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GREENBACK CUTTHROAT TROUT RECOVERY PROJECT
1988 PROGRESS REPORT

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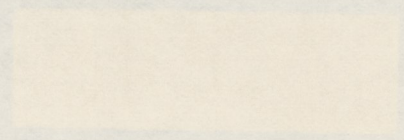
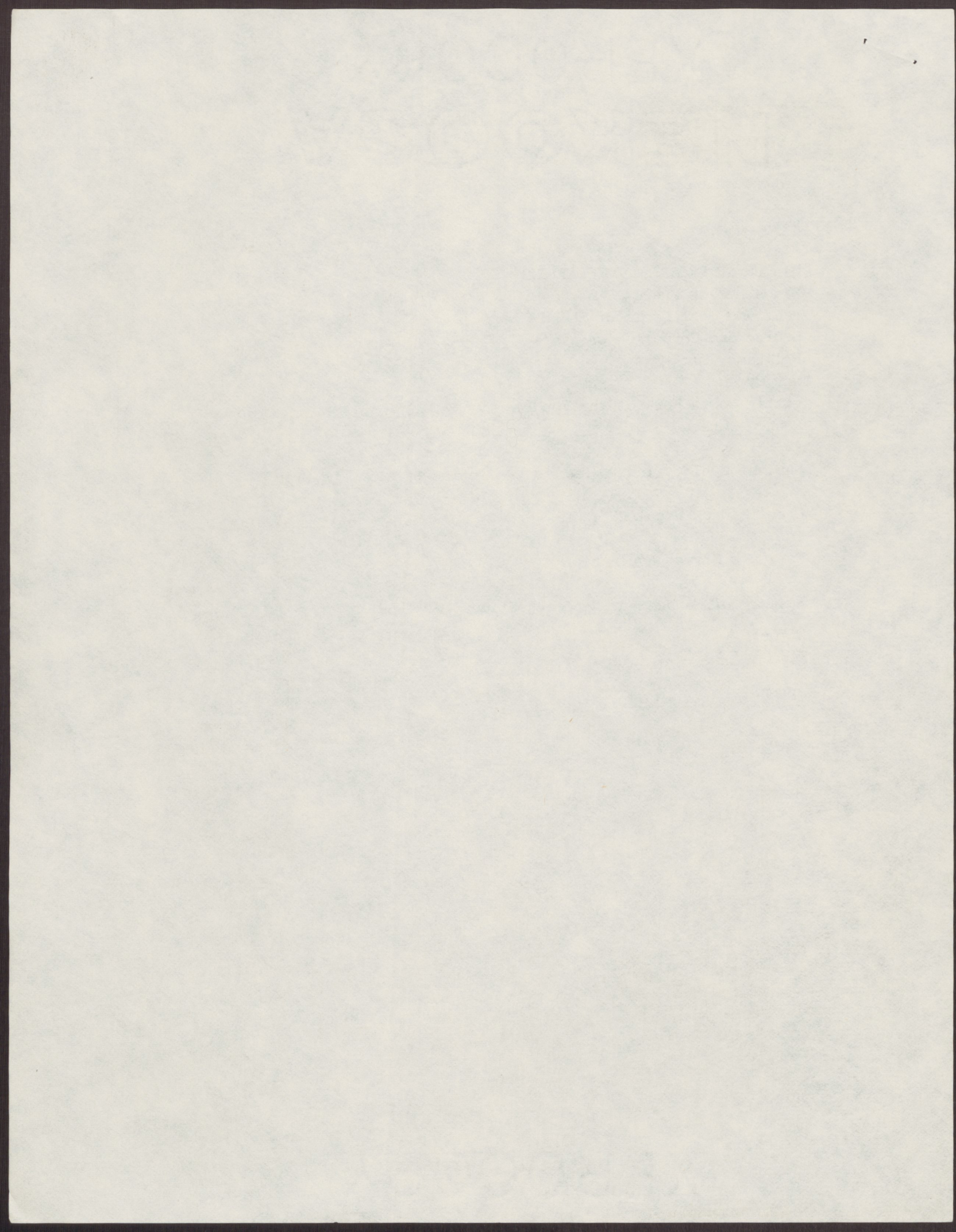


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INTRODUCTION

The greenback cutthroat trout (*Onchorhynchus clarki stomias*) was one of two native salmonids present east of the Continental Divide in Colorado when European settlers arrived. The range of the greenback, along with that of the yellowfin cutthroat (*O. clarki macdonaldi*), gradually decreased as habitat loss from mining activities combined with the fishes inability to compete with non-native salmonids. The yellowfin was driven to extinction by the early 1900's. The greenback steadily lost ground and hybridized with introduced rainbow and other subspecies of cutthroat until only three genetically pure populations existed. Historical populations of greenbacks occurred in Como Creek in Boulder County, the Little South Fork of the Poudre in Larimer County, (both tributaries of the South Platte River) and Huerfano Creek in the Arkansas River drainage.

In 1977, the Greenback Cutthroat Trout Recovery team was organized with personnel from the U.S. Fish and Wildlife Service, U.S. Forest Service, U.S. Bureau of Land Management, U.S. Park Service and Colorado Division of Wildlife. The goal of the team is to remove the greenback from the USFWS threatened and endangered list. To accomplish this 20 stable populations must be established within the species historical range.

Efforts in 1988 toward achieving this goal in the DOW Northeast Region consisted of annual population surveys of the seven populations, re-evaluating the potential of each creek using the Habitat Quality Index model (Binns 1982) and evaluating the success of 1987 stocking. Fry from Bozeman, Montana were not stocked in 1988 due to disease importation laws of the Colorado Division of Wildlife.

In 1988, four of the greenback streams were opened to catch and release fishing. The stability of these populations is discussed as are the fishability and accessibility of the streams.

METHODS

Population sampling was conducted at the same sites as those used in 1987 (Appendix Figures 1-6). Population was estimated using the Seber-LeCren two pass depletion method. A block net was set at the lower terminus of each section to prevent fish from leaving or entering the section.

Thermographs were placed in Black Hollow Creek, Sheep Creek, George and Cornelius Creeks to provide baseline information on spawning, timing of fry emergence timing and maximum summer temperature (Figure 1-4) .

Habitat Quality Index (HQI) measurements were redone in an attempt to rectify the unsatisfactory results obtained in 1987. Water quality measurements were not repeated, so 1987 values were used in 1988 predictions.

A voluntary creel census was initiated with the opening of four greenback streams (Black Hollow, East and West Forks of Sheep Creek, George and Cornelius Creeks) to catch and release fishing. At major access points for each stream, two signs were placed describing the regulation and the voluntary creel card system. Also, if any fishermen were contacted during our visits to the stream we utilized the contact interview approach to obtain creel information.

STATUS OF EXISTING POPULATIONS

Black Hollow Creek

Restoration efforts in Black Hollow Creek began in 1962, when a barrier was constructed. Brook trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*) were eradicated and greenback cutthroat reintroduced. During a 1978 population survey in this drainage brook trout were found to have reinvaded the reaches above the barrier. In 1979, a second attempt was made to remove brook trout from the system. Since that time no non-native salmonids have been found in the Black Hollow Creek drainage upstream of the barrier.

