United States Department of the Interior

FISH AND WILDLIFE SERVICE
COLORADO FIELD OFFICE
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GOLDEN, COLORADO 80401

IN REPLY REFER TO:

10 November 1992

To: Greenback Team Members and Consultants

From: Bruce D. Rosenlund
Colorado Fish and Wildlife Assistance

Subject: Greenback Recovery Plan

Enclosed is the 10 November 1992 draft version of the Greenback Cutthroat Trout Recovery Plan. Many thanks to all of you who provided information and comments on the 21 September 1992 draft.

Of 19 draft Plans provided for review on 21 September 1992, comments were received from eight persons through 2 November. Very few changes were requested by Team members, CDOW Regional Fisheries Managers and Rocky Mountain National Park, with all changes requested from these parties incorporated into the 10 November version of the Plan. Substantial comments were received from the USFWS Regional Office for Endangered Species, with many of these comments incorporated into the 10 November 1992 version of the Plan. However, since a large number of the Endangered Species comments relate to style and format, we are requesting that the Endangered Species Office reformat the Plan to meet current recovery plan guidelines, since the ES Office has the best working knowledge of current recovery plan styles and formats.

The narrative art work is completed, with the final art work for the cover to be completed by 30 November.

Since there has been so few requests for change received from Team Members and consultants, the next Recovery Team Meeting should will be coordinated following the changes made by the ES Office.

Thank you for your time and input into the Greenback Cutthroat Trout Recovery Plan.

CC: CSU, Dr. Behnke ✓
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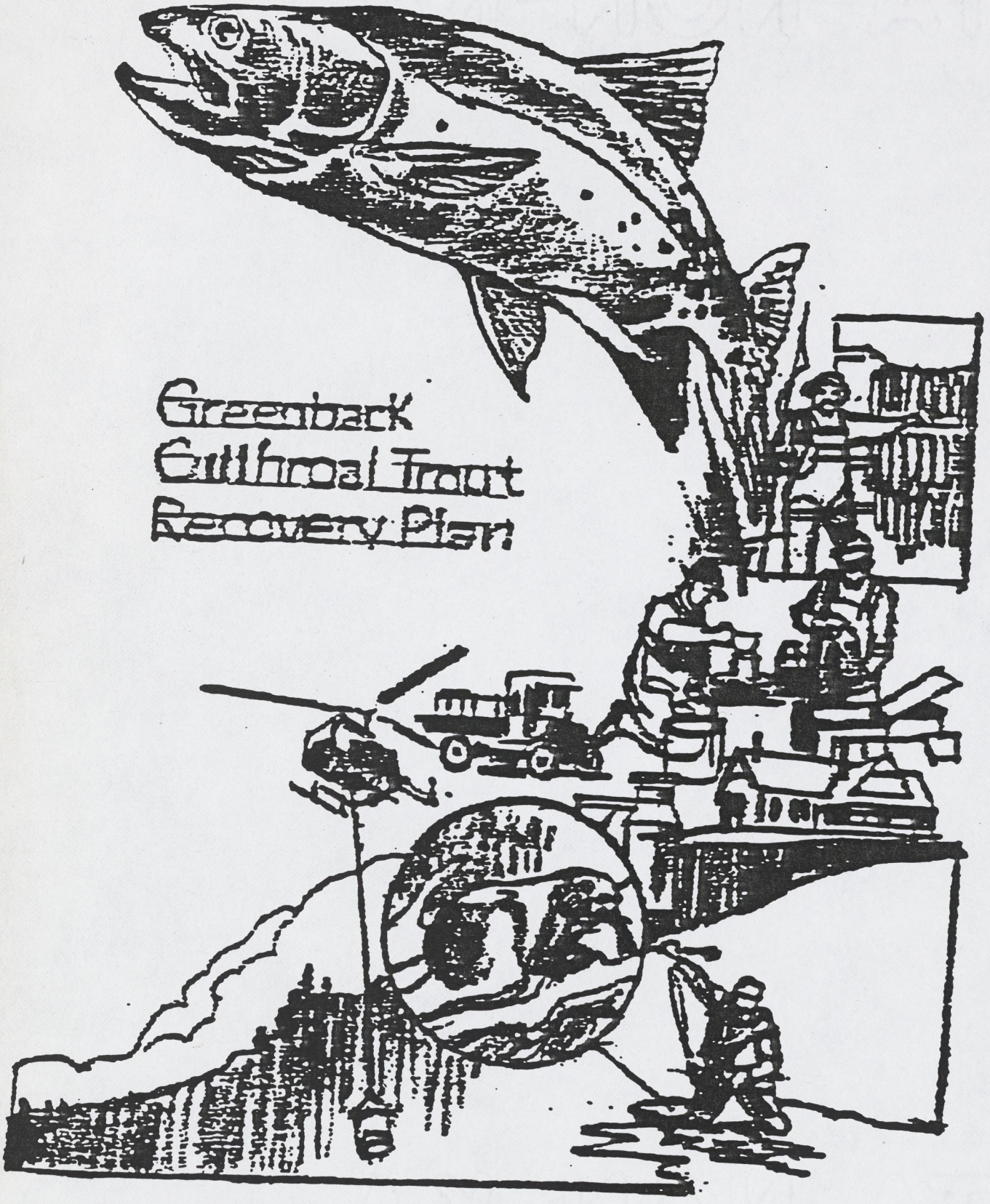
BLM, Mitchell
FS, Sloan
NPS, Devine
CDOW, Puttman, Ft. Collins
CDOW, Krieger, Colorado Springs
CDOW, Goebel, Denver
CDOW, Harris, Ft. Collins
CDOW, Kochman
FS, Winters, Pueblo
FS, Gerhart, Ft. Collins
CTU, Gomolchak
FWE, Harris
FWE, Carlson
FWE, Worthing, Endangered Species, RO
FFA, ARD
FFA, Bozeman FCDC
FFA, Saratoga NFH

D R A F T



DRAFT

GREENBACK CUTTHROAT TROUT RECOVERY PLAN
1992

Prepared by:
Greenback Cutthroat Trout Recovery Team

for

Region 6
U.S. Fish and Wildlife Service
Denver, Colorado

10 November 1992

DISCLAIMER

Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect the species. Plans are prepared by the U.S. Fish and Wildlife Service, sometimes with the assistance of recovery teams, contractors, State agencies, and others. Objectives only will be attained and funds expended contingent upon appropriations, priorities, and other budgetary constraints. Recovery plans do not necessarily represent the views, official positions, or approvals of any individuals or agencies, other than the U.S. Fish and Wildlife Service, involved in the plan formulation. They represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director, or Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature citations should read as follows:

U.S. Fish and Wildlife Service. 1992. Greenback cutthroat trout recovery plan. U.S. Fish and Wildlife Service, Denver, Colorado. pp.

Additional copies may be purchased from:

Fish and Wildlife Reference Service
5430 Grosvenor Lane, Suite 110
Bethesda, Maryland 20814
(301) 491-6403 or 1-800-582-3421

The fee for the plan varies with the number of pages of the plan.

Artist Credit: Bill Border, Nederland, Colorado.

Acknowledgments

This revision of the 30 September 1983 plan was made possible through $5,000 in funding provided by USFWS Region 6 Endangered Species to the USFWS Colorado Fish and Wildlife Assistance Office, and agency funding of Team members and staff of the Bureau of Land Management, Colorado Division of Wildlife, Forest Service and National Park Service.

We gratefully acknowledge the dedication of Dr. Robert Behnke for years of service to the greenback program, and Colorado Trout Unlimited for their interest and funding of greenback restoration projects. Also, the Bozeman Fish Cultural Development Center and Saratoga National Fish Hatchery for their work in developing the captive rearing techniques for South Platte and Arkansas River drainage greenbacks, and to Mr. McAlpine and the U.S. Army, Ft. Carson, for providing habitat for the early Arkansas River broodstock program.

The Team is also grateful to its former members and consultants who aided in the preparation of previous versions of this plan:

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Current Team Members

David R. Stevens	1973-1992	National Park Service
Bruce D. Rosenlund	1977-1992	U.S. Fish and Wildlife Service
Brenda Mitchell	1981-1992	Bureau of Land Management
Gordon Sloan	1989-1992	U.S. Forest Service
Tom Nesler	1992-1992	Colorado Division of Wildlife

EXECUTIVE SUMMARY

Current Species Status: The greenback cutthroat trout (Oncorhynchus clarki stomias) is the only trout species endemic to both the headwaters of the South Platte and Arkansas River drainages. Although once abundant, their numbers declined in the late 1800's due to over-harvest and the introduction of exotic trout species. The greenback was extirpated from most of its native range by the early 1900's, and Greene (1937) considered the subspecies extinct. In 1973, two small populations were confirmed that represented approximately 2,000 greenbacks in 6.4 km of stream, and indicated that remnants of the subspecies still existed. The subspecies was listed as "endangered" in 1973, and downlisted to "threatened" in 1978 to facilitate recovery efforts. As a result of recovery efforts, captive broodstocks were established, non-native fish were removed from suitable habitat, greenbacks were reintroduced, stable populations were developed and catch-and-release fisheries were initiated.

Through 1991, greenbacks are present in 52 sites that total 100 hectares (247 acres) and 144 kilometers (89 miles) of stream habitat. Twenty nine sites are open to catch-and-release fishing and 19 populations are considered to be stable. Seventeen stable populations are located in the South Platte drainage, and two stable populations are located within the Arkansas drainage.

Habitat Requirements and Limiting Factors: Cold water fisheries habitat, with adequate trout spawning substrates and temperatures. Limiting factors include other spring spawning trout species that hybridize with greenbacks, and fall spawning species that compete with greenbacks for food and space.

Recovery Objective: Delisting by the year 2000.

Recovery Criteria: The goal of the Plan is the preservation of historic populations through maintaining at least 20 stable greenback populations that occupy at least 50 hectares (123 acres) of lakes and ponds and 50 kilometers (31 miles) of stream. At least five of the stable populations should occur in the Arkansas drainage.

Actions Needed for Delisting:

1. Establish a total of five stable Arkansas River populations.
2. Establish a wild Arkansas River broodstock population.
3. Establish captive broodstocks within Colorado.
4. Conduct experimental stocking and angling programs.
5. Conduct greenback information and education programs.
6. Expand efforts to obtain non-agency funding of projects.
7. Prepare a long-term management plan.

Date of Recovery: Delisting could be possible by 2000.

This Recovery Plan for the greenback cutthroat trout (greenback) was developed by the Greenback Cutthroat Trout Recovery Team, an interagency group of scientists operating under the sponsorship of the U.S. Fish and Wildlife Service. The goal of this Plan is to restore the greenback cutthroat trout to non-threatened status within its native range.

The original Greenback Recovery Plan was written in 1978, revised in 1983 and is superseded by this Plan. This latest edition contains updated information and recovery objectives completed by researchers since 1973.

The Plan is organized into five sections:

1. Introduction - Historic distribution, type specimens, taxonomy, reasons for decline and recovery history from 1959 through 1992.

2. Recovery - Recovery objectives, and tasks considered vital to the successful recovery of the greenback.

3. Life History and Management Practices - Habitat requirements, reproduction, food and feeding, size and growth, disease and parasites, sensitivity to pH and heavy metals, fish culture, stocking, angling studies.

4. Implementation Schedule - An itinerary of scheduled recovery tasks assigning lease-agency responsibility and estimated costs.

5. Figures and Tables - Figures, Tables.

We sincerely hope that this document will be used by agencies involved with greenback cutthroat trout management to coordinate their efforts to most effectively work toward our common goal.

Revisions of this Plan will occur as often as is feasible and appropriate.

TABLE OF CONTENTS

Part I

INTRODUCTION

The greenback cutthroat trout, (Oncorhynchus clarki stomias, formally Salmo clarki stomias), is one of the most colorful subspecies of cutthroats (Figure 1), and in 1973, was one of the rarest. At the time of the enactment of the Endangered Species Act in 1973, only two small historic populations of greenback cutthroat trout were known to exist - Como Creek and South Fork, Cache La Poudre River - that conformed to the meristics of the type specimens. These two small headwater streams of the South Platte River drainage collectively represented 4.6 kilometers of stream habitat and supported less than 2,000 greenbacks.

Contrary to the common name of the fish, the back of the greenback is not especially green in color. However, in older age classes (4+), mature males display crimson red colors along the ventral region during the spring spawning season, especially in lake environments.

Historic Distribution

The greenback is native to the headwaters of the South Platte and Arkansas river drainages within Colorado and a small segment of the South Platte drainage within Wyoming. The greenback and the Rio Grande cutthroat trout (Oncorhynchus clarki virginalis), represent the easternmost limits of native trout distribution in the western United States, Behnke, 1984.

