fish in the upper stream indicated good spawning success. Each pool contained several small fish as well as larger mature specimens. Fish were abundant in all sections of the stream examined, except that section lying between 9,500 and 10,000 feet elevation. Fish were relatively scarce in this area. Fishermen apparently hike down from Trail Ridge Road, fish this section, and climb out again.

The specimens captured appear to have the characteristics of green-back trout; and if they are proven to be such, it would mean that an excellent source of fish for propagation purposes is available within Rocky Mountain Park.

Recommendations

Based on the assumption that the fish in question is the green-back trout, the following recommendations are submitted:

1. Biological studies be conducted where the fish now occurs in order to learn about the biology and life history in its natural habitat. It is recommended that the studies be made on the upper Big Thompson River. A trap would be installed in the stream for control of upstream and downstream migrants. The studies would feature measurements of numbers, sizes, sexes, and condition of fish, fecundity, times of migration, water temperatures and flow, and other biological features.

2. Studies be continued on the present distribution of the green-back trout in and around Rocky Mountain National Park. The assistance of interested agencies would be most welcome on this project.

3. Studies be continued to complete the inventory of waters suitable for restoration by stocking the green-back trout.

4. The Fay Lake drainage be poisoned in 1958 for the elimination of all fish and preparation for the 1959 stocking of green-back trout fingerlings.

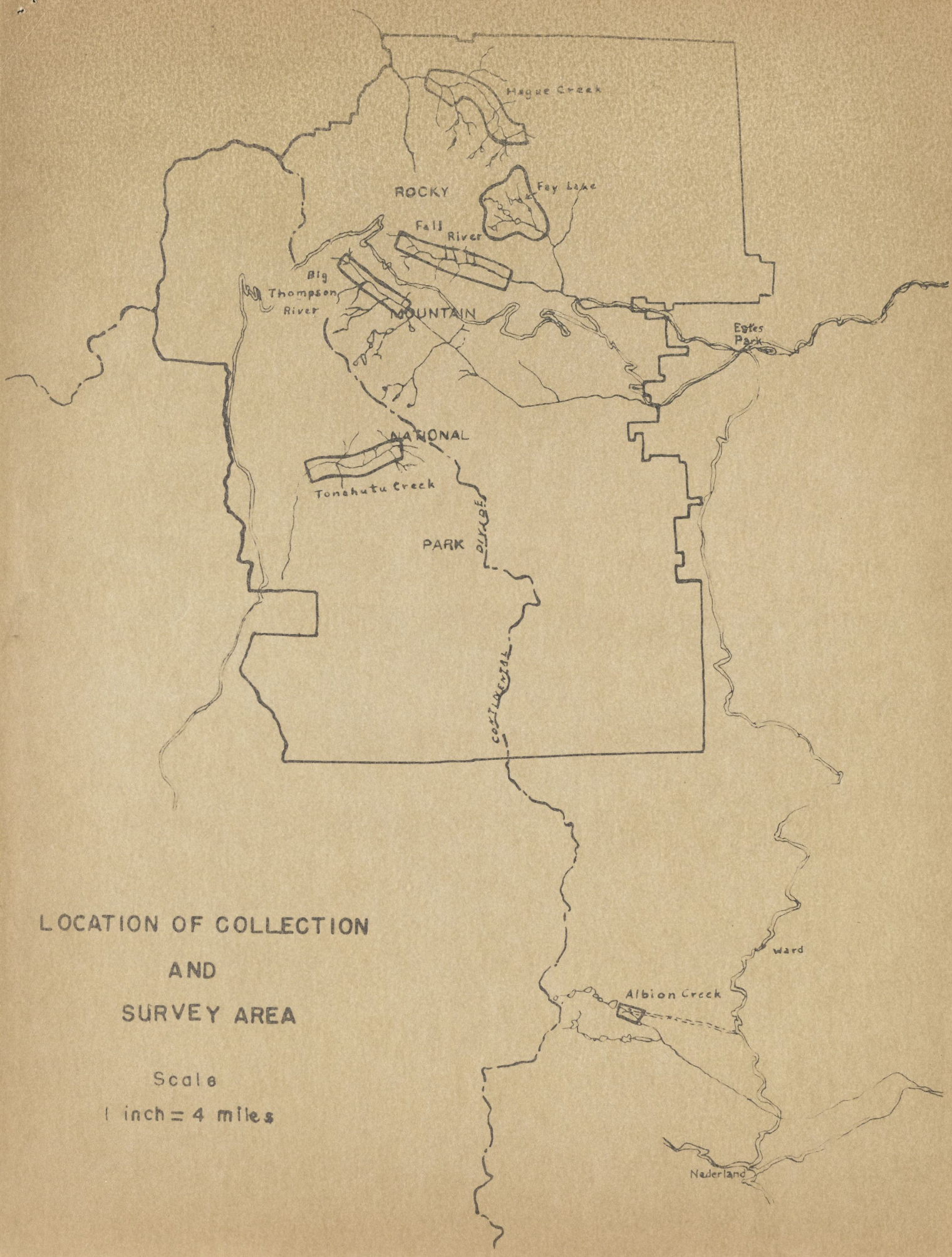
5. Studies be made by hatchery personnel at Leadville, Colorado, on the culture of the green-back trout. Spawn should be taken in the summer of 1958 and hatched and cultured for planting in 1959.