Thirty-seven greenback cutthroat adults from the Como Creek stock were transferred to Black Hollow Creek in 1980, and fry and fingerlings from the Bozeman, Montana hatchery were stocked in 1983 and 1984.

Since 1985, two sites have been sampled annually to determine the status of the existing cutthroat population. The lower station is located immediately above the barrier; the upper station is located approximately 2.4 kilometers further upstream. Standing crop estimates decreased significantly from 37.7 kg/ha in 1987 to 17.0 kg/ha in 1988 (Table 1). Both stations decreased approximately 20 kg/ha which we attribute to low winter survival due to low flows.

During the late fall of 1987 we had reports of streams flows in the same areas being low enough to strand fish. Length frequency analysis shows a change in size distribution toward smaller size fish (≤ 100 mm) with significant loss of fish larger than 150 mm. Survival of fish stocked in 1987 remained high and the Black Hollow population should rebound if flows remain high enough for overwinter survival. Log drop structures were installed in Black Hollow Creek during the summer of 1988 to improve spawning and adult holding water. Because of the short time the structures have been in the stream we were not able to assess their effectiveness.

Maximum summer temperature (Figure 3) of 11° C occurred during the week of August 6 but declined to 9° C by August 13 with continual decline until the thermograph was removed in September.

East and West Forks of Sheep Creek

Sheep Creek is a tributary of the mainstem Poudre River. A natural waterfall located downstream of the confluence of the East and West Forks acts as a barrier to upstream fish migrations. Non-native salmonids were poisoned from the drainage above the waterfall in 1981. Greenback cutthroat fry and fingerlings were stocked in both forks from 1982 through 1985 and in 1987.

Standing crop estimates of 52.0 kg/ha (Table 1) remained very stable in the West Fork since 1986, only varying 3 kg/ha in the last three years. We did see a slight decrease in the East Fork from 37.5 kg/ha in 1987 to 30.8 kg/ha (Table 1) in 1988. This drop is not of concern and may represent natural movement of fish in and out of our sampling station. Both forks show good stability and have shown tremendous increases in biomass since 1984, with very little artificial stocking.

In 1987 natural reproduction was documented in both forks and the mainstem Sheep Creek, with emergence occurring in late August when stream temperature is $11-13^{\circ}$ C (Figure 3). Late emergence, such as this may limit recruitment to age 1+ and growth potential of the fish in early life.

George and Cornelius Creeks

George and Cornelius Creeks are tributaries of Sheep Creek (not the same Sheep Ck. previously referred to) in the North Fork of the Poudre River drainage. Greenback populations are isolated from downstream non-native salmonid populations by a man-made barrier on George Creek (located 0.8 km below the George/Cornelius confluence). These creeks were sites of restoration in 1981 and 1982. An incomplete removal of the dominant species, brook trout, in 1981 made it necessary for a second application of rotenone the following year. Greenback fry and fingerlings were reintroduced in 1983 and 1984.

In 1985, brook trout were again found throughout Cornelius Creek and in the headwaters of George Creek. Population sampling in 1986 confirmed the presence of brook trout in Cornelius Creek however none were collected in the 100 meter study site on George Creek. In 1987 an intensive effort was made to electrofish a substantial portion of both drainages to determine the range and concentration of brook trout. Juvenile and YOY brook trout were found while conducting a population estimate on Cornelius Creek (a 100 meter site located approx. 1.2 km above the George/Cornelius confluence). Brook trout were also observed and four adults were collected with hook and line in beaver dam ponds in the upper reaches of this drainage.

Standing crop estimates for Cornelius Creek decreased to 51.6 kg/ha (Table 1) in 1988 from 75 kg/ha in 1985. Brook trout biomass dramatically increased from 6.8 kg/ha in 1987 to 41.3 kg/ha in 1988 (Table 1). Even though greenbacks still outnumber brook trout, species composition is changing quickly. As in 1987 three brown trout were captured in Cornelius Creek and seem to be expanding in numbers. The potential for a species composition shift due to brook trout's competitive advantage and the fact that brook trout numbers are increasing and greenback numbers are declining appears to be leading to the demise of the greenback in Cornelius Creek.

The greenback population in George Creek has remained strong since 1986. A biomass estimate of 79.1 kg/ha is the highest for a greenback stream in northeastern Colorado (Table 1). Although brook trout were found in the upper reaches of George Creek in 1985, the density of this population does not appear as great as that found in Cornelius Creek. Presently, we must assume that some unquantified contingent of brook trout still exists in George Creek.

With unobstructed flows between George and Cornelius Creeks the non-native salmonid abundance will likely increase in George Creek. An attempt to maintain the greenback population in George Creek should be made if non-native species continue to increase in numbers in Cornelius Creek. Some consideration should be given to the construction of a new barrier on George Creek to isolate it from Cornelius Creek in the near future.

Williams Gulch

Williams Gulch, which was formerly barren, was stocked with 48 (127mm) fish in 1981, 200 fry in 1982, 400 fry in 1983 and 1400 fry and 230 marked fingerlings (140mm) in 1984. No marked fingerlings have been recovered since 1985.

The lower termini of the three sites sampled are located 2.5, 2.8 and 3.5km downstream from the point where the Green Ridge Trail meets the creek. The lower site had a moderate gradient, slight to moderate shading, and boulder, cobble and sand substrate. There were no substantial pools and few undercut banks. The middle section was located in a small clearing, shaded slightly by pines. Gradient was low and substrate was predominantly sand and gravel. There was moderate undercutting throughout this intermediate section. The upper sampling station meandered extensively through an open meadow with a tributary entering from the south at the section mid-point. Habitat was primarily slow-flowing runs broken up with short riffles; substrate was fine sediments and gravel.

In 1988 standing crop (Table 1) was estimated at 27.1 kg/ha in the lower station, 75.1 kg/ha in the middle and 51.5 kg/ha at the upper station. This represents virtually no change from the 1987 results at the lower and upper station, but a 21 kg/ha increase in the middle station.

The upper station decreased from 84 kg/ha in 1986 to the 51.5 kg/ha and may be a direct result of habitat degradation caused by grazing. Cattle grazing in the open meadow has decreased bank stability and increased siltation of the stream bed to the detriment of cutthroats in that region. Biologists with the Arapahoe-Roosevelt Forest are currently assessing the extent of grazing caused habitat damage in the drainage and plan to selectively fence areas to remedy this situation in the next two years.

Length frequency analysis (Table 2) in 1988 indicates recruitment of the 1987 year class to age 1+ (50-70mm) at all three stations. Overall stability of Williams Gulch appears to be nearly achieved if the grazing and land use practices at the upper station can be corrected.

May Creek

May Creek, a tributary of the Big South of the Poudre, was barren when stocked in 1980 with 54 adult greenbacks from Como Creek. Subsequent stockings included, 2000 fry in 1982, 700 fry in 1983, 1400 fry and 90 fingerlings in 1984 and 2000 fry in 1987.

Population estimates (Table 1) (17 fish) and biomass (34.2 kg/ha) for the lower station remained consistent with the 1987 results. The upper station sampled for the first time in 1987 showed a decrease in numbers (12) and biomass to 23.2 kg/ha. Without additional years to compare with, no conclusion for this station can be drawn except that the upper station appears to show few differences from the lower station.