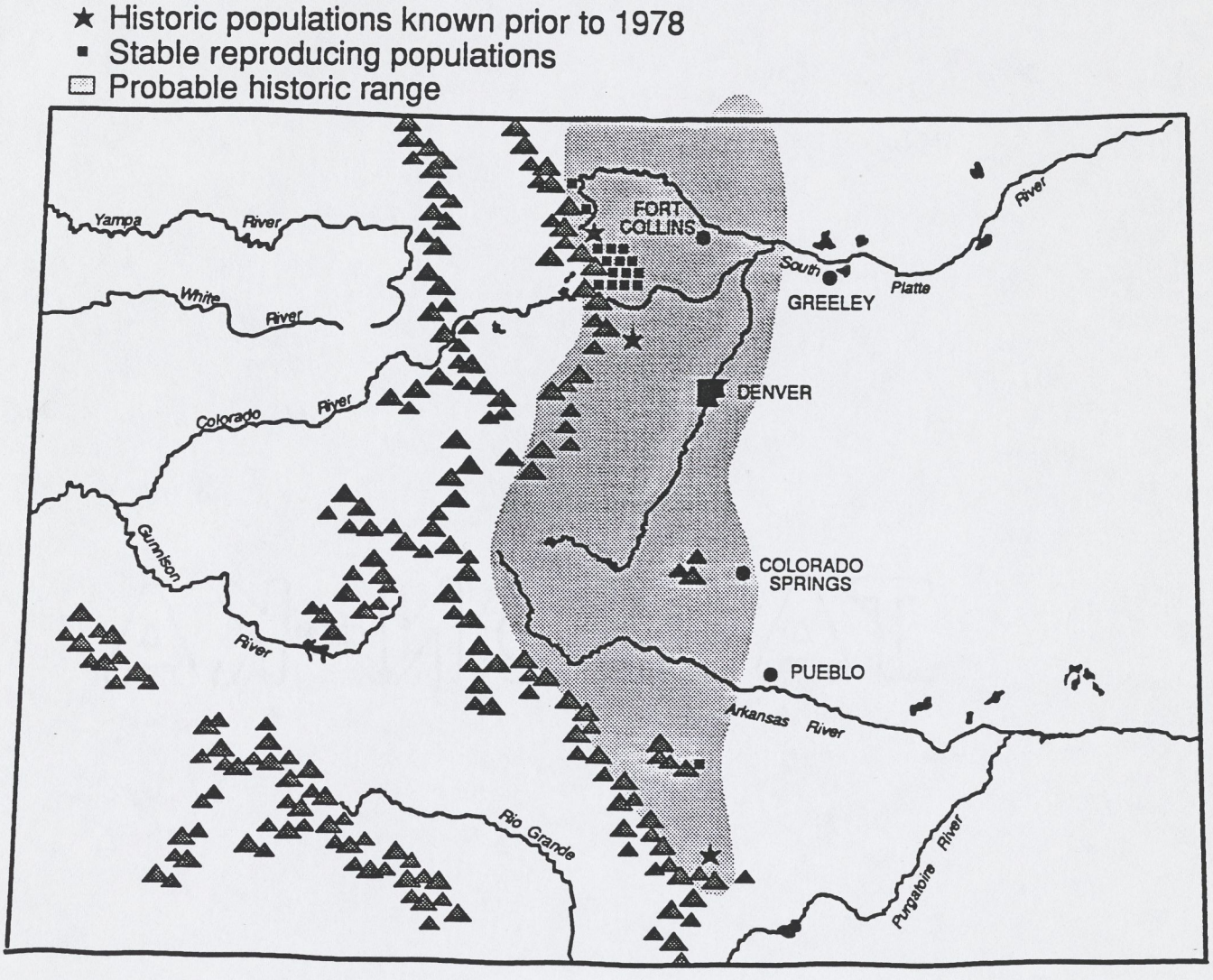
The greenback declined so rapidly in the 1800's, that the original distribution of the subspecies is not precisely known. Behnke and Zarn (1976) assumed the original distribution included all mountain and foothill habitats of the Arkansas and South Platte drainages, Figure. 2. Although the greenback was present within these drainages, little is known of its exact lake and stream distribution and the range in elevation the species once occupied. The only other trout species thought to have occurred within the greenback's native range was the yellowfin cutthroat (Oncorhynchus clarki macdonaldi) collected from Twin Lakes (Arkansas River drainage) in 1889 (Behnke 1979). The yellowfin cutthroat appears to have become extinct by the early 1900's.

Figure 1. Photograph of male and female greenback.

Female South Platte drainage greenback with typical coloration and spotting pattern from a small stream environment

Mature South Platte drainage male greenback with spawning coloration for a lake environment, Bear Lake, RMNP

Figure 2. Historic distribution of greenback cutthroat trout, (Behnke and Zarn, 1976) and location of historic sites and stable reproducing populations. 1992.



Type Specimens

According to Behnke (1979), "There is considerable confusion concerning the name stomias in regard to where the original (type) specimens actually came from. It is possible that the specimens on which the name is based were not greenback trout taken from the South Platte drainage. Cope (1872), in the same publication in which he names S. pleuriticus, named Salmo stomias from specimens collected from: "The South Platte River at Fort Riley, Kansas." The South Platte River drainage does not enter the State of Kansas. In later publications, Cope stated that the "type locality" of stomias is the Kansas River at Fort Riley, Kansas. The Kansas River, however, has no native trout. The confusion originated with an Army expedition under the command of Lt. F. T. Bryant, traveling from Fort Riley, Kansas, to Fort Bridger, Wyoming, and back again in 1856. A surgeon, Dr. W. R. Hammond, accompanied the expedition and made natural history collections; among his collections were two specimens of cutthroat trout. The expedition traversed parts of the Kansas, North Platte, South Platte, and Green River drainages in Kansas, Nebraska, Wyoming and Colorado. Cutthroat trout could have been collected only in the Green River or South Platte drainages. The problem is that all of the specimens collected on the expedition were simply labeled 'Fort Riley, Kansas' (the terminus of the expedition) and shipped to the Philadelphia Academy of Sciences, where Cope later saw the cutthroat trout specimens and named Salmo stomias."

Jordan (1891) redefined stomias and limited its use to the cutthroat trout native to the South Platte and Arkansas River drainages. Jordan also appears to be the first person to use the common name "greenback" for this trout in the literature. All cutthroat trout are currently placed in the genus Oncorhynchus, with the current scientific name of the greenback being Oncorhynchus clarki stomias.

Taxonomy

The cutthroat trout, Oncorhynchus clarki (formerly Salmo clarki), is a prime example of a polytypic species. Trout referred to as O. clarki are found in both coastal and inland streams from Alaska to New Mexico, and within this range the species has evolved into numerous subspecies or geographic races. Many subspecies undoubtedly are polyphyletic, having evolved directly from other subspecies rather than (monophyletically) from a centrally localized stem group. This evolutionary pattern, coupled with the declining abundance of "pure" inland trout, and extensive hybridization with introduced species (e.g. rainbow trout O. mykiss), has made it nearly impossible to unravel the myriad systematic problems within inland O. clarki (Gold 1977).

The taxonomy of the greenback cutthroat trout (O. c. stomias) ("greenback") has been described by Wernsman (1973) and Behnke (1973, 1979), with the following species description from Behnke and Zarn (1976), "Taxonomic criteria for S. clarki stomias remain tentative due to the extreme rareness of pure populations and to the scarcity of ancient museum specimens. Even so, scale counts (180-230) made from available specimens consistently exhibit the highest values of any cutthroat trout, or any trout in the genus Salmo. It may be assumed that extremely high scale counts are characteristic of pure populations of S. c. stomias, with some suggestion that those populations native to the South Platte Basin may show slightly higher counts than those native to the Arkansas drainage. The greenback cutthroat trout displays typically lower numbers of pyloric caeca and vertebrae than most other subspecies of S. clarki, but much overlap occurs in these characters."

"Salmo clarki stomias undoubtedly derived via an ancient headwater transfer from waters of the Colorado River basin to the South Platte River drainage (and then to the Arkansas River drainage) and for this reason shares many similarities with the Colorado River cutthroat, S. c. pleuriticus.

The striking spotting pattern and intense coloration which can develop in mature fish are the most diagnostic field characteristics of the greenback trout. S. c. stomias typically displays the largest and most pronounced spots of any cutthroat trout. Round to oblong in shape, the spots appear concentrated posteriorly on the caudal peduncle area. Coloration is similar to that found in S. c. pleuriticus and tends toward blood-red over the lower sides and ventral region, especially in mature males. Although a genetic basis exists to express characteristic color patterns, the actual manifestation of color intensity and pattern depends upon age, sex, and diet", Figure 1. A summary of parameters for various Colorado subspecies of O. clarki are provided in Figure 3.

Due to the close relationship between greenbacks and Colorado River cutthroat trout, recent DNA studies of greenback cutthroat trout indicate that the Cascade Creek population (Arkansas River drainage) appear to be more closely related to Colorado River cutthroat trout than those in the South Platte drainage. The Como Creek population (South Platte drainage) may have a unique haplotype (Dr. Minkly personal communication). Because of these apparent genetic differences and geopgraphic separation of the drainages, greenbacks from the two drainages should not be mixed for restoration purposes.

Figure 3. Comparison of selected parameters for various Colorado subspecies of O. clarki and rainbow trout.

Comparison of Selected Parameters for
Various Colorado Subspecies of *Salmo clarki* and Rainbow Trout
(From Johnson 1976)

	Number vertebrae	Number pyloric ceaca	Number gill-rakers	Number basibranchial teeth	Lateral line scale count (2 rows above lateral line)	Scale count from lateral line to dorsal fin	Spots
	mean (range)	mean (range)	mean (range)	mean (range)	mean (range)	mean (range)	
S. clarki stomias (Greenback Cutthroat Trout)*	60.6 (59-62)	29.4 (24-42)	20.5 (17-22)	usually present (0-15)	195.0 (175-214)	48.0 (46-53)	Large, absent from head
S. clarki virginalis (Rio Grande Cutthroat Trout)*	61.7 (60-63)	46.0 (33-59)	19.5 (18-21)	7.3 (4-12)	164.0 (146-186)	41.9 (39-47)	Medium size concentrated posteriorly
S. clarki pleuriticus (Colorado Cutthroat Trout)*	61.2 (60-63)	35.0 (23-46)	19.0 (16-21)	usually present (0-15)	180.0 (159-202)	43.0 (31-51)	Large spots concentrated posteriorly
S. clarki macdonaldi (Yellowfin Cutthroat Trout)*	60.6 (60-61)	42.0 (32-49)	21.3 (20-22)	15.5 (15-16)	161.7 (149-172)	41.3 (38-46)	Spots small irregular shape
S. clarki lewisi (Yellowstone Cutthroat Trout)	61.6 (60-63)	41.2 (31-51)	20.6 (18-23)	24.0 (9-46)	179.2 (161-187)	40.6 (37-46)	
S. gairdneri (Rainbow Trout)	63.0 (62-65)	55.0 (40-70)	19.0 (18-21)	absent	130.0 (120-140)	27.0 (24-30)	Small, equally distributed

*Counts from populations thought to be pure strains and typical of the subspecies.

Since greenback cutthroat trout hybridizes with other species of trout, populations can range phenotypically from "essentially pure" to obvious hybrids. The Colorado Division of Wildlife (CDOW) has adopted a rating system developed by Binns (1977) as a means of rating population purity. Each population is assigned a letter ranging from A (pure) to F (obvious hybrids).

Only Type A populations are considered for recovery purposes in this plan, Tables 1, 2, 3 and 4. However, known type B and C greenback populations are also included in hopes that information obtained from research on types A through C populations will be of value in formulating management plans for all cutthroat trout subspecies, Table 5.

Reasons for Decline

Fate of historic populations. Four cutthroat trout subspecies are known to have existed in Colorado when European settlers first arrived. In addition to the greenback, the yellowfin (Oncorhynchus clarki macdonaldi) occurred in the upper Arkansas River drainage in Twin Lakes, the Rio Grande cutthroat in the Rio Grande drainage and the Colorado River cutthroat in the Colorado River drainage.

Unfortunately, all four cutthroat trout subspecies proved quite susceptible to negative influences associated with human development of Colorado. Land and water exploitation, mining, logging and unregulated fishing all took their toll in reducing the numbers and habitat of endemic trout populations. However, no action had more long-term impacts on the Colorado endemic trout species than the introduction of non-native salmonids which hybridized and competed with native fishes. Greene (1937) believed the greenback to be extinct.

The fate of the greenback population native in Twin Lakes, in the Lake Creek drainage, illustrates the impact of subsistence harvest and the stocking of nonnative fish, and typifies the fate of the greenback trout in general. According to Behnke (1979), "Twin Lakes was noted for its abundance of greenback trout in the nineteenth century. In the 1890's rainbow trout, brook trout, lake trout (Salvelinus namaycush), and Atlantic salmon were introduced. When Juday sampled Twin Lakes in 1902-1903, rainbow trout were dominant (Juday 1906). Although Juday collected specimens of greenback trout (some of these were identified as hybrids when examining Juday's specimens at the National Museum), he found no "yellowfin" cutthroat trout. The greenback disappeared from Twin Lakes shortly thereafter. Twin Lakes is now primarily noted for its lake trout fishery."

Introduction of non-native fish. The major factor in the decline of the greenback cutthroat trout was the introduction of non-

native salmonid species (rainbow trout, brook trout, brown trout and Yellowstone cutthroat trout), within the South Platte and Arkansas River drainages.

The 1800's began with the greenback cutthroat as the dominant salmonid of these two drainages. However, the arrival of the railroad and the emergence of the art of fish culture and fish hatcheries combined to make large numbers of fish eggs and fry readily available and transportable in a relatively short period of time. The greenbacks failure to respond to early fish culture practices soon led to other fish species, such as brook trout and rainbow trout, being reared and stocked throughout the greenbacks limited native range.

Hybridization. Greenbacks hybridize readily with rainbow trout and other subspecies of cutthroat. This is evident from the array of intergrades of greenbacks and other spring-spawning salmonids within Colorado, Table 5.