6. Consideration be given to the transplantation of adult green-back trout from Big Thompson River or Albion Creek to the Fay Lake drainage, should the culture of green-back trout be unsuccessful.

Cost Estimate
1958 Poison Operation

Item	Cost, Fiscal Year 1959
Personnel:	
2 Fish and Wildlife Service permanent personnel (4 days)	
2-3 National Park Service permanent personnel (4 days)	
1 Fish and Wildlife Service Fishery Aid (1 pay period)	$ 122.00
5 Fish and Wildlife Service laborers, temporary (4 days)	250.00
Services:	
Horses	100.00
Materials:	
Poison	90.00
Neutralizer	60.00
TOTAL COSTS	$ 622.00

October 18, 1957



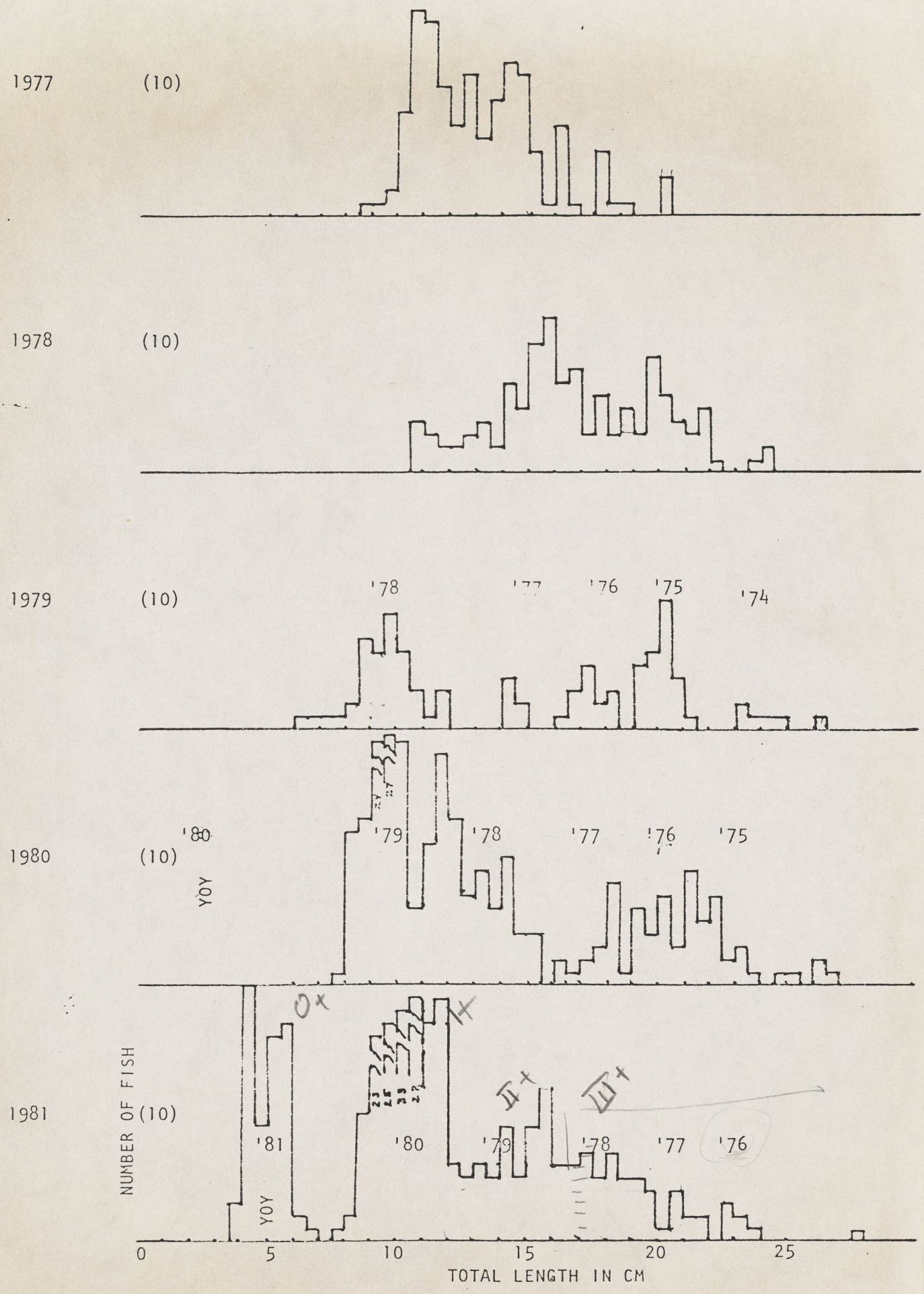
LOCATION OF COLLECTION AND SURVEY AREA

Scale
1 inch = 4 miles

Taxonomic data for six cutthroat trout collected from Forest Canyon of the Big Thompson River, Rocky Mountain National Park, Colorado. (measurements in millimeters)

Sex	Head Length	Standard Length	Body depth	Dorsal fin length	Adipose fin length	Head Width	Orbit length	Snout length	Upper jaw length	Branchiostegals left	Branchiostegals right
M	49	170	42	36	14	27	12	11	29	11	10
M	44	170	38	36	19	26	11	10	25	11	10
F	41	167	37	39	16	26	10	9	23	12	11
M	39	157	35	33	13	24	10	8	22	11	10
F	36	150	33	33	14	22	10	8	20	11	10
F	39	155	37	38	15	23	10	8	22	11	10

Scales in lateral line	Scales two rows above lateral line	Scales above lateral line	Spotting Areas 1-6	Hyoid Teeth
134	186	44	45-12-22-16-28-11	8
126	177	40	64-20-34-25-31-22	10
131	176	42	49-18-28-25-27-18	12
127	182	41	56-18-39-25-28-13	12
132	183	44	54-14-34-22-33-23	9
131	179	42	35-13-29-24-28-19	14



LENGTH FREQUENCY OF GREENBACKS, HIDDEN VALLEY CREEK DOWNSTREAM FROM BEAVER PONDS

ROCKY MOUNTAIN NATIONAL PARK

Fishery management research in Rocky Mountain National Park was resumed in June, with emphasis on the second phase of the restoration of the green-back trout and on measurement of the creel.

The green-back trout project proceeded according to schedule. The Fay Lake drainage was chemically treated in late 1958 for removal of all fish. In June of 1959 it was determined that these waters were free of fish and that detoxification was complete. Accordingly, capture of adult green-back trout from the Upper Big Thompson River in Forest Canyon was begun, and about 300 were captured and held in the Fall River Hatchery of the Colorado Game and Fish Department. The U. S. Air Force furnished helicopter service in mid-summer, and 209 green-back trout were successfully dropped into Fay Lake at the 11,500-foot elevation. Observers reported that no loss of fish took place in connection with the plant. The population will be studied in future years to measure the success of the restoration.