Reproduction in May Creek appears to be limited at best. No young of the year have ever been sighted. This is further substantiated by the absence of 0+ and 1+ fish in the 1988 sampling (Table 2). Spawning habitat is noticeably lacking in the two stations as well as in a 2.5 km stretch downstream of the sites (Chart et. al 1987). This is due to high gradient and a predominance of boulder and cobble. Habitat improvement has been recommended to the USFS to promote spawning and juvenile habitat. Until this can be documented intermittent stocking of greenback cutthroat fry to maintain recruitment will be utilized. A thermograph will be put into May Creek to gain information on temperature regimes which will allow successful reproduction.

Little South Fork of the Poudre

The Little South Fork of the Poudre is an historical population of greenback cutthroat trout which has received no stocking. The section sampled is located approximately 2.5 km southwest of the Pingree Park campus (above private land). The lower terminus was 50m downstream of a tributary entering from the west. The gradient was low to moderate throughout and the substrate was cobble/gravel. Three log jams provided the majority of cover found in this section.

Although the biomass estimate has remained constant from 1986 to 1988 (Table 1) it appears this population is comprised of older fish that have not successfully reproduced in several years. No YOY were observed again this year, despite efforts to locate them in August and September. The number and biomass estimates (9 fish and 25.8 kg/ha) were identical to the numbers collected in 1987. Culver and Bestgen (1985) designated this population unstable because age classed 0+ to 3+ were often missing from survey data.

Ongoing efforts have tried to establish a hatchery stock of Little So. Fk Poudre fish, however it has been difficult to collect sufficient numbers of fish at the proper time of year. Supplemental stocking of offspring from indigenous parental stock would certainly help this population. In spite of the fact that this population has sustained itself through time, results of surveys indicate that the slightest illegal exploitation or even significant natural disturbance (flooding heavy enough to dislodge the log jam) could cause this population to crash.

A thermograph will be placed in the stream and extra electrofishing will be conducted in 1989. This will help determine if limited reproduction is maintaining this population or if any type of habitat improvement would benefit this population.

Pennock Creek

Pennock Creek was chosen for reintroduction of greenback cutthroats in 1984 and non-natives were removed in 1985. Once it was determined that the creek was barren, the three year restocking program was started. Pennock Creek received its first stocking in 1986 and received approximately 6000-7000 fry in 1987. As earlier stated, disease problems curtailed the 1988 stocking and no stocking will take place unless deemed necessary during 1989.

Pennock Creek was sampled in 1988 to determine the condition of the greenbacks population. Approximately 2.5 km was electroshocked beginning immediately above the gabion fish barrier. This sampling revealed good numbers of 60 mm fish from the 1987 stocking. Fish larger than 75 mm and up to 120 mm were well represented and were in good to excellent condition. The greenbacks overwintered well and showed excellent growth from the 1986 stocking. Sampling in 1987 showed that the small fish remained in the area where they were stocked. Because of this the fry were stocked over a large area in 1987 which helped spread the fish throughout the drainage. This tactic worked well as fish were not concentrated in certain areas in 1988 as they were in 1987, prior to stocking.

Habitat Quality Index (HQI) - Prediction of Standing Crop

The HQI is a model developed on Wyoming streams which involves rating physical and biotic components of a stream and its drainage (Binns 1982). These ratings are then entered into a logarithmic function which yields an estimate of standing crop (lb/ac) in the absence of fishing pressure or other factors that might decrease biomass. The Binns HQI was calculated for all greenback sampling sites from the same sites utilized in 1987.

Despite efforts to more accurately assess certain attributes, such as cover, water velocity and maximum summer temperature most ratings did not deviate from the 1987 ratings (Table 3). However, a change in the water velocity rating from a 1 (1987) to a 0 (1988) led to a decrease in the predicted standing crop estimate from 25 kg/ha to 6 kg/ha for Cornelius Creek and from 62 kg/ha to 9 kg/ha for George Creek. Although a more liberal assessment in what was considered cover was practiced this year, percent cover ratings for most streams remained the same as last years's. Consequently, predicted standing crop estimates were not affected by these more liberal practices as was expected.

The HQI was redone to determine if it would more accurately predict the stream potential production, utilizing the more lenient cover classification. If accuracy is increased, predicted biomass should be higher than or equal to observed biomass based on if the stream is at carrying capacity. Except for Black Hollow and the East Fork of Sheep Creek this was not the case (Table 3). The HQI model underestimated the potential biomass of these streams and is not considered a suitable model for headwater streams in Colorado.

CREEL CENSUS RESULTS ON FOUR GREENBACK STREAMS

On January 1, 1988 Black Hollow Creek, East and West Forks of Sheep Creek, George and Cornelius Creeks were opened to catch and release fishing with flies and lures only. On all of these streams two signs were installed at all major access points. One sign described the greenback recovery effort and listed the regulations. The other sign asked fishermen to participate in a voluntary creel census program. This sign has a box which contains stamped pre-addressed creel cards asking the essential creel questions (Figure 5). In addition small signs reminding anglers of the special regulations were put up and all "CLOSED TO FISHING" signs were removed.

Throughout the summer whenever we were in the area of these streams we made concerted efforts to contact fishermen in the field. Unfortunately, we never saw an angler on any of the stream visits. Return on the cards was also light showing either light fishing pressure or refusal of the angler to fill out and return the creel card. We feel that fishing pressure on all of the se streams was light and anglers will fill out the cards. This type of census is used successfully throughout Colorado on streams with limited access, for example the Gunnison River Gorge.

Although the Black Hollow population is located near a major highway (Colorado HWY 14), the dense woody riparian growth should preclude heavy angler use. Also the land surrounding the confluence of Black Hollow Creek and the Poudre River is privately owned. Access to the stream will be restricted to the upper drainage, via Crown Point Road, unless arrangements can be made with the current landowners. Because of the access and riparian area we do not feel angler-induced mortality will have or has had any significant affect on Black Hollow Creek.

The two forks of Sheep Creek are the most fishable of the streams opened in 1988. Accessibility (3.2 km hike) should limit the amount of angler use. Card returns (3) showed catch rate to approach 10 fish per hour and that anglers were catching and releasing up to 75 fish per day of angling. If any significant mortality is caused by this angling it should become evident in the 1989 sampling, not only with a drop in biomass but a shift in length frequency to a smaller size.

Regulations on George and Cornelius Creeks serve a dual purpose in these fisheries. First, catch and release fishing will act to preserve the greenback population. Second, catch and creel (8 brook or brown trout bag limit/day) will hopefully help control the non-native salmonids through selective harvest. This management practice has been in use in Rocky Mountain National Park on Hidden Valley Creek for several years. The distinctive characteristics of these species lend themselves to easy recognition, which would reduce confusion on the part of most anglers.

Both George and Cornelius Creeks offer areas of good fishability, especially in the beaver ponds. In 1987 members of the inventory crew fished for brook trout in these ponds. Catchrate on the greenback cutthroat was nearly equal to that seen with card returns from Sheep Creek in 1988.

The ultimate ability of the Division of Wildlife to open more streams to catch and release fishing for greenback cutthroat trout depends on the findings in next two years on these four streams. If angler induced mortality appears to influence the stability of the population to exist then opening more small streams to fishing is unlikely. However, if we find that these populations can withstand the pressure of catch and release angling then more greenback cutthroat streams could be opened to catch and release fishing.