Competition, brook trout. The ability of brook trout to displace a pure greenback population was dramatically demonstrated by events in Black Hollow Creek, Arapaho/Roosevelt National Forest. Brook trout were removed from this small montane stream in 1967 prior to restocking with 50 pure greenback cutthroat trout, which later established a reproducing greenback population. However, in 1973, two brook trout were found above the barrier, and by 1977, electrofishing for more than one mile above the barrier produced only brook trout (Behnke 1976, 1979).

The mechanism by which brook trout displace greenbacks is not thoroughly understood. However, in colder habitats, it probably includes an advantage gained through a one year earlier sexual maturation by brook trout and larger brook trout young-of-the-year (YOY). Brook trout spawn in the fall, with their fry emerging from the redds much earlier in the year than do the spring spawning greenbacks, and can be 30 mm longer than greenbacks by their first October. In Hidden Valley Creek, Rocky Mountain National Park (RMNP), YOY brook trout (65 mm) and YOY greenbacks (35mm) are usually found in the shallow stream habitat by October and appear to compete for food and space during winter minimum flows. Fausch and Cummings (1986), found brook trout juveniles to occupy more energetically favorable positions than greenbacks in stream habitats when the two were found in sympatry within Hidden Valley Creek, RMNP, and indicated that brook trout juveniles were dominant over juvenile greenbacks (probably due to their larger size). However, Fausch and Cummings found aggression between adult (>150 mm) brook trout and greenbacks to be minimal.

Although brook trout dominate greenbacks and represent 60%-90% of the fish population in Black Hollow and Hidden Valley Creeks, greenback hybrids and Colorado River cutthroats have successfully

co-existed for over 40 years and/or dominate (50% to 90%) over brook trout within Lake-of-Glass, Thunder Lake and Willow Creek, Rocky Mountain National Park (RMNP). Greenbacks have also demonstrated that they can invade dense brook trout populations in some circumstances, such as in the North Fork of the Big Thompson River. Greenbacks were introduced into a fishless habitat above an un-named falls on the upper North Fork of the Big Thompson River, RMNP in 1970, and established a reproducing population of greenbacks. By 1986, greenbacks had drifted downstream, and represented 14.5 percent of the fish over 50 mm in length in the stream section from Lost Falls to the unnamed falls. In this section, brook trout did not exceed 280 mm in length, while greenbacks to 304 mm in length were collected.

Arkansas River greenbacks in Lytle Pond (U.S. Army, Ft. Carson) successfully coexist with brook trout, with brook trout numbers declining. However, spawning habitat at Lytle pond is less favorable in the fall than in the spring, and may provide greenbacks with a competitive advantage over brook trout at this location.

Competition, brown trout. Wang (1989) observed the behavior and competition of yearling South Platte greenbacks and brown trout in an indoor stream aquarium. Brown trout were found to be more aggressive than equal sized greenbacks, with brown trout out competing greenbacks 1.27 times longer and 1.69 times heavier. Slow current combined with dim light significantly increased attack frequency of brown trout on greenbacks. Although few of the greenback restoration projects involved former brown trout habitat, the dominance of brown trout over greenbacks indicated by Wangs study is evident in George and Cornelius Creeks, where brown trout appeared to be well on their way to displacing greenbacks by 1991.

Angler Harvest. The removal of older aged greenbacks by anglers, in some habitats, may have had a negative impact upon greenbacks when exotic salmonids were present. Since greenbacks are more easily caught than other species, removal of the older greenbacks would remove their "specialist" size and age advantages, while emphasizing the "generalist" advantage of brook trout to reproduce at smaller sizes and younger ages. Changes in fishing regulations in effect since 1982 within RMNP that limited the harvest of non-native cutthroats and Colorado River cutthroat to two fish over 250 mm, and catch-and-release only for greenbacks, appears to be allowing for the downstream expansion of cutthroats into brook trout populations in some streams within RMNP (North Fork of the Big Thompson River, North Inlet and North St. Vrain). However, in other areas, brook trout continue to expand into populations of greenbacks where no angler harvest is allowed (Ouzel, Hidden Valley, George and Cornelius Creeks).

Recovery History

Conservation efforts started in 1959, and have resulted in considerable accomplishments in the preservation of the greenback. The following summary of recovery efforts is presented as an introduction to the current recovery tasks being proposed in Section II, Recovery. Additional detail of some subjects discussed in this recovery history can be found in Part III, Life History and Management Practices.

Recovery, 1959 to 1972. Prior to the enactment of the Endangered Species Act, conservation efforts commenced in 1959, when greenback trout from the headwaters of the Big Thompson River in Forest Canyon of Rocky Mountain National Park (RMNP) were stocked into Fay Lakes of the Park after removal of non-native trout with rotenone. A greenback population did not establish in Fay Lakes, but the descendants have maintained a reproducing population in Caddis Lake. Unfortunately, the Forest Canyon population was later classified as slightly hyridized with Yellowstone cutthroat trout, therefore both the Forest Canyon and Caddis Lake greenback populations are now classified as B populations, Table 5.

Analysis of all specimens examined to 1970 indicated only two pure populations, one in Como Creek, an isolated tributary of North Boulder Creek, Boulder County, and one in the very headwaters of the South Poudre River, above a barrier falls in Larimer County.

In 1967, a cooperative project between the USFS, Colorado Cooperative Fishery Unit and the CDOW resulted in the removal of brook trout above a barrier on Black Hollow Creek and the introduction of Como Creek greenbacks. Unfortunately, brook trout were reestablished, and displaced the greenback population. However, a 1971 transplant of 50 Como Creek greenbacks into the fishless headwaters of the North Fork of the Big Thompson River, RMNP, was successful and resulted in the establishment of a stable greenback population by the early 1980's.

Recovery, 1973-1975. With the enactment of the Endangered Species Act in 1973, the greenback was classified as Endangered and a Recovery Plan was written.

Hidden Valley Creek, RMNP was treated to remove brook trout, and greenbacks were introduced in 1973. This area was opened to catch-and-release angling for greenbacks and catch-and-kill for brook trout in 1982, but the population is not considered to be stable due to the dominance of brook trout in the beaver pond habitat.

Brook trout were removed from Bear Lake, RMNP, greenbacks were introduced in 1975, and this population is considered to be stable.

Recovery, 1976-1982. A new Recovery Plan was written, and an Arkansas River population of pure greenbacks was confirmed in 2.8 km of Cascade Creek. The Team recommended downlisting species to allow for angling opportunities and to assist in habitat acquisition, with the Federal listing changed from endangered to threatened in 1978.

A total of 58 adult and sub-adult Como Creek greenbacks were shipped to the FWS, Bozeman Fish Cultural Development Center, Montana, to establish a captive South Platte broodstock in 1977. This project was successful, with 630 greenback sub-adults and 16,579 greenback fry stocked into restoration projects in 1981. Milt from wild South Platte populations was taken from wild populations and shipped to Bozeman by 1982. The taking of milt from wild fish was originally used to compensate for asychronization of males and females at the hatchery, and later to improve heterozygosity of the captive stock due to the small number of fish available to found the broodstock.

Semi-wild Arkansas River broodstocks were initiated in 1980 and 1981 at McAlpine Pond (private) and Lytle Pond (U.S. Army, Ft. Carson).

Since restoration projects could now be restocked with greenbacks at the rate of 1000 fry/ha, and the areas opened to catch-and-release fishing within four years, restoration projects increased. Restoration projects were completed, and greenbacks stocked into Black Hollow (second restoration), May Creek, Hourglass Creek, Williams Creek, Sheep Creek, and Bard Creek on National Forest lands, and into West Creek, Ouzel Lake and Ouzel Creek and Fern Lake and Fern Creek within RMNP.

Hidden Valley Creek, RMNP, opened to catch-and-release for greenbacks and catch-and-kill for brook trout in August 1982.

Recovery, 1983-1986. With the success of the captive breeding programs and adequate agency funding, a new Recovery Plan was written that capitalized upon the successes of the broodstock programs and chemical techniques for removing non-native fish species. This recovery plan identified an objective for delisting the species upon establishment of 20 stable reproducing populations. The plan identified six recovery goals, with achievements for these goals described below:

1. <u>Protect Historic Populations and Stable Populations</u>. New historic populations were confirmed in Hunters Creek, and the Hutcheson Lakes, Rocky Mountain National Park. These historic populations probably were established by transfers of greenbacks above natural barriers in the late 1800's.

2. Establish 20 Stable Populations. Using the South Platte broodstocks, greenbacks were introduced into George Creek, Cornelius Creek, Pennock Creek and Bruno Gulch within Arapaho/Roosevelt and Pike National Forests, and into Odessa Lake, Lawn Lake, Roaring River and Big Crystal Lake, Rocky Mountain National Park. Within the Arkansas River drainage, Cascade Creek greenbacks were introduced in Cottonwood Creek, Boehmer Reservoir and exotic fish were removed from Virginia Lake, Timberline Lake, Zac Bog and Lake Fork Creek within the Pike/San Isabel National Forests.

3. Establish Wild and Captive Broodstocks. Poudre River greenback eggs were shipped to the Saratoga NFH, Wyoming in 1985. The Poudre River greenbacks hatched, but did not accept feed and all died. Milt from the Poudre River fish was later shipped to Bozeman to increase the heterozygosity of the South Platte broodstock.

Cascade Creek/Lytle Pond greenback eggs were shipped to the Saratoga NFH in 1984. The Cascade Creek (Arkansas River) stock was established, and sub-adults and fry were shipped to Colorado to restock restoration projects by 1987.

4. Document Response to Angling. In addition to the Hidden Valley fisheries, Ouzel Lake and Ouzel Creek, and Fern Lake and Fern Creek, Rocky Mountain National Park, opened to catch and release greenback angling in 1986.

5. Increase I&E Program. The Team was awarded the Colorado National Wildlife Federation Researcher of the Year Award in 1984.

6. Long Range Management Plan. To be completed upon delisting of the species.

Recovery 1987- 1991. Had the pre-1987 pace of restoration work continued, it would have been possible to completely delist the greenback by 1990-1992. Unfortunately, Section 6 funding for CDOW recovery activities and FWS funding of FWS activities did not extend past 1986. Reorganization of the FWS and the CDOW compounded funding problems, and resulted in no greenback restoration projects completed outside of Rocky Mountain National Park and the Leadville National Fish Hatchery from 1987 through 1991. Problems with fish control permits further complicated the problem of completing restoration projects.

Although the Recovery Plan was not revised in 1988, recovery efforts have followed the six goals established in 1983:

1. Protect Historic Populations and Stable Populations. New historic populations were confirmed in South Apache Creek, (Leary, 1987) and Upper Hague Creek. Other possible historic

populations in Chicago Creek and Bear Creek in the Boulder watershed, Tarryall Creek, and a site near Rollinsville are being evaluated, Table 1.

2. Establish 20 stable populations. Due to funding problems, South Platte restoration projects were limited to Rocky Mountain National Park and the Leadville National Fish Hatchery (NFH). In the South Platte drainage, Rocky Mountain National Park projects included Lost Lake, NF Big Thompson River, Husted Lake, Lower Hutcheson lake, Pear Lake, Coney Creek, Sandbeach Lake, Loomis Lake and Spruce Lake through 1990. No South Platte restoration projects were completed in 1991 and 1992.

In the Arkansas River drainage, fish disease problems within the watershed of the Leadville NFH resulted in the removal of infected non-native salmonids through funding from Colorado Trout Unlimited, Texaco Foundation and assistance from the Forest Service and Colorado Division of Wildlife in August 1990. The 20.4 ha of lakes and ponds and 10.3 km of stream habitat above the Leadville NFH was restocked with catchable greenbacks from the Saratoga NFH in June 1991, and immediately opened to catch-and-release fishing.

Through 1991, greenbacks were known to exist within 52 sites that represent 100 ha and 144 km of stream. Of the 52 sites, 29 are open to angling and 19 are considered to be stable, see Tables 1-4. However, the majority of the projects and 17 of the stable populations, are located within the South Platte River drainage.

3. Establish Wild and Captive Broodstocks. Due to the expense of maintaining native Colorado fish in National Fish Hatcheries in Wyoming and Montana, and limited use of these fish outside of Rocky Mountain National Park, the decision was made to abandon these stocks as soon as they could be replicated within Colorado. Fish and Wildlife Service hatchery activities were funded by the FS and BLM, while their function was transferred to the CDOW Experimental Hatchery, Ft. Collins, Colorado.

Eggs were collected from Hunters Creek, Upper Hutcheson Lake, Bear Lake and the Poudre River in 1989, from Upper Hutcheson Lake in 1990, and the South Fork of the Poudre in 1992 to begin a new CDOW South Platte broodstock at Ft. Collins. Eggs were taken from the 1989 year class in 1991, with 447 greenbacks surviving to December 1991.

Attempts were made to start a CDOW Arkansas broodstock at Ft. Collins by collecting eggs from Cascade Creek in 1991. The Cascade Creek egg collection was not successful, but 3,200 eggs were collected from South Apache Creek in 1992. In addition to South Apache Creek eggs, 10,000 eggs were shipped from the Saratoga NFH to Ft. Collins in August 1992. Due to problems associated with construction at the Saratoga NFH in 1992, the

majority of the adult Arkansas greenback broodstock was lost, and the Saratoga program was terminated by September 1992.

4. Response to Angling. Within Roosevelt National Forest, catch-and-release fishing for South Platte greenbacks opened in Sheep Creek, Cornelius Creek and George Creek. Within Rocky Mountain National Park, Odessa Lake, Lawn Lake, Roaring River, Big Crystal, Lost Lake, North Fork Big Thompson River, Lower Hutcheson Lake, Pear Lake, Sandbeach Lake and Coney Creek opened to catch-and-release angling by 1990.