209-4-10"

A group of 89 green-back trout was transferred to the U. S. Fishery Station at Leadville, Colorado, for cultural purposes. Some spawn was taken in 1959 from green-backs captured in 1957 and 1958, so we are hopeful that a brood stock can be established at Leadville.

The creel census in Rocky Mountain National Park covered the important fishing waters east of the Continental Divide. From 1958 to 1959 fishing success rose from 0.551 to 0.615 fish per hour and fishing effort changed from 29,466 to 26,787 hours of fishing. The net result in the catch represented practically no change, with total catch at 16,210 fish in 1958 and 16,344 fish in 1959. Of the four species involved here, brook trout were the most abundant fish in the catch in most waters in both years. Rainbow, brown, and cutthroat trout were taken in smaller numbers in 1959 than in 1958.

A report prepared for the National Park Service recommended the planting of the largest rainbow trout consistent with Park Service policy in Fall River, Lower Big Thompson River, Mill Creek, Glacier Creek, and Bear Lake, and that studies be made of the fate of hatchery-reared trout in Fall River and Big Thompson River.

Excerpt from Annual Progress Report (1958) of Chief, Rocky Mountain Sport Fishery Investigation, Fish and Wildlife Service, concerning studies supervised by Dr. Oliver Cope.

ROCKY MOUNTAIN NATIONAL PARK

A study was initiated in 1957 in Rocky Mountain National Park to locate existing populations of green-back trout, Salmo clarki stomias, and to find suitable waters within the park for the restoration of this native subspecies. An investigation of the nature and extent of the fishery in the park was also requested. By the end of the 1958 field season, much progress had been made on several phases of the study.

The discovery in 1955 of fish suspected to be the green-back trout was made in Albion Creek, a tributary of Boulder Creek, which drains into the South Platte River. A survey was made in 1957 and 1958 of waters within Rocky Mountain National Park to see if similar fish existed within the park. Cutthroat from upper Big Thompson River in Forest Canyon closely resembled the Albion Creek fish. As the population in Forest Canyon was much larger than that in Albion Creek, Forest Canyon was selected as a site to study the fish in its natural environment. In 1958 a trap was installed in Forest Canyon to obtain information on the biology of this trout.