CANIDATE STREAM EVALUATIONS

Five prospective streams were investigated and evaluated for their potential to support viable greenback cutthroat trout populations. Three streams will not be considered further as possible reintroduction sites (Beaver Creek in the N. Fk. of she Poudre River drainage and Elk and Headwater Creeks in the Buckhorn Creek drainage).

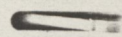
All three streams were found to have insufficient flows and or numerous beaver dams which are not conducive to reclamation efforts.

Killpecker Creek, a tributary to the North Fork of the Poudre River, appeared to have suitable habitat and flows in late fall to support greenback cutthroat. It had numerous plunge pools, adequate spawning habitat and rearing area. It currently contains a healthy brook trout population with fish up to 200 mm with multiple age classes represented.

Cascade Creek, a tributary to Buckhorn Creek, also showed promise as a possible reintroduction site. Cascade Creek currently supports healthy brook and brown trout populations with adequate flows and sufficient habitat to support native trout.

MANAGEMENT RECOMMENDATIONS AND SUGGESTIONS

1. Repeat population estimates on all streams and develop permanent sampling stations on Pennock Creek.
2. Evaluate habitat and temperature regimes on streams that do not show reproduction and recruitment.
3. Install signs on secondary access point to all streams open to catch and release fishing.
4. Evaluate various larger stream systems for possible greenback recovery efforts such as the North Fork of the St Vrain Creek, The Big South mainstem of the Poudre River and the Little South Fork of the Poudre River.
5. Discontinue HQI sampling as a technique to evaluate the potential of headwater trout streams.
6. Further evaluate impacts of catch and release fishing on greenback cutthroat streams.



LITERATURE CITED

- Binns, N.A. 1982. Habitat Quality Index procedures manual. Wyoming Game and Fish Dept. 202pp.
- Chart T. R. Haneke and K. Kehmeier 1987. Greenback cutthroat trout recovery program. 1987 Progress report. Colorado Division of Wildlife
- Culver, S.R. and K.R. Bestgen. 1985. Greenback Cutthroat trout recovery project, 1985 progress report. Colorado Division of Wildlife, Fort Collins. 37pp.
- GreenBack Cutthroat Trout Recovery Team 1983. Greenback Cutthroat recovery plan revision. USFWS 45p.