Catch-and-release fishing for Arkansas River greenbacks opened on Ft. Carson, and in the Pike National Forest at Virginia Lake, Timberline Lake, Zac Bog and Lake Fork Creek.

5. Improve I&E Programs. The team increased it's involvement with conservation groups, particularly Colorado Trout Unlimited (CTU). The CTU partnership resulted in increased educational opportunities due to CTU publications and chapter meetings, and a funding partnership for the greenback restoration work above the Leadville NFH. Work was also initiated with school groups to propose the greenback as the Colorado State Fish. The rainbow trout, a fish native to California, is the current official Colorado State Fish.

6. Long Range Management Plan. To be completed upon delisting of the species.

PART II RECOVERY

OBJECTIVE FOR DELISTING OF THE GREENBACK CUTTHROAT TROUT

THE OBJECTIVE OF THE GREENBACK CUTTHROAT TROUT RECOVERY PLAN IS THE REMOVAL OF THIS SUBSPECIES FROM THE USFWS THREATENED AND ENDANGERED SPECIES LIST. THIS SUBSPECIES WILL BE CONSIDERED RECOVERED WHEN 20 STABLE GREENBACK CUTTHROAT TROUT POPULATIONS ARE DOCUMENTED WITHIN ITS NATIVE RANGE THAT REPRESENTS A MINIMUM OF 50 HECTARES OF LAKES AND PONDS AND 50 KILOMETERS OF STREAM HABITAT. A MINIMUM OF FIVE OF THESE POPULATIONS WILL EXIST IN THE ARKANSAS RIVER DRAINAGE.

A stable self-sustaining greenback cutthroat trout population is defined as a population of greenbacks that maintains a minimum of 22 kilograms of greenbacks per hectare of habitat through natural reproduction. The population should contain a minimum of 500 individuals greater than 120 mm in length, and be able to establish a minimum of two-year classes within a five-year period through natural reproduction.

A population of greenbacks cannot be considered stable unless the population is separated by physical or biological barriers from other salmonids. Although fall spawning trout species will not hybridize with greenbacks, the presence of brook trout and brown trout is usually not considered to be conducive to stable greenback populations. Fall spawning species will most likely displace greenbacks, or prevent the greenbacks from meeting the requirements for biomass and reproduction.

Highly glaciated drainages, with multiple hanging valleys, can contain more than one stable self-sustaining population. However, each reproducing population should contain at least two hectares of habitat that is separated by barriers to fish migration. Each stable population within a drainage must meet the previously stated requirements for biomass, population size and reproduction.

Overall, this objective implies the expansion of the range of pure greenback cutthroat trout to a level where isolated disruptions in population or habitat and controlled angler harvest of greenbacks will not result in the subspecies likely becoming extinct throughout all or a significant portion of historic range.

To attain this objective, completion of the following seven tasks is considered necessary by the Recovery Team.

1992 STEPDOWN OUTLINE

1. **Maintain or enhance all known Type A greenback trout populations and their habitats.**

    1.1. Conduct population and habitat monitoring

    1.2. Habitat improvement

    1.3. Maintain stream barriers

    1.4. Prevent introduction of non-native species

    1.5. Promote sound land and water use guidelines

    1.6. Enforce regulations

2. **Establish or document the existence of 20 stable populations of pure (type A) greenback cutthroat trout within the species' historic range that represents a minimum of 50 hectares of lakes and ponds and 50 kilometers of stream habitat. A minimum of five populations will be in the Arkansas River drainage.**

    2.1. Conduct surveys for historic populations.

    2.2. Prepare and maintain list of potential habitat.

        2.21. Consult with land owners and management agency(s).

    2.3. Prepare habitat for reintroduction.

        2.31. Habitat manipulation.

        2.32. Construct or improve barriers.

        2.33. Remove all non-native salmonids.

    2.4. Introduce pure (type A) greenback cutthroat trout.

        2.41. Use appropriate stocking rates for fish from wild populations.

        2.42. Use appropriate stocking rates for hatchery fish.

2.5. Monitor and document the success of introduction.

2.51. Prepare and annually update Tables 1, 2, 3, 4, 6 and 7.

3. Establish hatchery and wild populations of pure (type A) greenback trout for broodstock.

3.1. Establish one wild broodstock population in a lake/stream environment within the South Platte River drainage.

3.2. Establish one wild broodstock population in a lake/stream environment within the Arkansas River drainage.

3.3. Establish a hatchery propagation program.

3.31. Collect and utilize milt from wild populations.

3.32. Prepare reports on the status of the hatchery program.

3.33. Provide information necessary for the development of a long-term management plan and cooperative agreement.

3.4. Establish South Platte and Arkansas River greenback broodstocks at Colorado Division of Wildlife hatcheries.

4. Document angling studies and research introduction programs.

4.1. Assess mixed greenback/non-native salmonid recreational fisheries under a variety of harvest regulations.

4.2. Assess allopathic greenback recreational fisheries, under catch-and-release regulations.

4.3. Conduct research on allopatric greenback stocking and harvest programs, using a variety of habitats and harvest regulations.

4.4 Conduct research on experimental greenback/native non-game fish introductions to determine the response of greenbacks to other native fishes.

5. Conduct information and education (I & E) program.

5.1. Encourage I&E programs.

5.2. Promote interagency cooperation and understanding of recovery activities whenever possible.

5.3. Present current activities to professional and public meetings.

5.4 Promote watchable greenbacks programs.

5.5 Promote the adoption of the greenback as the Colorado State Fish.

5.6 Prepare a greenback display.

6. Promote Partnerships with conservation groups and explore alternative management and funding strategies

6.1 Increase the use of non-agency funds.

6.2 Encourage the production and distribution of greenback art work.

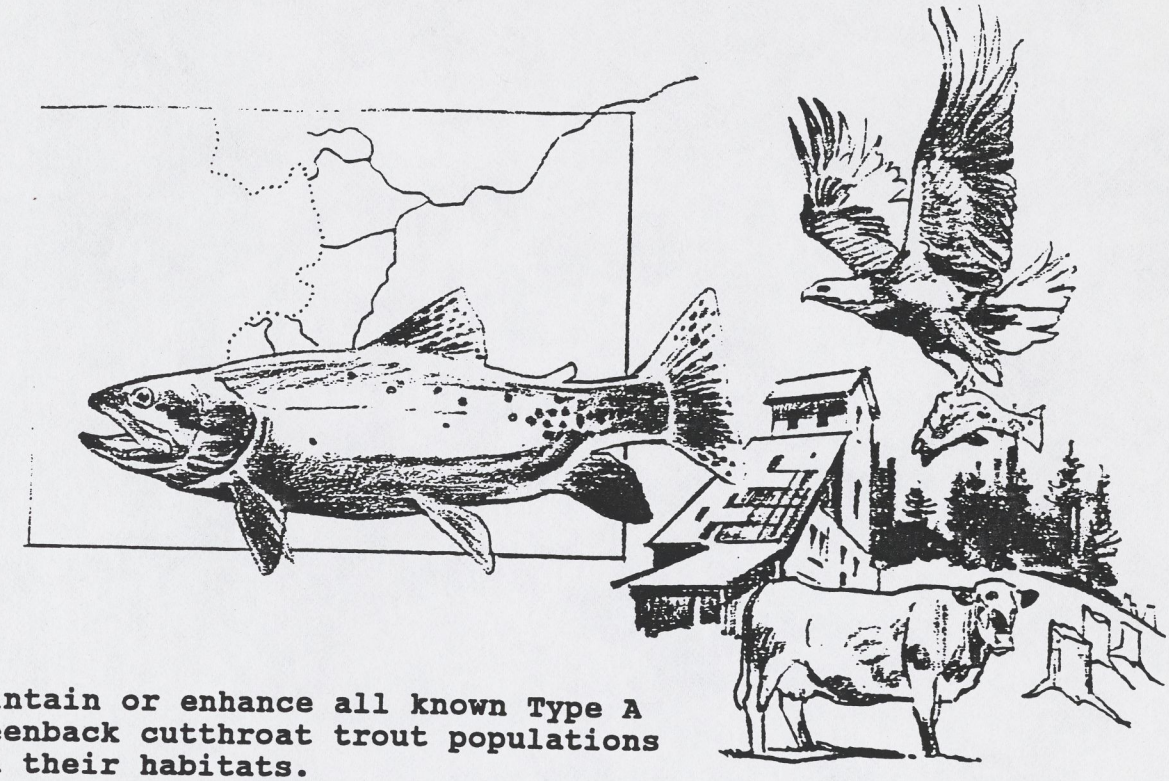
6.3 Produce a greenback brochure.

7. Prepare a long-term management plan and cooperative management agreement for the greenback cutthroat trout

7.1. Prepare a management plan

7.2. Prepare a cooperative agreement

NARRATIVE OUTLINE OF GREENBACK CUTTHROAT TROUT RECOVERY PLAN



1. Maintain or enhance all known Type A greenback cutthroat trout populations and their habitats.

1.1. Conduct population and habitat monitoring. All streams that contain populations of pure greenback trout should be censused at least once every 3 years. Numbers, age and condition of fish, and condition of the habitat should be evaluated. The presence of any non-native species or habitat degradation should be noted and appropriate management action taken.

1.2. Enhance or restore habitat. When necessary and appropriate, restore habitat quality that is below its potential through physical manipulation of the damaged habitat using sound land and water management practices.

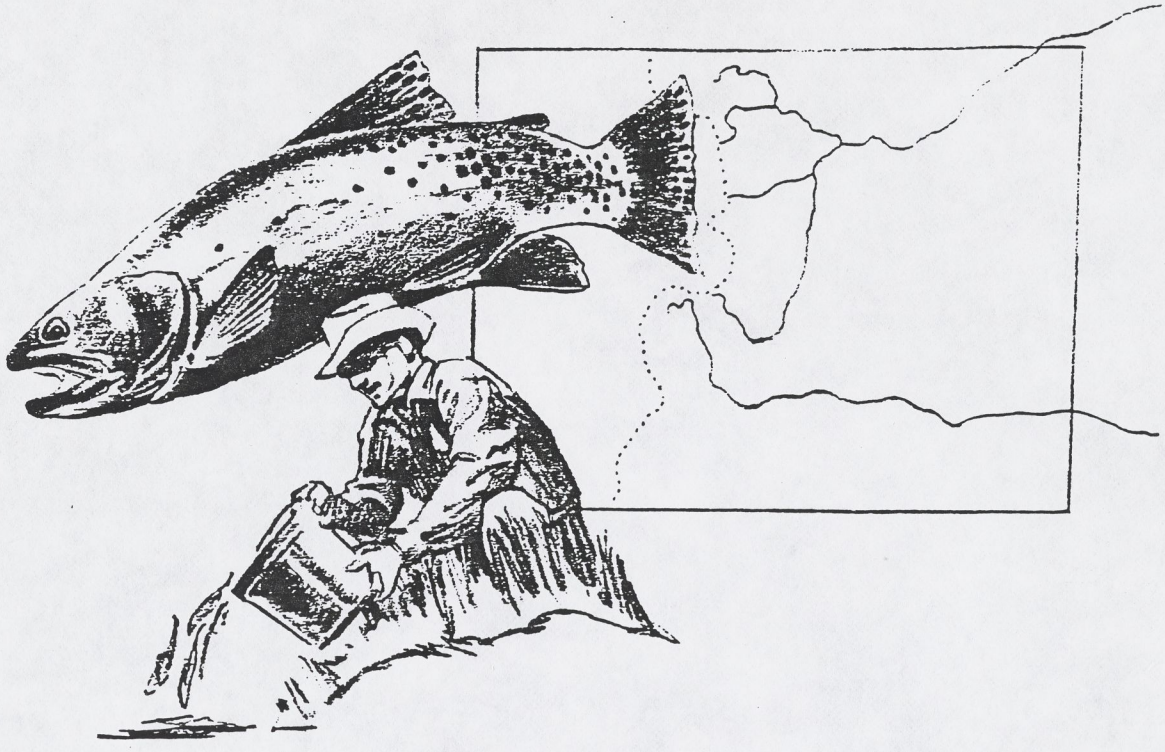
1.3. Maintain stream barriers. Stream barriers are essential to prevent invasions of undesirable fish into the habitat of greenback cutthroat trout. Natural barriers should be inspected periodically for their effectiveness and stability. Although natural barriers are strongly preferred, artificial barriers may be constructed when necessary and should be inspected regularly for needed repairs.

1.4. Prevent the introduction of non-native species. It is extremely important to prohibit the introduction of non-native fish into greenback cutthroat trout habitat. Such introductions foster competition and hybridization.

1.5. Promote sound land and water use guidelines. Promote and support grazing, logging, and agricultural and silvicultural techniques that do not adversely affect the greenback cutthroat trout habitat. The use of buffer strips along streams should be encouraged to help protect habitat from human and livestock impacts. Land use practices listed below should be monitored to ensure that they do not already affect greenback populations:

a. Grazing practices (BLM TR-1737-4)
b. Maintaining riparian vegetation
c. Silvicultural practices
d. Mining activities
e. Instream flow maintenance
f. Water diversion and reservoir operations
g. Road construction
h. Human activity

1.6 Enforce Regulations. Following the development of special angling regulations (see Task 4.0) or habitat closures, strict enforcement by the Colorado Division of Wildlife, Forest Service, Bureau of Land Management, Rocky Mountain National Park and Fish and Wildlife Service is necessary to ensure that the populations are protected from abuse.