In 1958 study revealed that the cutthroat in this stream do not migrate at spawning time. Spawning fish were relatively small; mean length of spawning fish was 190.8 millimeters. The largest speciman taken in the stream was 236 millimeters long. Age frequency of 41 spawners was: Age Class III, 71 percent; Age Class IV, 29 percent. Males were predominant in the spawning population. Spawning commenced about July 1, and was completed by July 15. First fry were observed on August 26.

Summer diet of the Forest Canyon fish consisted predominantly of terrestrial organisms, with adult Hymenoptera as the major food item. Aquatic organisms were taken in greatest numbers during the spring runoff.

Mean lengths at capture in millimeters for each age class were: Age Class I, 93.12; Age Class II, 130.13; Age Class III, 173.59; Age Class IV, 205.60. The Forest Canyon cutthroat do not appear to form scales during their first summer of life.

In order to study the green-back trout in both lake and stream habitats, the Fay Lake drainage in Rocky Mountain National Park was selected as an area for restocking this subspecies. The upper 2.2 miles of the Fay Lake drainage contains three lakes which are similar to many other montane lakes in the park. The area was treated in 1958 with Pro-Noxfish to remove the resident populations. Potassium permanganate was successfully used in the stream to restrict fish kill to the study area. The area should be ready for restocking in 1959.

Specimens of cutthroat trout from waters within Rocky Mountain National Park were sent to Dr. Robert Miller, Curator of Fishes, University of Michigan. Dr. Miller found interesting morphological differences between the fish, but he stated that the differences may be due to environment. Hence, in order to determine the true taxonomic status of the green-back trout, the fish must be reared concurrently with other cutthroat subspecies under controlled conditions. To accomplish this important phase of the project, and to determine if green-back trout could be reared in the hatchery, 26 Albion Creek fish were transported in 1957 to the U. S. Fishery Station at Leadville, Colorado. Many of these specimens died during the winter, and the survivors did not spawn in 1958, although they did put on good growth. In 1958, 50 adult cutthroat from Forest Canyon were taken to Leadville. If these fish spawn in 1959, eggs of this variety will be hatched and reared concurrently with young of the Colorado River cutthroat, Salmo clarki pleuriticus. If anatomical differences are found in the resulting fish, the status of the green-back trout may be clarified.

During the general survey of park waters to locate possible populations of green-back trout and to locate suitable areas for stocking this subspecies, some information was obtained on the fish populations now existing in these waters. Six streams and seven lakes were examined in 1957; in 1958 six streams and 17 lakes were surveyed. All of the lakes examined were relatively small (1.0 to 27.0 acres) and slightly acidic (pH from 5.5 to 6.8). Methyl orange alkalinity varied from 4.5 to 13.0 ppm. Little or no spawning gravel is available in most of the lakes. Only brook trout appeared to have much spawning success in the lakes, with one exception in the Fay Lake drainage where cutthroat were spawning successfully. Most of the lakes require periodic planting to maintain populations. Brook trout are reproducing well in streams containing this species. They are usually the most abundant species, when present. All of the streams surveyed had relatively small numbers of aquatic invertebrates. The summer diet of trout in most of the lakes and streams was predominantly terrestrial organisms.

In 1958 a creel census was conducted on waters within the park east of the Continental Divide to determine the amount of fishing pressure, species composition, mean lengths, and size of the harvest. Four streams received most of the fishing pressure: Big Thompson River, Fall River, Glacier Creek, and the North St. Vrain River. Fishing pressure and harvest estimates for these streams are given in Table 4, where mean length in inches is in parentheses.

Table 4, Effort and catch estimates for Rocky Mountain National Park streams, 1958.

Area	Total fisherman hours	Harvest				
		Brook	Rainbow	Brown	Cutthroat	Total
Big Thompson River	8,924	4,567 (7.04)	952 (8.01)	287 (9.45)	129 (6.66)	5,935
Fall River	8,453	3,926 (6.98)	1,152 (6.74)	200 (7.78)	26 (6.00)	5,304
Glacier Creek	8,039	2,525 (6.63)	1,341 (7.58)	66 (8.50)	395 (10.20) 1/	4,327
North St. Vrain River	2,570	1,315	460 (8.45)	480 (11.07)	395 (8.22)	2,650

1/ Only a single cutthroat measured.

Fishing pressure on lakes was less than on the streams, and catch per hour was higher than for the streams. Most of the catch from the streams was composed of wild brook trout. Planted rainbow trout were the next most important species. Approximately 21 percent of the harvest from the four streams listed above consisted of rainbow trout planted as fingerling in 1957.