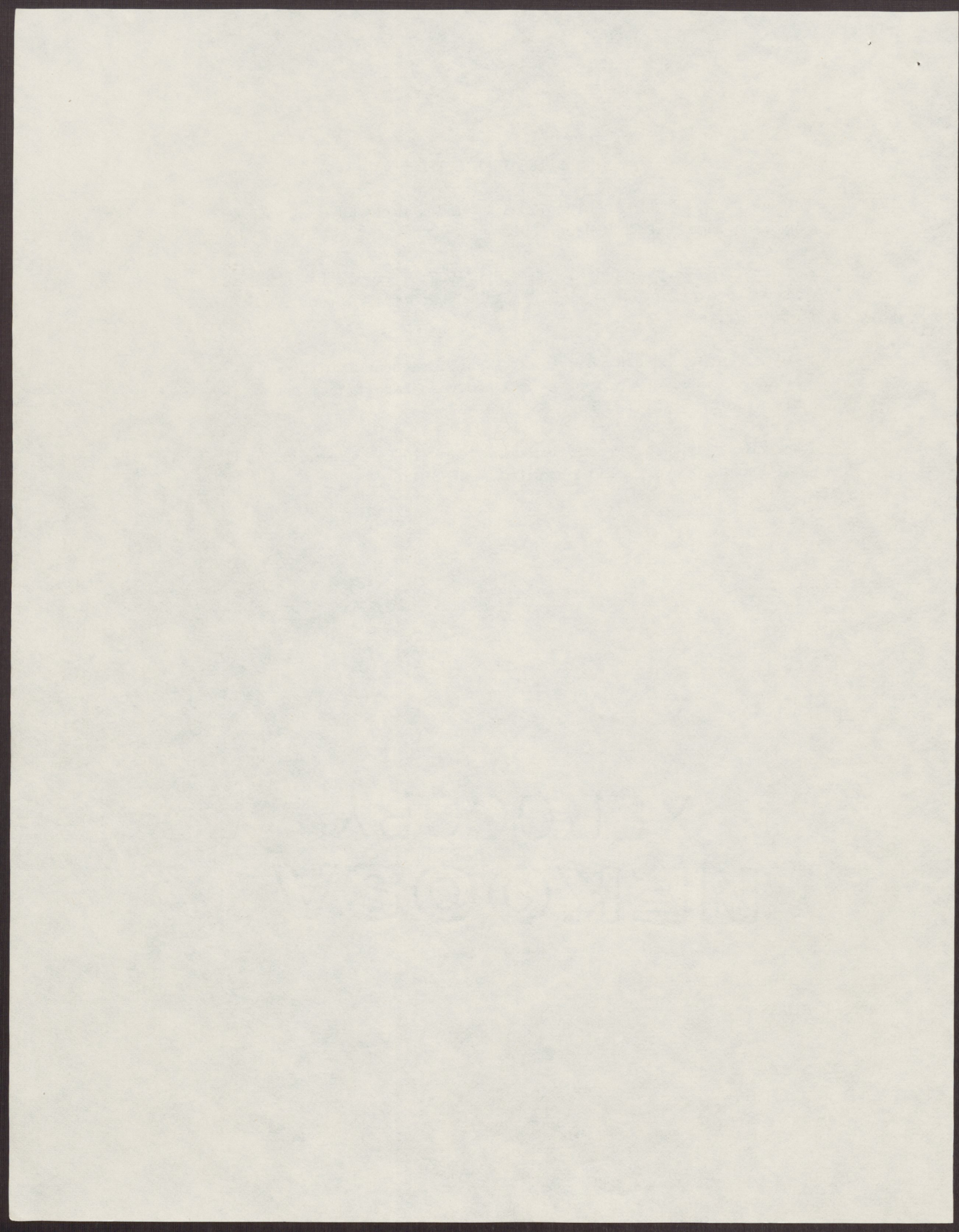


TABLE 2. Length frequencies of Greenback Cutthroat Trout collected in 1988

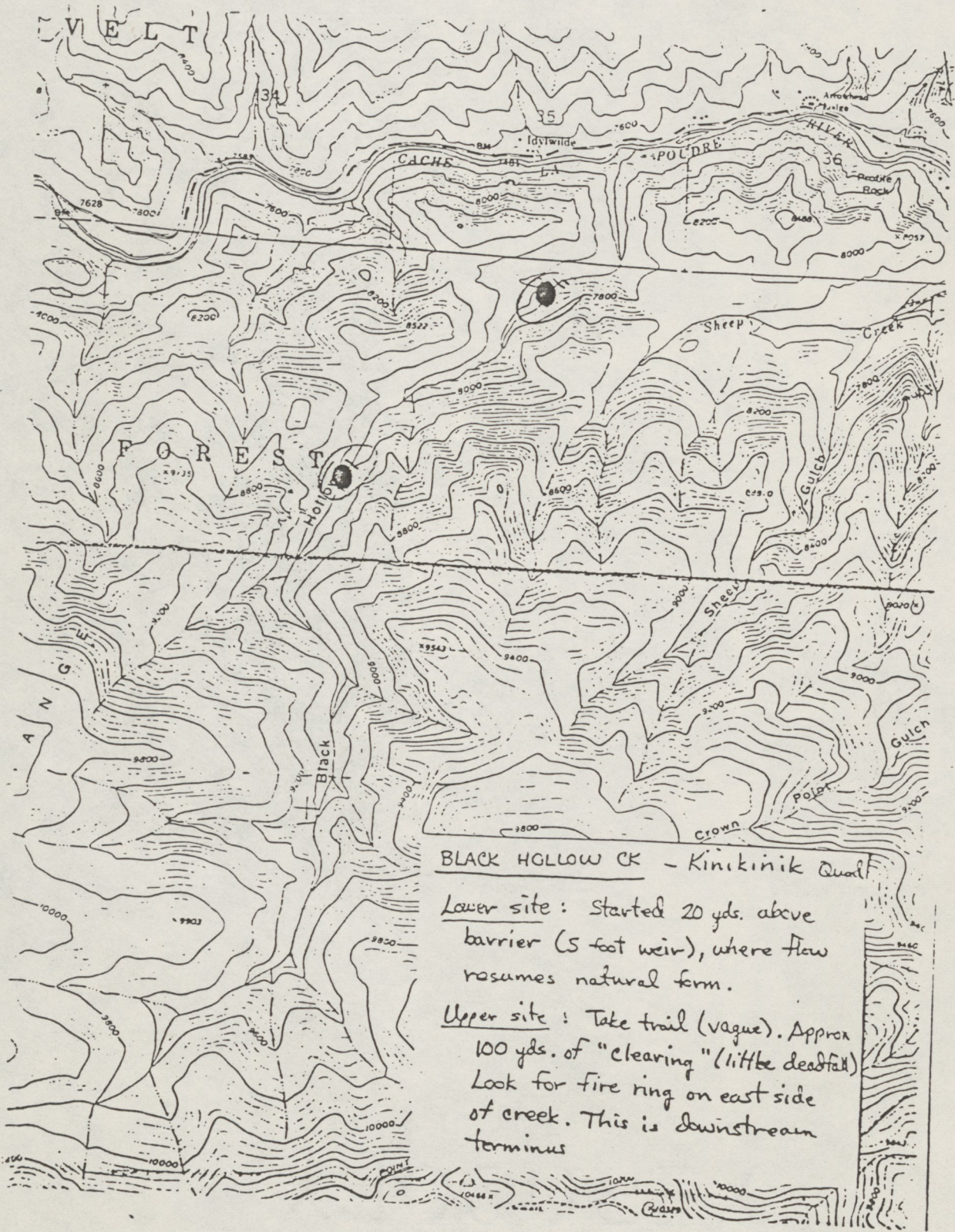
Length (mm)	Black	Black	Cornelius	George	Little			Sheep E. Fk.	Sheep W. Fk.	Williams	Williams	Williams
	Hollow Lower	Hollow Upper			So. Fk. Poudre	May Lower	May Upper			Gulch Lower	Gulch Middle	Gulch Upper
40												
50		3	2					2		2		4
60	3	2		8						4	2	6
70	5		4	19						3		
80		1	8	8						2		
90		1	4	8			2			1	2	2
100						1				2	2	3
110			1	6			1	2		5	4	4
120	1			4				2	1	2		1
130				1						1	1	1
140		1	1	4		1		5		2	1	6
150		3	2			3		1	2		4	2
160	1	1				3	3	1	6	1	8	4
170		1				5	3	7	7		1	1
180		2	1	5	1	2		4	9	1	1	3
190			1	2		1	1		5		3	1
200		1	2	3		1	1	1	1			1
210		1	2	2	1				5	1		
220	1	1	1	2	3				1			
230					1							
240												
250					1							
260												
270												
280					1							
290												
300					1							

TABLE 3. Habitat Quality Index (HQI) predictions of standing crop (kg/ha)
 HQI attributes for 1988 Greenback Cutthroat populations.

STREAM	PERIOD FLOW (CPF)	ANNUAL FLOW VARI. (ASFV)	MAX SUMMER TEMP.	NITRATE NITROGEN	COVER	BROODING BANK	STREAM WIDTH	WATER VELOCITY	SUBSTRATE	PREDICTED STANDING CROP (KG/HA)
Black Hollow Upper	3	2	3	2	0	4	2	2	1	30.2
Black Hollow Lower	3	3	3	2	0	4	2	2	2	59.0
Cornelius Creek	2	2	4	2	0	2	1	0	1	6.0
George Creek	3	3	4	2	0	1	2	0	2	9.4
Little So. Fork Poudre	4	3	2	3	0	4	3	3	0	5.6
May Creek Lower	3	3	1	2	1	4	2	2	2	19.0
May Creek Upper	3	3	1	2	1	4	2	2	2	19.0
Pennock Creek	4	3	2	2	0	4	3	0	1	26.0
Sheep Creek, E. Fork	2	2	4	2	0	3	2	1	1	30.0
Sheep Creek, W. Fork	2	2	4	2	0	2	3	2	1	42.6
William Gulch, Lower	3	3	3	2	1	3	2	0	1	10.0
William Gulch, Middle	3	3	3	2	1	2	1	0	0	8.6
William Gulch, Upper	4	3	3	2	1	1	1	0	0	9.7

APPENDIX I

Sampling sites on greenback cutthroat trout streams.