2. **Establish or document the existence of 20 stable populations of pure (type A) greenback cutthroat trout within the species' historic range that represents a minimum of 50 hectares of lakes and ponds and 50 kilometers of stream habitat. A minimum of five populations will be in the Arkansas River drainage.**

The requirements for this Task has largely been completed, with 19 stable populations documented, that represents 46.0 hectares of lake habitat and 51.6 kilometers of stream habitat, Table 4. However, only two stable populations currently exist within the Arkansas River drinage.

Thus, the major task that needs to be accomplished under this version of the Greenback Cutthroat Trout Recovery Plan is the documentation of at least five stable reproducing populations within the Arkansas River drainage, Tables 3 and 4.

2.1 Conduct surveys for historic populations. Continue to search systematically for historic populations of greenback cutthroat trout that may still exist within its historic range. Verify such populations by field collections and analysis by qualified taxonomists.

2.2 List of candidate habitats. Prepare and maintain a list of candidate aquatic habitats that delineates

areas that could, with or without modification, support populations of pure South Platte and Arkansas River greenback cutthroat trout. The selection of candidate aquatic habitats should be based upon the following criteria:

1. Presence of barriers.
2. Ease of removing non-native fish.
3. Water temperature of 5-8C by early July.
4. Adequate water flows.
5. Ability to sustain more than 500 adult fish and 22 kg/ha of biomass.
6. Ability to sustain reproduction.

This Task has been completed, and habitat areas are listed, see Tables 6 and 7.

2.23 Consult with the land owners or agency(s) responsible for land management. Determine if a greenback cutthroat trout population would be compatible with present and future agency management goals and with the management goal for each candidate water shown in Tables 6 and 7.

2.3 Prepare habitats listed in Tables 6 and 7 for reintroduction. Carry out remedial actions necessary and appropriate to make candidate waters suitable for the introduction of pure greenback cutthroat trout. Aquatic habitats selected for the introduction of greenbacks may be lacking in some phase of preferred or essential habitat requirements. Special emphasis should be given to Arkansas River projects (Table 7), since only two stable reproducing populations currently exist in this drainage, see Tables 1, 3 and 4.

2.31 Habitat manipulation. If necessary and appropriate, enhance candidate habitat by the use of good aquatic habitat management practices considering: pool/riffle ratios, riparian vegetation, spawning habitat, water quality and protection from excessive disturbance.

2.32 Construct or improve barrier(s). Although natural barriers are preferred, some areas may require the construction or improvement of existing barriers to fish migration.

2.33 Remove all non-native salmonids present within the candidate habitats with piscicides. Review project success and repeat application of piscicides if necessary. Special emphasis should be given to completing projects within the

Arkansas River drainage. Allow treated habitat to remain barren for a minimum of 6 months prior to proceeding to Task 2.4.

2.4 Introduce pure (type A) greenback cutthroat trout into the candidate waters, using the greenbacks most representative of the drainage being stocked. Greenback cutthroat trout populations introduced within the South Platte drainage should be established with trout from Como Creek, South Fork of the Cache La Poudre River, Hunters Creek, Upper Hutcheson Lake, their descendants, or from yet to be determined Type A South Platte populations, Table 6.

Greenback cutthroat trout populations established within the Arkansas drainage should be established with trout from Cascade Creek, South Fork Apache Creek, their descendants, or from yet to be determined Type A Arkansas River populations, Table 7.

Use of hatchery-reared pure greenbacks or pure (type A) greenbacks from wild populations will depend upon the management goal of the particular project.

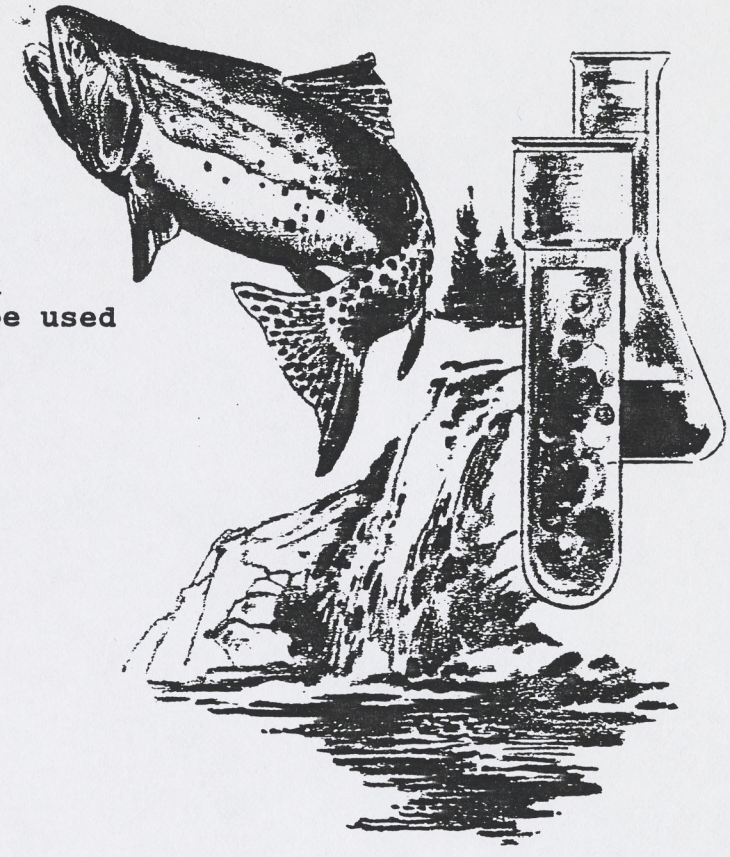
2.41 Use appropriate stocking rates for fish from wild populations. Stocking rates for greenbacks from wild populations should be 100-200 sub-adults or adults per site, with 200 being the most desirable number. Removal of any greenbacks from the historic pure (type A) populations will require approval from the responsible management agencies.

2.42 Use appropriate stocking rates for larval hatchery fish. Annual stocking rates for hatchery fry should be 1,000 25mm fish per hectare of lake and 1,000 25mm fish per 1.6 km of stream. Areas should be stocked for three consecutive years following the removal of non-native fish to maximize heterozygosity and the establishment of multi-year class populations capable of supporting recreational fisheries, Tables 6 and 7.

2.5 Monitor and document the success of each introduction of greenbacks into candidate waters. Projects should be examined annually for the first 3 years following stocking and then once every two to three years until the candidate water meets its management goal and meets criteria defining stability. Monitoring and reporting of each project's success will be the responsibility of the lead agency on the project.

2.51 Annually update status of historic populations and restoration projects, Tables 1, 2, 3 and 4.

2.52 Annually update candidate list of restoration projects, Tables 6 and 7.



3. Establish hatchery and wild populations of pure (type A) greenback cutthroat trout that can be used as broodstock

3.1 Establish a South Platte River wild broodstock. Establish/maintain at least one lake/stream environment within the South Platte River drainage to function as a practical wild broodstock source. These broodstocks can also constitute one or more of the 20 stable populations under Task 2.0. This Task is completed, with egg sources demonstrated from Como Creek, Hunters Creek, Bear Lake and Upper Hutcheson Lake.

3.2 Establish a Arkansas River wild broodstock. Establish one lake/stream environment within the Arkansas River drainage to function as a practical wild broodstock source. This broodstock may constitute one of the 20 stable populations under Task 2.0. Although eggs have been taken from Lytle Pond on Ft. Carson, this task is not completed. Boehmer Reservoir and Native Lake have the potential to serve as broodstock areas, as well as the historic populations in Cascade Creek and South Apache Creek, but require additional evaluated.

3.3 Establish a captive broodstock. Establish and demonstrate the successful use of a hatchery propagation program at the USFWS, Bozeman Fish Technology Center, (FTC) Bozeman, Montana, using pure (type A) greenback cutthroat trout. Movement of greenback fry and milt between Bozeman FTC and Colorado will be in accordance with current State and Federal

fish disease policies and good fisheries management practices. Use greenback fry from this source as outlined in Task 2.4. This task is completed. In addition to the Bozeman program, another successful hatchery program was demonstrated at the Saratoga NFH.

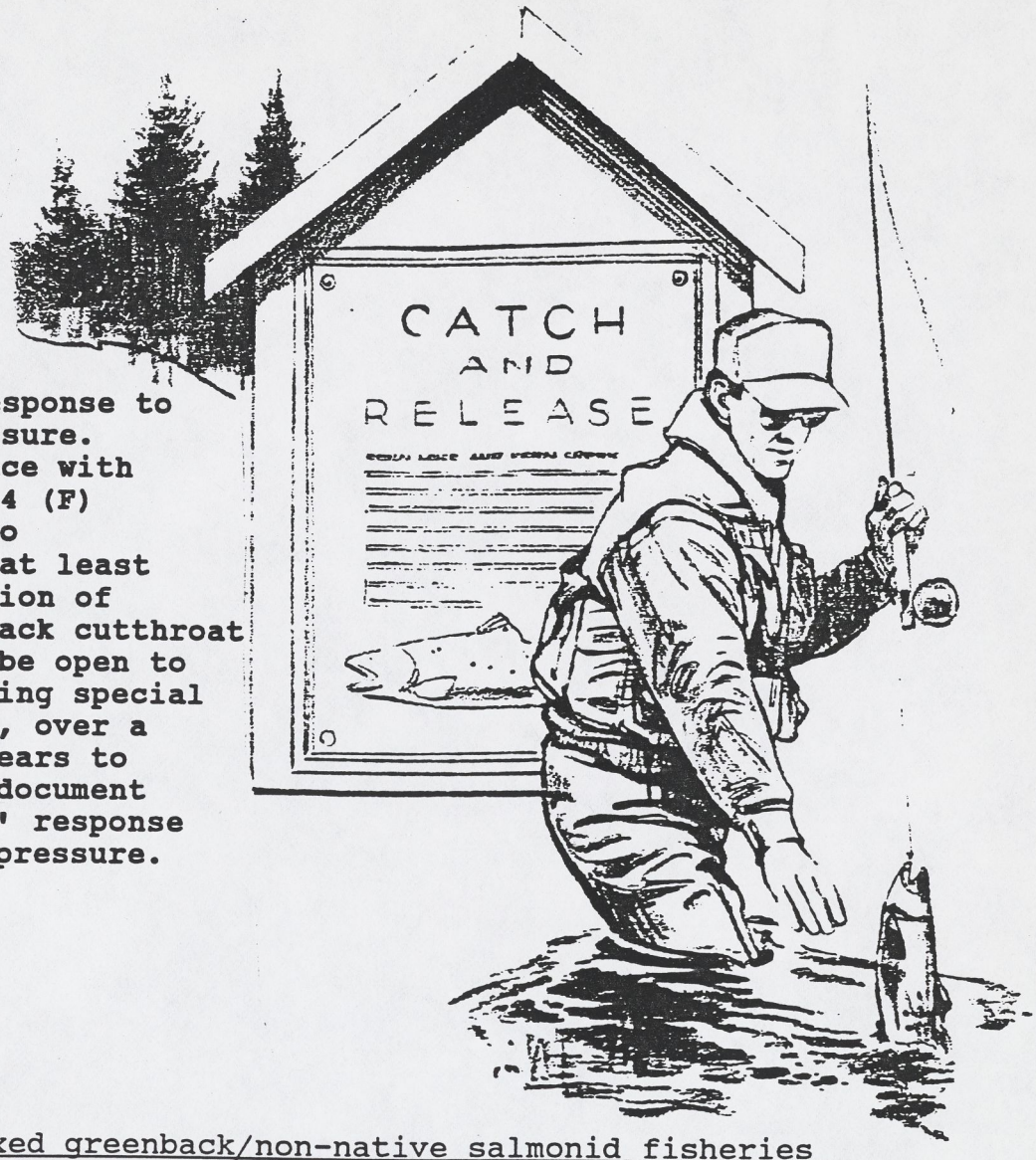
3.31 Collect and utilize milt from wild populations. Collect and utilize milt from wild populations of pure (type A) greenbacks for fertilization of hatchery ova to minimize genetic drift within the hatchery. This has been completed, with milt from Hidden Valley Creek, Como Creek, Poudre River and Hunters Creek used since 1982.

3.32 Prepare reports on the status of the hatchery program. The Bozeman FTC and CDOW Experimental Hatchery should annually report the status of the greenback hatchery project. This task is completed.

3.33 Provide information necessary for development of a long-term management plan and cooperative agreement. The Bozeman FTC should prepare a report which address pertinent topics under Task 7.0, and provides additional information detailing hatchery aspects of managing greenbacks.

3.4 Establish a South Platte and Arkansas greenback broodstock at a Colorado hatchery. Preferably, these broodstocks will be based on a mixture of historic populations within their respective drainages.

Eggs from historic populations of South Platte greenbacks were shipped to the CDOW experimental hatchery in 1989, 1990 and 1992. Eggs from the Saratoga NFH and South Apache Creek were shipped to the CDOW Experimental Hatchery in 1992. Although greenback eggs and fry have been produced at the Experimental Hatchery, fungus infections have eliminated a substantial number of the mature broodstock now that malachite green cannot be used for the control of fungus on hatchery fish.



4. Document response to angler pressure. In accordance with 50 CFR 17.44 (F) and prior to delisting, at least one population of pure greenback cutthroat trout will be open to angling, using special regulations, over a period of years to adequately document the species' response to angling pressure.