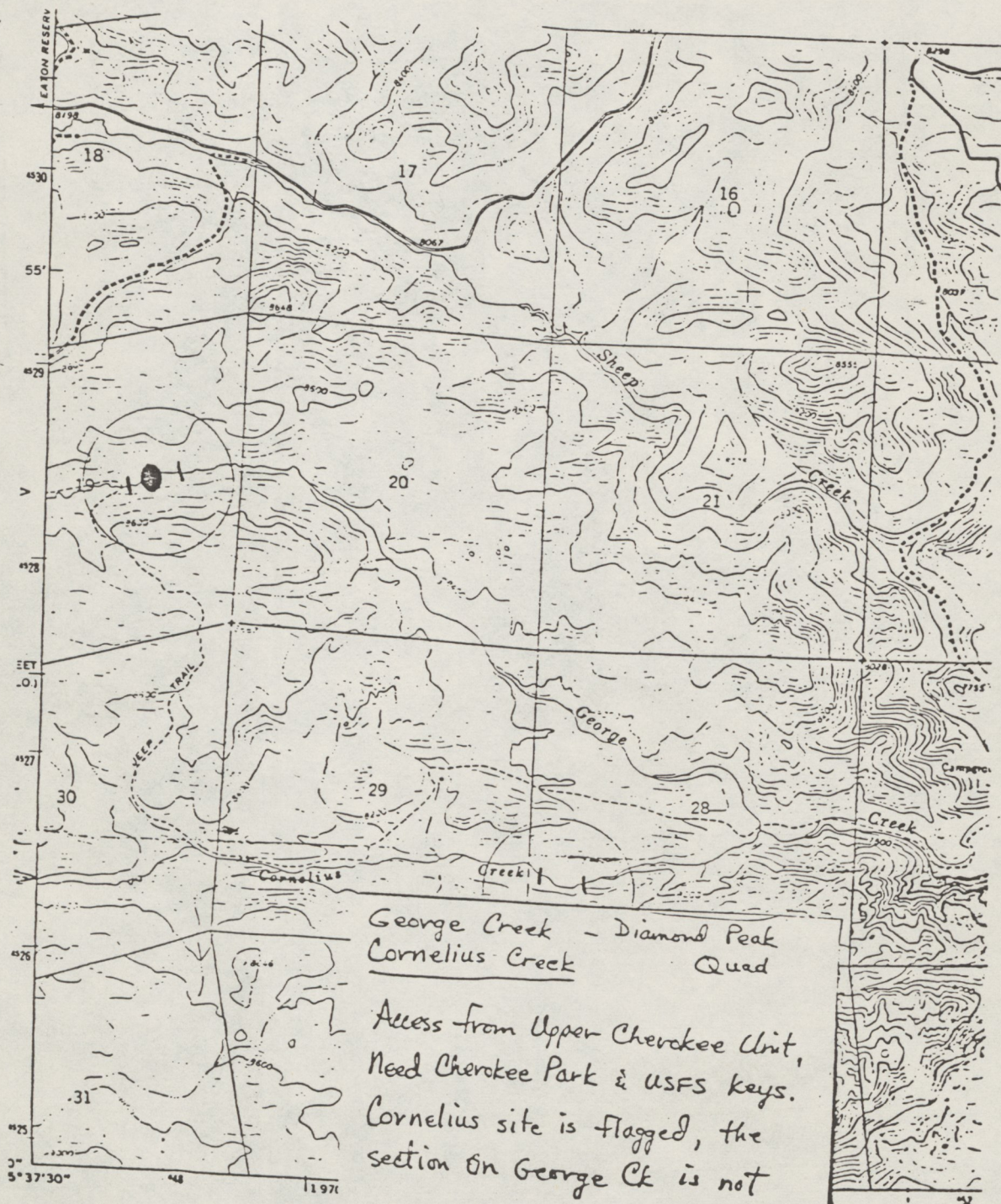
BLACK HOLLOW CK - Kinikinik Quail

Lower site: Started 20 yds. above barrier (5 foot weir), where flow resumes natural form.

Upper site: Take trail (vague). Approx 100 yds. of "clearing" (little deadfall) Look for fire ring on east side of creek. This is downstream terminus

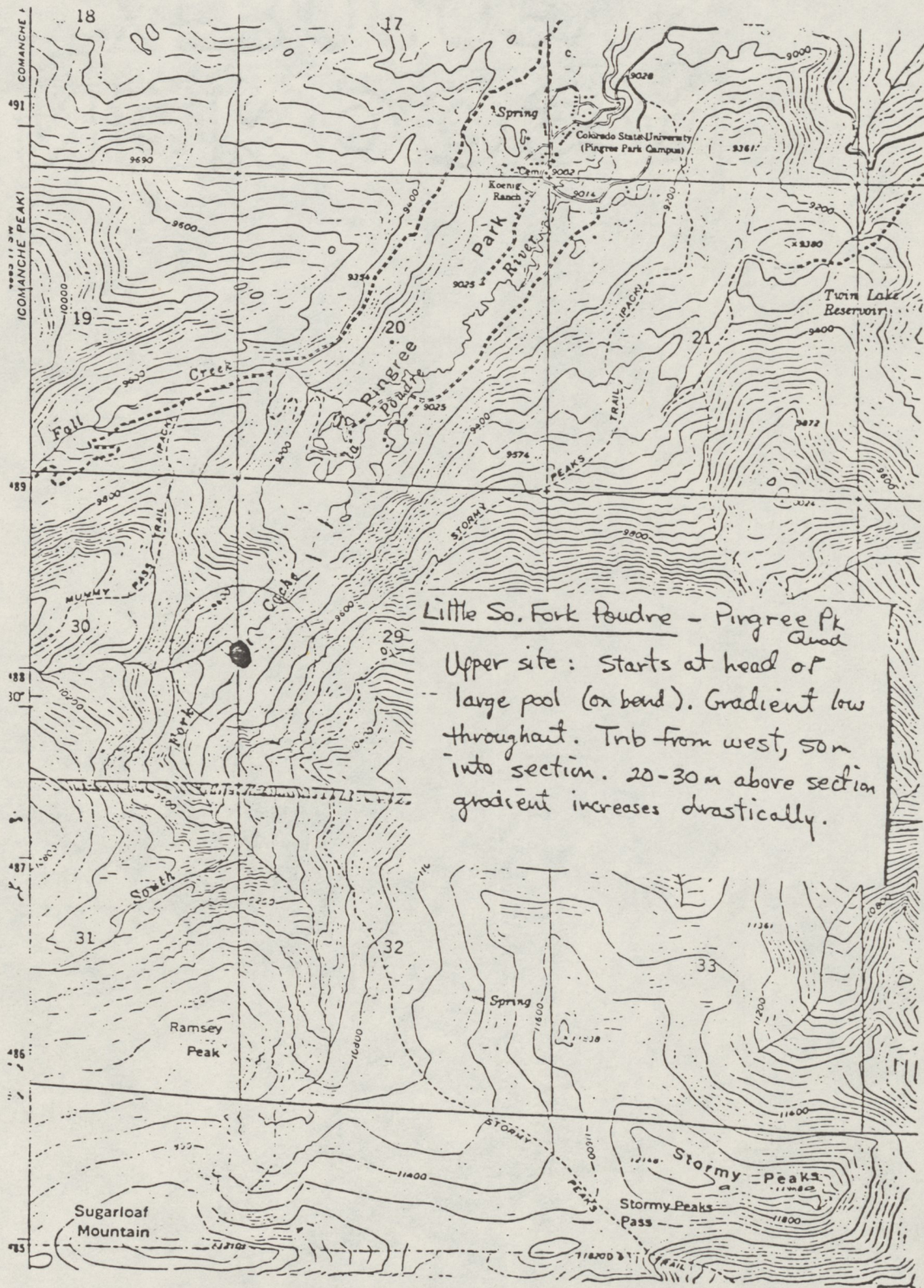
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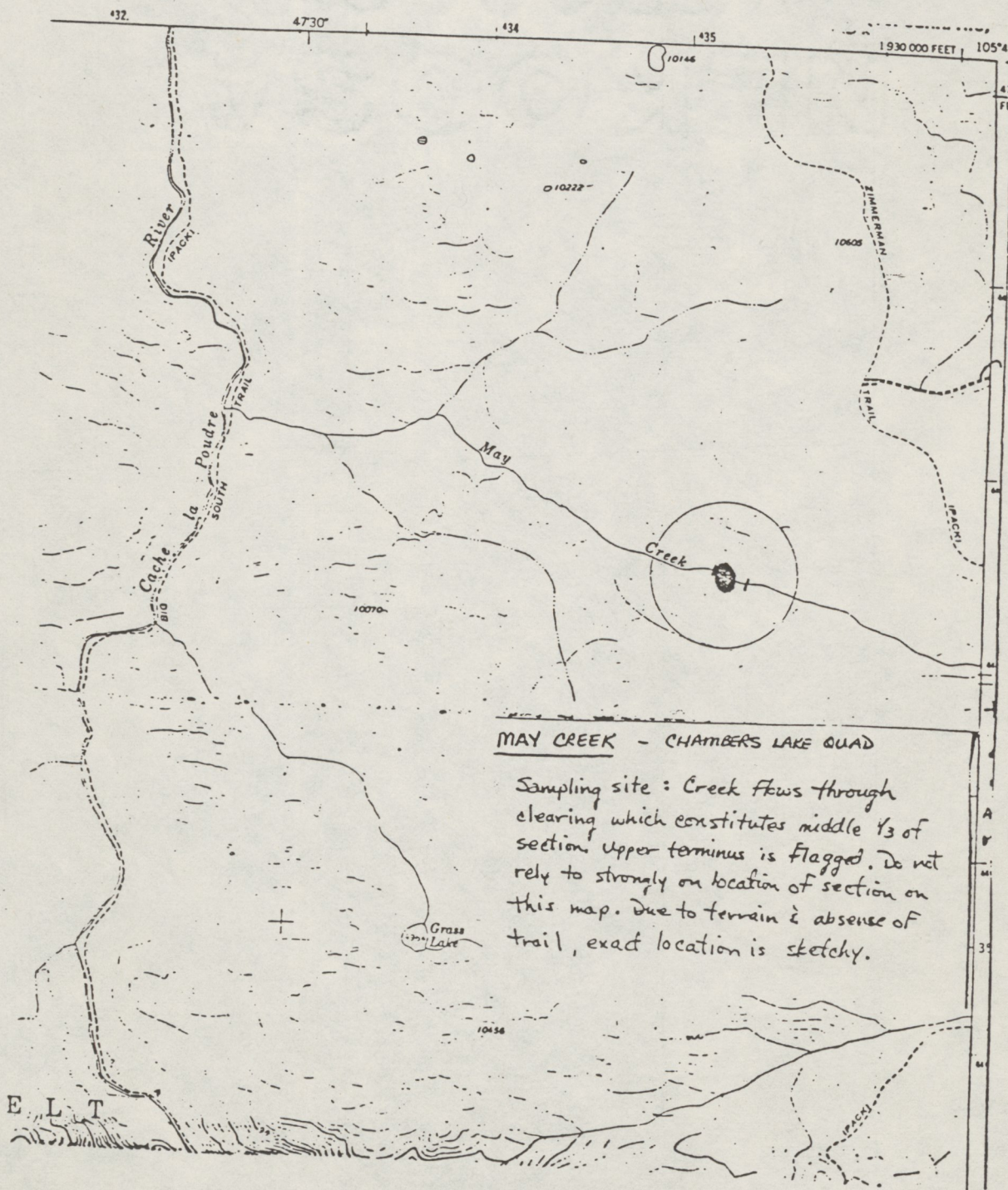
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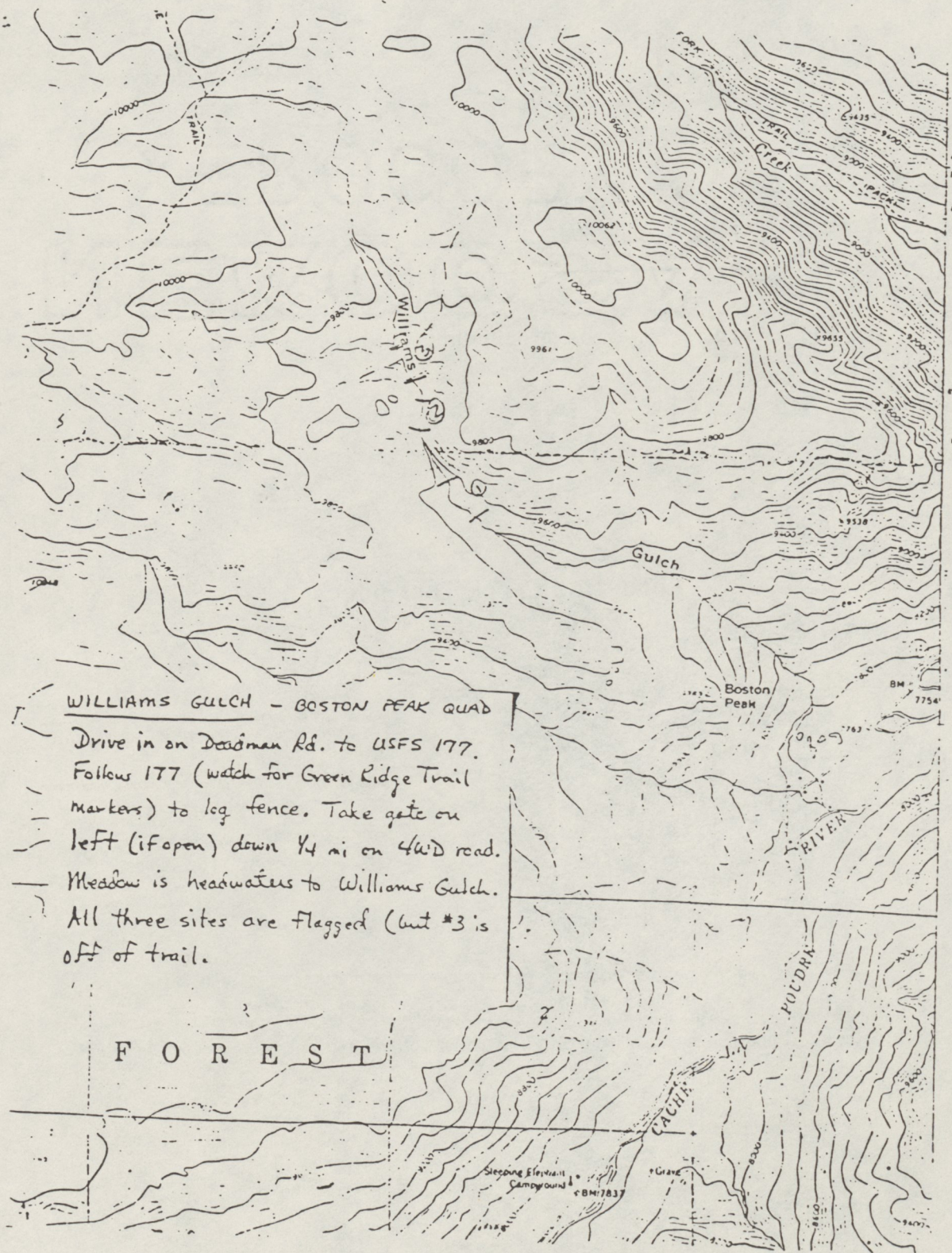
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Sampling sites on greenback cutthroat trout streams.



WILLIAMS GULCH - BOSTON PEAK QUAD

Drive in on Deadman Rd. to USFS 177.
 Follows 177 (watch for Green Ridge Trail
 markers) to log fence. Take gate on
 left (if open) down 1/4 mi on 4WD road.
 Meadow is headwaters to Williams Gulch.
 All three sites are flagged (cut #3 is
 off of trail).