4.1 Assess a mixed greenback/non-native salmonid fisheries under a variety of harvest regulations. A mixed brook trout-greenback cutthroat trout fishery exists within the beaver pond habitat of Hidden Valley Creek, RMNP, with this area opened to artificial lure catch-and-kill angling for brook trout and catch-and-release angling for greenbacks to determine if such special regulations give a competitive edge to greenbacks. This task is completed, please see angling section, page 48.

4.2 Implement catch-and-release greenbacks fisheries programs on public lands. Monitor fisheries to determine angler success rates and populations status. Completed, areas opened to catch-and-release fishing are listed in Tables 1-4.

4.3 Complete research stocking and angling programs. Research stocking and angling programs will be conducted using surplus captive reared greenbacks to explore the response of greenbacks to a wide range of habitat types, angler pressures and appropriate angling

regulations. Research stocking sites are listed in Tables 8 and 9.

4.4. Complete research stocking of greenbacks into waters with native non-salmonids, or, introduce native non-salmonids to greenback projects. One project has been completed at Lytle Pond, U.S. Army, Ft. Carson, Colorado, using Arkansas darters, with this project successful for both species. Other proposed projects include Monument Creek and Crow Creek. However, due to the proximity of white sucker and creek chub habitat to developed areas, these projects may have to be completed after delisting to prevent conflicts due to the current listed status of the species.

5. Conduct an information and education program. Explain the goal, objectives, and recovery activities for the greenback cutthroat trout to promote public support.

5.1 Encourage I&E programs. Make newsworthy activities available to media outlets, particularly when these activities mark the completion of objectives of the Recovery Plan. These activities include the opening of lakes and streams to sport fishing, local hatchery greenback activities and watchable fish programs. Public understanding and support of Tasks 2, 3 and 4 of this Plan will promote recovery efforts.

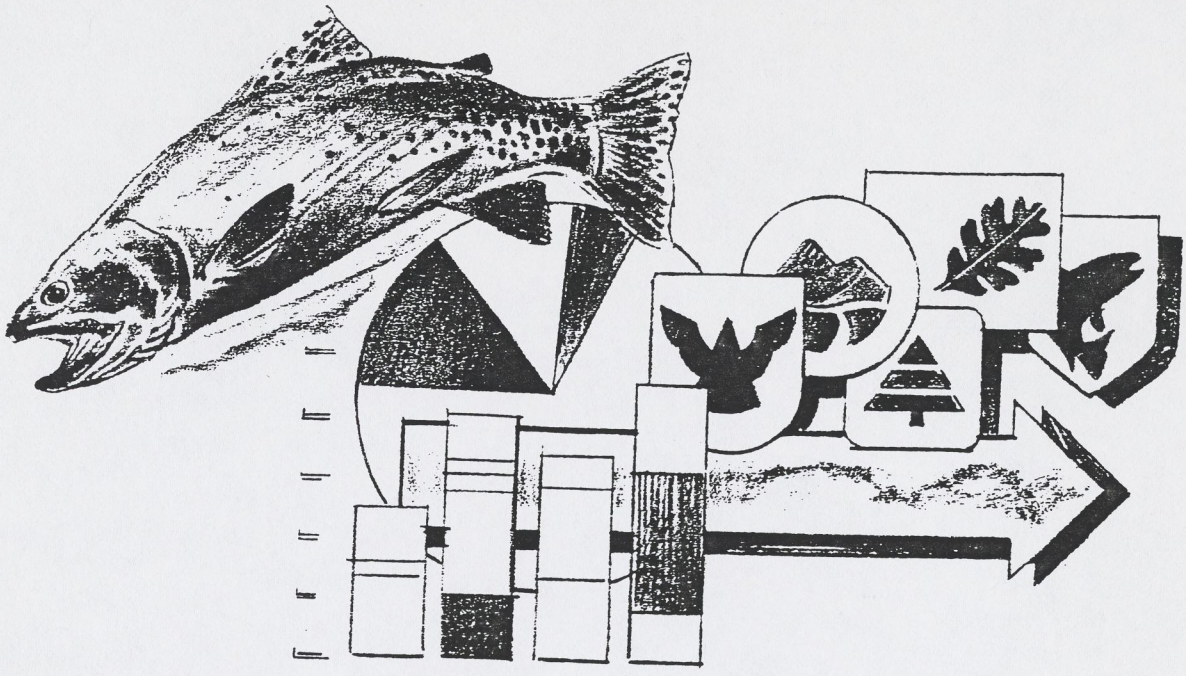
5.2 Promote interagency cooperation and understanding of recovery activities whenever possible. This should include interagency coordination meetings, agency reports, publications and cooperative funding of recovery efforts.

5.3 Present current recovery activities at professional and public meetings. This should include papers presented at American Fisheries Society and Wildlife Society meetings, and to interested public groups, such as Trout Unlimited, The Nature Conservancy and the National Wildlife Federation.

5.4 Promote watchable greenback programs. This should include viewing areas during the spawning season, and programs such as the boardwalk at the Hidden Valley beaver ponds, RMNP.

5.7 Promote the adoption of the greenback as the Colorado State Fish. Colorado Trout Unlimited supports this proposal, and has taken a lead role in contacting representatives to sponsor a bill.

5.8 Prepare a greenback display. Develop a greenback display that promotes the awareness of greenbacks and sympatric native species.

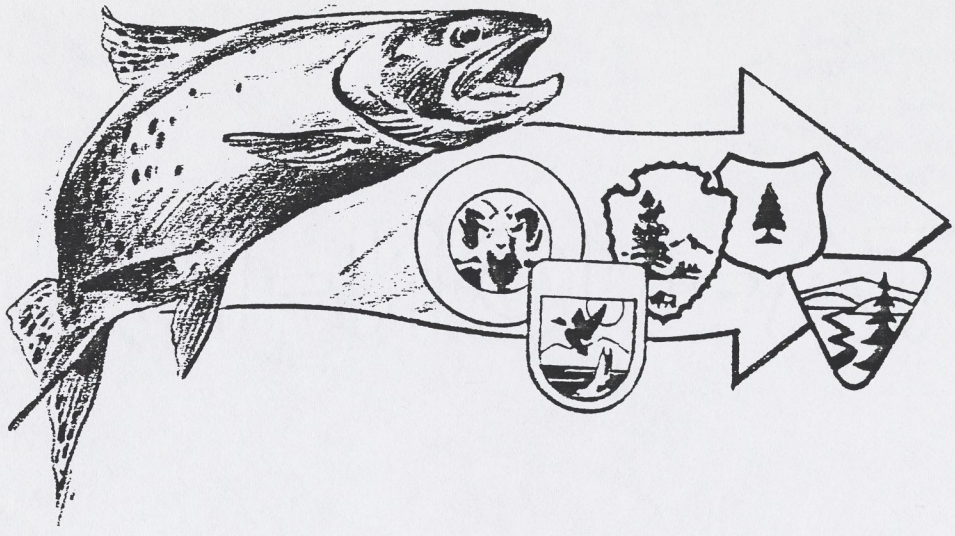


6.0 Promote partnerships with conservation groups and explore alternative management and funding strategies.

6.1 Increase the use of non-agency funds. Explore the use of inter-agency funding, challenge grants and Fish American funding of restoration work.

6.2 Art work. Produce art work based upon greenbacks that promote awareness of the species, and produces funds for restoration activities. Activites to include a limited edition greenback print, postcards and shirts.

6.3 Brochure. Produce a greenback brochure with funding from Colorado Trout Unlimited.



7.0 Prepare a long-term management plan and cooperative management agreement for greenback cutthroat trout. Prior to delisting, prepare a long-term management plan and cooperative agreement for the management of greenback cutthroat trout that will be acceptable to all participating agencies (Colorado Division of Wildlife, U.S. Bureau of Land Management, U.S. Forest Service, U.S. Fish and Wildlife Service, and National Park Service) having proprietorship over the populations of type A greenbacks.

7.1 Prepare a management plan. A management plan should be prepared that will incorporate all the information obtained through completion of the recovery plan tasks. Lead agency personnel ( ) will maintain records on their recovery activities so as to be able to address the following topics in the final management plan:

I. Life History and Ecology (Mitchell)
   a. Habitat requirements
   b. Reproduction
   c. Food preference

II. Present Status of Greenbacks
   a. Brief history of recovery (Mitchell)
   b. List of current Type A populations (Mitchell)
   c. Criteria for stable populations (Sloan)

III. Monitoring
   a. Habitat monitoring (Gerhadt & Winters)
      Existing site condition
      Potential new sites

b. Population Monitoring (Krieger/Puttman/Goeble)
   Stability
   Abundance
   Age structure

IV. Maintenance
   a. Habitat management guidelines (Mitchell/Sloan)
      Resource management activities
      Habitat improvement structures
   b. Species Management
      Broodstock maintenance (Harris)
      Stocking (Rosenlund)
      Angling regulations (Krieger/Puttman/Goeble)
      Methods for removing non-natives (Rosenlund)
         - with greenbacks present
         - for new sites

V. Recommendations (Mitchell/Sloan/Nesler)
   a. Mechanism to be followed if the number of stable populations fall below minimum numbers.
   b. Annual status report and annual meeting

7.2 Prepare a cooperative agreement. Cooperative management agreements should be prepared to define management agencies' roles in maintaining populations of pure greenback cutthroat trout established or documented under Task 2.0 of this Plan. If needed, the status of the subspecies can be reviewed at interagency coordination meetings.

PART III LIFE HISTORY AND MANAGEMENT PRACTICES

Habitat Requirements

Habitat requirements of greenback cutthroat trout appear little different from other species of trout. Bulkley (1959) gathered information on age, growth, food habits, and movement of a slightly hybridized population in the headwaters (3,200 m) of the Big Thompson River, Rocky Mountain National Park (RMNP). Nelson (1972) provided data on age, growth, and fecundity of a dense, unexploited, and slightly hybridized greenback population in Island Lake, Boulder Creek watershed.

Restoration efforts should be directed to habitats that are capable of supporting a minimum of 20 kg/ha of fish. Habitats occupied by non-native fish will require their removal prior to the introduction of greenbacks to prevent hybridization and competition.

Stable reproducing populations of greenbacks in Colorado are not documented above 3,400 m (timberline), since cold water temperatures do not allow for sufficient time for spring spawning, hatching and establishment of fry during the short ice-free period. However, due to the availability of surplus greenbacks, experimental introductions are being conducted in fishless waters to document the effect of elevation as a limiting factor on greenbacks. Two timberline lakes that were stocked with non-native cutthroats in RMNP, but became fishless after the termination of fish stocking, were subsequently stocked with greenbacks. In one of these lakes (Odessa, 3,048 m) greenbacks established a reproducing population. Greenbacks stocked into Crystal Lake (3,511 m) spawned by mid-July, but survival past the egg stage has not been documented through 1992.

The lower elevation limit of greenback survival is not known, but greenbacks have reached sizes of 2.0 kg in a lake located at an elevation of 1,889 m on the Ft. Carson military base. Future experimental stocking should involve lower elevation projects with non-salmonids forage species.

Reproduction

Spawning is generally initiated in the spring when water temperatures near 5C-8C, and corresponds to the blooming of a common native flower, golden banner in adjacent terrestrial habitats. Due to the influence of elevation on water temperatures, greenbacks in Lytle Pond on Ft. Carson (1,889 m) spawn by early April, greenbacks in Hunters Creek (2,896 m) spawn in mid-June, and greenbacks in Upper Hutcheson Lake (3,402 m) spawn in mid-July. Although greenbacks are spring spawners,

older greenback males in high elevation streams (Hunters Creek and the headwaters of the North Fork of the Big Thompson River within RMNP), were observed to be in spawning colors and running milt by mid-September.

Although Como Creek greenbacks can produce eggs at age 2 in the hatchery, females in small subalpine streams within Colorado appear to mature after their third to fourth summer of life when they reach lengths of approximately 180 mm.

The fecundity of seven females from Island Lake, averaging 270+mm in length, had a mean value of 299 eggs per fish (Nelson 1972). Como Creek greenbacks held at the USFWS Fish Technology Center (FTC) at Bozeman, Montana, produced 1.5 eggs per gram of female weight for 2-year-old greenbacks weighing 254 grams and 1.4 eggs per gram of female weight for 3-year-olds weighing 357 grams (Dwyer 1981).

In the Big Thompson River (Forest Canyon), RMNP at an elevation of approximately 3,200 m, Bulkley (1959) observed type B fry emerging on August 26.

Food and Feeding

Jordan (1891) mentioned that stomias fed on invertebrates when held in the Leadville NFH, but were reluctant to accept fish flesh as food. Bulkley (1959) reported that the slightly hybridized greenbacks in Forest Canyon, RMNP (3,200 m), fed upon terrestrial organisms during the summer, primarily adult Hymenoptera and adult Diptera. Fausch and Cummings (1986) found greenbacks in Hidden Valley Creek, RMNP (2,690 m), fed opportunistically on a wide variety of organisms. In Hidden Valley Creek, greenback gravimetric analysis revealed that terrestrial invertebrates comprised a relatively constant proportion of the diet through September, but terrestrial invertebrates declined rapidly in October as temperatures declined. None of the stomachs contained YOY greenbacks.

The stomach of a 1.19 kg, type A Cascade Creek greenback, that was illegally taken in 1982 from Lytle Pond, Fort Carson contained a 114 mm tiger salamander (Amystoma tigrinum). Variations in the Arkansas darter population that co-exists with the greenbacks in Lytle pond indicates that greenbacks use these native darters for forage, although this observation has not been confirmed by stomach analysis of the greenbacks.

Size and Growth

Behnke (1979) stated that, "Historically, it appears that the greenback seldom attained a large size. About 1-2 pounds seems

to be typical maximum size given by old timers. In Twin Lakes, Colorado, during the late 1800's, the greenback did not exceed a foot in length, while the yellowfin cutthroat (now extinct) attained a size of 10-12 pounds."

Recently, the size and growth of greenbacks has observed to vary, based upon the elevation and population size. In small headwater habitats, the greenback can attain a relatively large size of 356-380 mm as observed in the headwaters of the South Fork, Cache La Poudre River, where it is much larger than most brook trout in similar habitat.

In September 1981, 40 type A Cascade Creek greenbacks were transferred to the fishless 0.4 ha Lytle Pond at an elevation of 1,889 m to establish a wild broodstock. Although none of these greenbacks exceeded 250 mm in September 1981, one male attained a total length of 510 mm and a weight of 2.00 kg by November 1983. Studies of tagged greenbacks in Lytle pond have shown a 79 mm and 410 g increase for male greenbacks, and a 86 mm and 315 g increase for pre-spawning females from April 1991 to April 1992.

Depending upon population density, the growth of reproducing greenbacks at higher elevations can be much less. The stocking of 161 mm greenbacks into two fishless RMNP alpine lakes (Sandbeach and Pear) at the rate of 22.7 to 26.0 kg/ha resulted in a 57 mm (range 47-68 mm) length increase from 30 June 1989 to mid-September 1989. These two populations began to spawn by 1990, with growth averaging only 20 mm for Sandbeach from September 1989 to September 1991, and 16 mm for Pear from September 1989 to July 1991. Tag studies conducted in Hunters Creek, indicated that growth for six greenbacks (178-252 mm in length), averaged only 6 g from June 1988 to June 1989. Hunters Creek is 2,896 m in elevation, and has a large (118 kg/ha) stable fish population that is used for egg collections and is closed to fishing.

Disease and Parasites

The first modern fish pathology work on wild greenbacks was conducted prior to the transfer of 66 Como Creek greenbacks to the USFWS, Fish Technology Center in 1977. Fecal material, ovarian fluid and seminal fluid from 78 Como Creek pre-and post-spawning greenbacks failed to show any viral activity when inoculated onto susceptible tissue cultures. One moribund greenback collected from Como Creek on June 22, 1977, had numerous Gyrodactylus spp. and Glossatella spp. covering the body, with Hexamita spp. and Crepidostomum farionis within the intestinal tract. Although bacteria were present within the kidney, they were nonobligate to salmonids. Following the transfer of the Como Creek greenbacks to the FTC, 11 greenbacks were lost within six months. Examination of these fish revealed

no viral activity, and no clinical bacterial infection was found although Pseudomonas spp. and Aeromonas hydrophilia were isolated. Additional non-lethal fish disease samples (fecal, seminal fluid, ovarian fluid) collected from Hunters Creek, Upper Hutcheson Lake and South Fork of the Poudre River from 1983 to 1990, found no viral activity and no obligate fish bacterial infections. Fish diagnostics work was performed by the USFWS, Fish Disease Control Center, Fort Morgan, Colorado.

Due to the concern over the recent introduction of whirling disease (Myxobolus cerebralis) to Colorado, experiments were conducted on the response of greenbacks to whirling disease at the USFWS, National Fish Heath Research Laboratory, in conjunction with the Colorado Division of Wildlife. The experimental exposure of two to three month old greenbacks to a light exposure of whirling disease (Myxobolus cerebralis), indicated that greenbacks produced 7.5 times less M. cerebralis spores than rainbow trout after three months, and 15.6 times less spores than rainbows after six months. However, infected greenbacks weighed about 45% less than the infected rainbows, with greenback mortalities 26% to 32%, compared to 3 percent to 4 percent for infected rainbows. These results indicate that although greenbacks showed no overt signs of infections (skeletal deformities and tail chasing), mortalities for infected greenbacks were higher than for infected rainbow trout. Mortalities of unexposed controls were one percent for both species (Markiw 1990).

Sensitivity to pH

Research conducted by Woodward (1991), indicated that the threshold concentration on greenbacks in the absence of aluminum was pH 5.0. However, adverse effects were observed at pH 6.0 when 50 ug/l of aluminum was present. Greenback alevin and swim-up larva were found to be more sensitive to acidic pH and elevated aluminum than eggs and embryos. However, growth of greenbacks was not reduced at low pH, as was observed in Snake River and Yellowstone cutthroats. Most of the historic greenback populations and greenback restoration projects are located in alpine habitats that are susceptible to acid precipitation, with changes in acid precipitation having potential impacts to the survival of the species.

Heavy Metals

Experimental stocking of greenbacks into fishless habitat in Bard Creek has indicated that greenbacks stocked at over 25 mm in length will survive to maturity and spawn despite elevated concentrations of heavy metals. However, eggs from these mature fish deposited by late June did not to survive to the fall in

Bard Creek. As Woodward found with low pH and elevated aluminum levels, the swim-up and alevin stages may be the most sensitive to elevated levels of heavy metals.

Fish Culture

Although the stocking of cultured nonnative salmonids almost resulted in the extinction of the greenback, the greenback was one of the earliest fish to be reared in Federal hatcheries. In 1889, the Leadville National Fish Hatchery was established near Leadville Colorado, and some of its original objectives were to rear greenbacks and yellowfins. Both subspecies were obtained from waters adjacent to the hatchery and moved by wagon to the hatchery to be used as broodstock. Eggs of both species were taken from Twin Lakes. However, the greenback and yellowfin cutthroat trout did not adapt well to captive rearing, and local citizens were so displeased with the hatchery spawning traps in Twin Lakes that they were "blown out with dynamite" (Tulian 1896). The availability of other species (brook and rainbow trout) more adaptable to hatchery rearing, and the large scale availability of Yellowstone cutthroat (O. c. bouverie) from Yellowstone Lake, led to the abandonment of the greenback by early fish culturalists as a source of trout for stocking purposes.

A second attempt to rear greenbacks at the Leadville National Fish Hatchery was attempted in 1957 and 1958 using 50 slightly hybridized greenbacks from the Big Thompson River in Forest Canyon, RMNP, and 26 pure greenbacks from the now extirpated Albion Creek population. This project was abandoned due to fish mortality in the hatchery and asynchronous maturation of the remaining males and females. The project terminated with the stocking of the surviving broodstock into Florence Creek, Uinta and Ouray Indian Reservation, Utah. The greenbacks in Florence Creek were almost totally displaced by brook trout by 1978.

South Platte Drainage Broodstock. As part of the Recovery Plan, another attempt to rear South Platte drainage greenbacks was initiated in 1977, with the transfer of 66 Como Creek greenbacks to the USFWS, Fish Culture Development Center, Bozeman Montana. This broodstock initially encountered the same problems with asynchronous maturation of males and females, loss of males due to fungus and feeding by the greenbacks in a captive situation. In 1978, males produced milt in April and May, but the females matured in July and August. Asynchronous maturation problems were overcome by allowing water temperatures to decline to near 2 C, then allowing the temperature to rise again in the Spring. Problems with the males fungusing was controlled with malachite green. The use of variable temperatures and malachite green allowed for successful spawning, with 160,000 fry shipped to Colorado from 1981 to 1988. Milt from wild greenbacks from Como

Creek, Hunters Creek, Hidden Valley Creek and the Poudre River was also collected and used to fertilize ova from Bozeman females (Dwyer, 1988). This action also helped enhance the genetic diversity of the broodstock.

Leadville National Fish Hatchery Egg Collection, Circa 1890

An attempt was also made to establish a Poudre River greenback broodstock at the Saratoga NFH in 1984 and 1985. Eggs collected in 1984 did not survive, but 47% of the eggs collected in 1985 survived to swim-up. None of the young accepted feed, and all died. Poudre River eggs were again collected in 1992, with these fish surviving at the CDOW Experimental Hatchery through September 1992. Interestingly, eggs from the Poudre River population required much less time to develop and hatch than did those of the greenbacks from Arkansas drainage's Cascade Creek at the Saratoga NFH. At 8 C, eggs from the Poudre River fish required only 16 days to reach the eyed egg stage and 32 days to hatch, compared to 29 days to the eyed stage and 39 days to hatch for Cascade Creek (J. Hammer, Saratoga NFH, personal communication).

New South Platte and Arkansas greenback broodstock were initiated at the CDOW Experimental Hatchery at Ft. Collins to replace the aging and unfunded USFWS broodstocks. During 1989, a total of 5,419 eggs were collected from Bear Lake, Como Creek, Hunters Creek and the Poudre River. In 1990, about 200 eggs were collected from Upper Hutcheson Lake. Fish were produced from all areas, except the Poudre River. In July 1992, eggs were again collected from the Poudre River, with these eggs surviving to through September 1992. Eggs were collected from the CDOW Experimental Hatchery broodstock in 1991 and 1992, with problems with asynchronous spawning experienced during 1992. Malachite green could not be used to control fungus in 1992, and all the 1989 year class of broodstock did not survive past the spawning season.

Arkansas Drainage Broodstock. To develop an Arkansas River greenback broodstock capability for the Greenback Recovery Plan, greenbacks from Cascade Creek were introduced into McAlpine Pond (Private) and Lytle Pond (U.S. Army, Ft. Carson) to develop semiwild broodstocks. Eggs were collected from McAlpine Pond and greenbacks establishing a reproducing population in Lytle Pond. Eggs from these areas were sent to Saratoga NFH in 1984, with greenback fry and catchables produced from 1987 through 1992. The Arkansas drainage broodstock program was scheduled to be transferred to the CDOW Experimental Hatchery in 1992, due to FWS funding problems and age of the Saratoga broodstock, with 3,000 eggs from South Apache Creek and 10,000 Saratoga NFH eggs shipped to the CDOW Experimental Hatchery in 1992. Following the collection of eggs at the Saratoga NFH in 1992, the Saratoga broodstock was lost due to water problems at the hatchery.

Stocking

A wide range of stocking rates and methods have been used to re-introduce greenbacks into historic habitats. Early stocking usually involved the fall stocking of 64 to 84 adult and sub-

adult greenbacks into the renovated habitats, due to the limited number of greenbacks available from Como Creek. Unfortunately, these low stocking numbers resulted in slow colonization, loss of administrative confidence in establishing fishable populations, and a loss of genetic diversity due to the limited numbers of fish available to start the population.

The captive broodstock programs were initiated to resolve problems of reestablishing stable populations in a timely fashion, and genetic diversity to the populations. The program enabled stocking for three consecutive years to build a multi-year class population, and using milt from wild populations enhanced by genetic diversity.

Initial stocking rates for hatchery fry was 2,500/ha, for three consecutive years in fishless lakes, and 1,666 fry/1.0 km in fishless streams for three consecutive years. These rates were considered to be necessary to compensate for the stress and mortality of 12 hours of trucking required to haul the fish from Bozeman, Montana to Ft. Collins, Colorado, followed by final stocking by horseback or helicopter. However, these rates were found to be excessive for lakes, with stocking rates for fry reduced to 1,000/ha per year to increase growth rates and produce catchable sized fish within four years.

In 1988, fry were not to be shipped into Colorado in the fall, and resulted in sub-adults (161 mm) available for stocking in June 1989. The larger fish were beneficial in reestablishing fishable populations, but presented problems with stocking over 386 kg of fish into alpine lakes within the RMNP. To resolve these problems, helicopter fire buckets aerated with oxygen were used to restock lakes at the rate of 18.5 to 36 kg/ha, and allowed these lakes to be reopened to angling the following year. This same technique was used on the Rock Creek drainage, above the Leadville National Fish Hatchery in 1991. However, stocking in the Rock Creek drainage used 2,444 greenbacks at 234 mm in length, and allowed the area to immediately be reopened to catch-and-release angling.

Angling

As with most sub-species of cutthroat trout, the greenback is easily caught by sport anglers. This feature makes the greenback a good species for catch-and-release fisheries today, but severely impacted the abundance and distribution of the subspecies during the 1800's. To quote Bell (1887) "The fish is so easily caught, it is so unwary and confiding, that the fish in a moderate-sized stream can be taken out in one season with a hook and line and a grasshopper. Without the modern hereditary instincts of self-preservation, apparently, it cannot hold its own against the fisherman". As part of the recovery program,

studies on the performance of greenbacks in sport fishing management areas have been conducted since 1982.

South Platte drainage, mixed species. In September 1973, brook trout and longnose suckers were removed from Hidden Valley Creek, Rocky Mountain National Park, with antimycin. This was followed by the stocking of 82 greenbacks from Como Creek in October 1973. The greenbacks established a reproducing population in both the stream and beaver ponds; but by 1976, brook trout were once again collected in Hidden Valley. Brook trout numbers continued to increase in the beaver ponds through 1981 even with the removal of brook trout by fyke nets. By the end of 1981, it was feared that brook trout would soon displace greenbacks in the beaver ponds if a more efficient method of brook trout removal could not be found. As an alternative to the expensive netting program, an experimental angling program (catch-and-release for greenbacks and catch-and-kill for brook trout) was opened on August 1, 1982. Angling was limited to barbless artificial lures only, and a daily possession limit of 18 brook trout of which 10 must be 203 mm or less in length.