FOREST

George Creek Thermograph

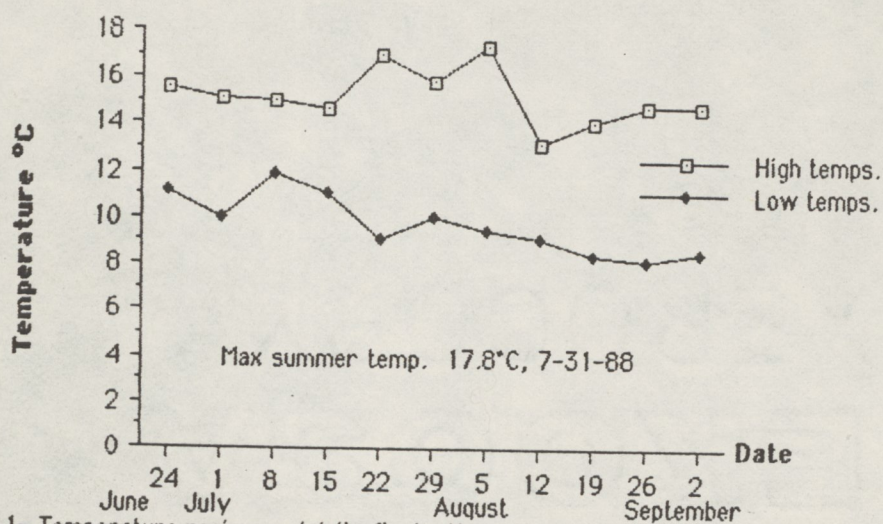


Figure 1- Temperature regime and daily fluctuations of water temperature in George Creek, 1988.

Cornelius Creek Thermograph

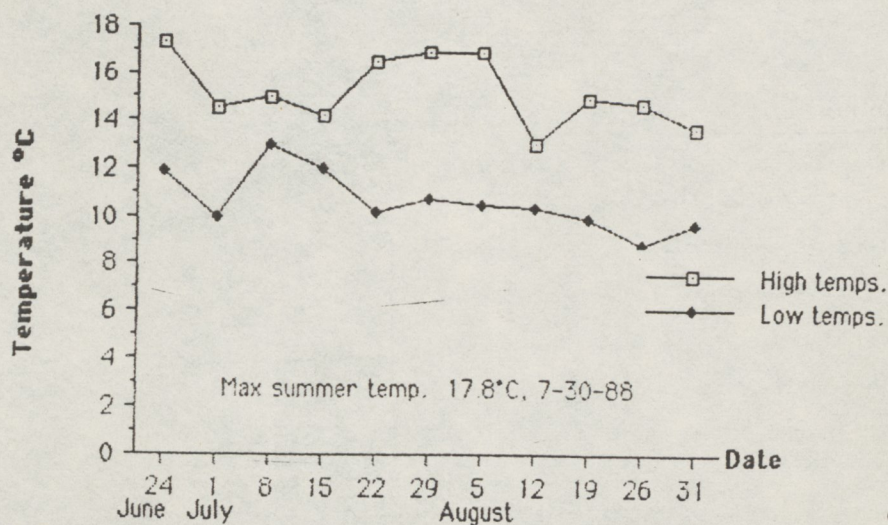


Figure 2- Temperature regime and daily fluctuations of water temperature in Cornelius Creek, 1988.

Sheep Creek Thermograph

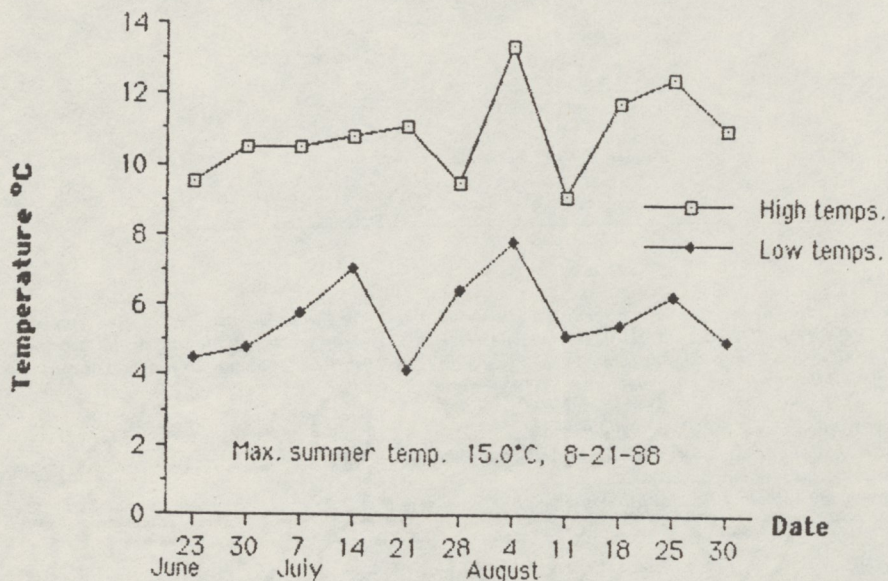


Figure 3-Temperature regime and daily fluctuations of water temperature in Sheep Creek, 1988.

Black Hollow Thermograph

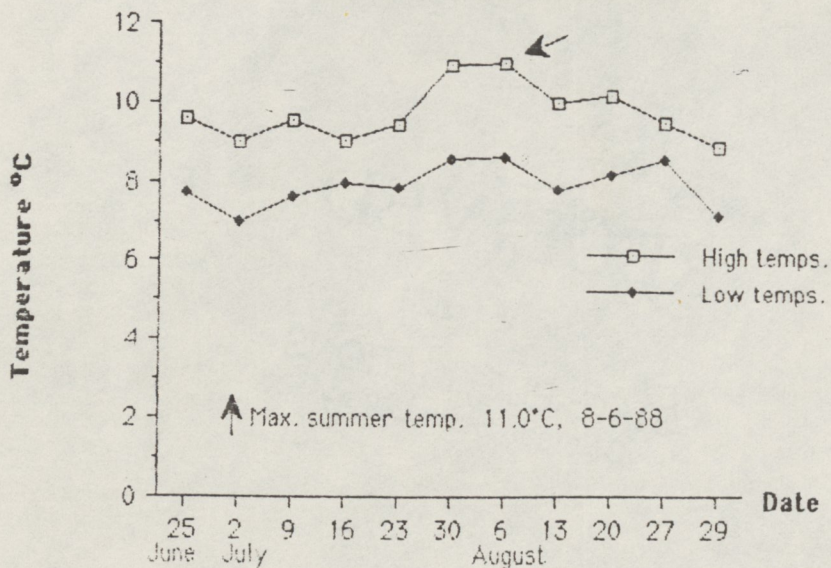


Figure 4-Temperature regime and daily fluctuations of water temperature in Black Hollow Crk, 1988.

Figure 5. Voluntary creel census card used on greenback cutthroat streams open to catch and release fishing

Stream: _____ Date: _____

The Colorado Division of Wildlife is conducting a survey to determine fisherman use in this area. Report information **ONLY FOR THE AREA YOU JUST FINISHED FISHING**. Please take a few minutes to fill out the questionnaire and return it as soon as possible, **EVEN** if you didn't catch fish. Your cooperation will help us return the greenback cutthroat trout to its native range. **THANK YOU.**

1. How many people in your vehicle actually fished? _____
2. What is the **TOTAL** number of hours spent fishing by all members of your party **COMBINED** on this date? _____
3. Are you a Colorado resident? _____
4. Totally, how many and what sizes of fish were caught and released?

	0-6"	6-8"	8-10"	10-12"	12-14"	14"+
GREENBACK CUTTHROAT	_____	_____	_____	_____	_____	_____
OTHER _____ Name	_____	_____	_____	_____	_____	_____

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