Prior to the start of the experimental Hidden Valley angling program, fyke nets were set throughout the beaver ponds. Greenbacks were captured at an overall ratio of one greenback to every three to four brook trout captured. The ratio of greenbacks to brook trout varied between beaver ponds with ratios of 1:1 to 1:50 observed in 12 ponds.

During the first week of fishing in 1982, anglers caught an average rate of 0.86 greenbacks and 0.40 brook trout per hour. In 1983, anglers caught an average of 0.78 greenbacks per hour and 0.25 brook trout per hour during the first week of angling. Fifteen percent of the greenbacks captured in fyke nets during September 1983 exhibited visible damage attributed to angler's hooks. The ratio of greenbacks to brook trout caught by anglers have been similar to that observed in 1982, and demonstrate that although greenbacks are in the minority, they represent the majority of fish caught. It was hoped that anglers would keep all brook trout caught, but interviewed anglers reported releasing 60 percent of all brook trout caught in 1982 and 1983, and 45-100% of all brook trout caught from 1984-1991. Although anglers must release all greenbacks, as many as seven percent of the greenbacks were kept due to mistaken identification of species in 1986.

Although the trapping and angling program appeared to reduce brook trout numbers and improve the condition factor of greenbacks by September 1983, there has not been a significant long term improvement in the Hidden Valley greenback population abundance. However, the program may have prevented a faster decline in the greenback population, as was observed in Black Hollow Creek where no trapping or angling programs occurred.

South Platte drainage, non-mixed fisheries. Several lakes and streams within the National Forest and RMNP are open to catch-and-release angling for greenbacks, Tables 1-4. Due to the catch-and-release regulations, fish biomass in greenback renovation projects is usually greater than that found under the previous catch-and-kill regulations. Within RMNP, angler success rates for greenbacks ranged from 0.3 to 6.4 fish per hour from 1986-1989, and from 1.7 to 12 fish per hour on National Forest and RMNP waters from 1990 to 1991

Arkansas River drainage. The first catch-and-release greenback fisheries opened at the 0.4 ha Lytle Pond on Ft. Carson in 1989. A limit of 25 annual greenback permits are sold at a cost of $20.00 through Ft. Carson. Prior to obtaining a greenback permit, all greenback anglers are required to hold a $10.00 Ft. Carson general fishing permit, a Colorado State fishing permit and attend a Ft. Carson safety briefing. Angler success, satisfaction and experience was measured by a self-conducted creel census, with anglers ranking themselves as "experienced" anglers, with the following angler success and satisfaction expressed for 1990 and 1991:

			% Anglers Satisfied with:		
Year	Average Fish/H	Length	Number	Length	Overall Program
1990	1.52	307 mm	72	78	81
1991	0.47	353 mm	52	77	100

As in RMNP, about 16% of the fish examined showed some signs of hooking or hooking damage. Although brook trout are present in Lytle pond, none were reported caught in the 1990-1991 creel census.

Interestingly, after opening Lytle Pond to unlimited catch-and-release fishing for 25 anglers, the banks showed less angler use than when the area was officially closed to all angling. No angler-related litter and set lines were found after 1990.

PART IV IMPLEMENTATION

The Implementation Schedule that follows outlines actions and costs for the recovery program. It is a guide for meeting the objective and tasks outlined in Part II of the plan. This schedule indicates the general category for implementation, recovery plan tasks, corresponding outline numbers, task priorities, duration of tasks ("ongoing") denotes a task that, once begun should continue on an annual basis, the responsible agencies, and estimated costs. These actions, when accomplished should bring about the recovery of the greenback cutthroat trout and protect its habitat.

Previous editions of the Greenback Cutthroat Trout Recovery Plan have resulted in significant improvements in the status of the species, with 19 stable greenback populations documented through 1992. Complete delisting of the species is possible when the following three critical tasks are completed:

1. Task 2.0. Establish a minimum of five stable populations of greenbacks in the Arkansas River drainage. Two stable populations currently exist, with three additional stable populations required for delisting.

2. Task 3.4. Establish successful South Platte and Arkansas River greenback broodstocks with the CDOW hatchery system.

3. Task 7.0. Prepare a long-term management plan and cooperative management agreement for greenback cutthroat trout.

Definition of Priorities

Priority 1 - All actions that are absolutely essential to prevent the extinction of the subspecies.

Priority 2 - All actions necessary to maintain the subspecies' current population status.

Priority 3 - All other actions necessary to provide for full recovery of the subspecies.

Abbreviations Used in Implementation Schedule:

CDOW - Colorado Division of Wildlife
BLM - Bureau of Land Management
RMNP - Rocky Mountain National Park
FS - U.S. Forest Service
FWS - U.S. Fish and Wildlife Service

Other Definitions. On-going, task or action which is now being implemented, but which need not be continuous. Continuous, task or action which will be required over a very long or undetermined period of time.

Recovery Implementation Schedule for Greenback Cutthroat Trout

Priority	Task	Duration	Responsible Agency	Costs (x $1,000) FY1	FY2	FY3	Comments
1	1.0-1.6	continuous	BLM	2	4	5	
			CDOW	5	0	0	
			FS	2	2	2	
			FWS	2	2	2	
			RMNP	10	10	10	
3	2.0-2.5	continuous	BLM	5	14	10	
			CDOW	10	10	10	
			FS	3	3	3	
			FWS	0	0	0	
			RMNP	10	10	10	
3	3.0-3.4	continuous	BLM	1	1	1	
			CDOW	3	3	3	
			FS	12	12	12	
			FWS	5			
			RMNP				
3	4.0-4.4	continuous	BLM				
			CDOW	12	12	12	
			FS	0	0	0	
			FWS	5			
			RMNP		5	5	

Recovery Implementation Schedule for Greenback Cutthroat Trout (Cont.)

Priority	Task	Duration	Responsible Agency	Costs (X $1,000) FY1	FY2	FY3	Comments
3	5.0-5.8	continuous	BLM	6	8	8	
			CDOW	2	2	2	
			FS	5	5	5	
			FWS	5	5	5	
			RMNP	5	5	5	
3	6.0-6.3	continuous	BLM	0	2	0	
			CDOW	8	0	0	
			FS	5	5	5	
			FWS	5	5	5	
			RMNP	5	5	5	
3	7.0-7.2	on-going	BLM	3	2	2	
			CDOW	2	2	2	
			FS	2	2	2	
			FWS	2	2	2	
			RMNP	2	2	2	

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Table 1. Summary of Historic Greenback Cutthroat Trout Sites and Stability of Population. 1970-1992.

Area	Habitat	Survey	Kg/Ha	>500 Fish	Reproduction of GBC	Other Species	Stable 1991	Comments
South Platte								
S.F. POUDRE NF/RMNP	1.7 km	1991	17.8	N	Y	N	N	
Como Creek NF	**2.9 km**	**1991**	**46**	**Y**	**Y**	**N**	**Y**	
Hunters Cr. RMNP	**2.0 km**	**1991**	**118**	**Y**	**Y**	**N**	**Y**	
Up. Hutch. Lk. C&R RMNP	**3.0 ha**	**1990**	**50**	**Y**	**Y**	**N**	**Y**	**Open to angling.**
Mid Hutch. Lk C&R RMNP	**1.7 ha**	**1988**	**20**	**Y**	**Y**	**N**	**Y**	**Open to angling.**
Upper Hague Cr. RMNP	2.0 km	1990	?	N	Y	N	N	
Tarryall near Boreal Pass	?	1991	?	N	?	BKT	N	

Table 1. Cont.

Arkansas River	Habitat	Survey	Kg/Ha	>500 Fish	Reproduction of GBC	Other Species	Stable 1991	Comments
Cascade Cr. NF	**2.8 km**	**1990**	**32**	**Y**	**Y**	**N**	**Y**	
S. Apache Cr. FS, Private, BLM	**12.2 km**	**1989**	**123**	**Y**	**Y**	**N**	**Y**	**3900 GBC estimate.**

Summary South Platte	Sites	Hectares (Acres)	Kilometers (Miles)
Total	7	4.7 (11.6)	8.6+ (5.3)
Angling	2	4.7 (11.6)	
Stable	4	4.7 (11.6)	4.9 (3.0)

Arkansas River Summary	Sites	Hectares (Acres)	Kilometers (Miles)
Total	2		15.0 (9.1)
Stable	2		15.0 (9.1)

Table 2. Summary of South Platte Greenback Cutthroat Trout Restoration Projects and Determination of Stability. 1970-1992.

Area	Habitat	Stocked	Kg/Ha	>500 Fish	Reproduction of GBC	Other Species	Stable 1991	Comments
N.F. Thompson above 3274 m and	**1.7 km**	**1970**	**62**	**Y**	**Y**	**N**	**Y**	**Open to C&R angling, 1990. Greenbacks to 400 mm.**
L. Louise, **RMNP**	**1.0 ha**	**1970**						
	2.6 ha	**1989**		**Y**	**N**	**N**		
Hidden Valley RMNP	1.6 km 2.5 ha	1973	20-50	Y	Y	BKT	N	Brook trout dominate beaver pond habitat. Open to angling 1992.
West Creek above West Cr. Falls, RMNP	2.4 km	1979-1989	0	N	N	N	N	Greenbacks present, but no reproduct.
Black Hollow NF	5.2 km	1981-1983	14	N	N	BKT RBT	N	
Bear Lake RMNP	**4.5 ha**	**1975-1987**	**50**	**Y**	**Y**	**N**	**Y**	**No angling due to heavy use of the lake trail.**
May Creek NF	1.7 km	1980-1987	0.6	N	Y	N	N	

Table 2. Cont.

Area	Habitat	Stocked	Kg/Ha	>500 Fish	Reproduction of GBC	Other Species	Stable 1991	Comments
Hourglass NF	2.0 km	1981-1982	0	0	0	N	N	
Williams Creek, NF	**3.2 km**	**1981-1983**	**84**	**Y**	**Y**	**N**	**Y**	**Closed to angling.**
Ouzel Lake and stream below Bluebird Lake	**2.6 ha 1.4 km**	**1981-1983**	**69**	**Y**	**Y**	**N**	**Y**	**Open to C&R angling, 1986.**
Ouzel Creek above Ouzel Falls, RMNP	4.7 km	1981-1983	229-34	Y	Y	BKT	N	Open to C&R angling, 1986.
Bard NF	6.1 km	1982-1987	43	Y	N	N	N	Open to C&R angling, 1992. No repro. due to metals.
Sheep NF	**11.2 km**	**1982-1987**	**67**	**Y**	**Y**	**N**	**Y**	**Open to C&R angling, 1988.**
Fern Lake RMNP	**3.7 ha**	**1982-1984**	**45**	**Y**	**Y**	**N**	**Y**	**Open to C&R angling, 1986.**
Fern Creek RMNP	**1.4 km**	**1982-1984**	**24**	**N**	**Y**	**N**		

Table 2. Cont.

Area	Habitat	Stocked	Kg/Ha	>500 Fish	Reproduction of GBC	Other Species	Stable 1991	Comments
Odessa Lk RMNP	**4.5 ha 0.2 km**	**1984-1989**	**27**	**Y**	**Y**	**N**	**Y**	**Experimental population open to C&R angling, 1987**
Cornelius Cr NF	6.9 km	1983-1985	0	N	0	BKT BNT	N	Open to C&R angling, 1988.
George Cr NF	12.7 km	1983-1985	3.6	N	Y	BKT BNT	N	Open to C&R angling, 1988.
Lawn Lk and Inlet below Big Crystal Lk.	**9.5 ha 0.9 km**	**1984-1986**	**120**	**Y**	**Y**	**N**	**Y**	**Open to C&R angling, 1988.**
Roaring R. RMNP	**6.5 km**	**1984-1986**	**81**	**Y**	**Y**	**N**	**Y**	**Open to C&R angling, 1991**
Big Crystal LK., RMNP	10.0 ha	1984-1989	114	Y	Y	N	N	Experimental population, open to C&R angling, 1990.
Jackson Cr.	0.3 ha	1985-1987	2	N	N	BKT	N	BKT dominate, open to std. regs., 1992.
Pennock Cr NF	8.0 km	1986-1988	9.4	N	Y	BKT	N	

Table 2. Cont.

Area	Habitat	Stocked	Kg/Ha	>500 Fish	Reproduction of GBC	Other Species	Stable 1991	Comments
Bruno Gulch NF	1.4 ha 9.0 km	1986-1990	8	N	N	BKT	N	No repro. in project area due to heavy metals.
Lost Lake and N.F.	**3.7 ha**	**1987-1989**	**30**	**Y**	**Y**	**N**	**Y**	**Open to C&R angling, 1990.**
Big Thompson above Lost Falls	**3.0 km**	**1987-1990**	**15**	**Y**	**Y**	**N**		
Lower Hutch. LK. and outlet stream above 3048 m	**1.7 ha 1.0 km**	**1988-1991**	**138**	**Y**	**Y**	**N**	**Y**	**Open to C&R angling, 1991.**
Pear Lake RMNP	**6.1 ha 1.2 km**	**1989-1990**	**80**	**Y**	**Y**	**N**	**Y**	**Open to C&R angling, 1991.**
Coney Cr RMNP	3.5 km	1989-1990	12	Y	Y	N	N	Open to C&R angling, 1991.
Sandbeach Lk. RMNP	**4.0 ha**	**1989-1990**	**69**	**Y**	**Y**	**N**	**Y**	**Open to C&R angling, 1991.**
Loomis Lk. RMNP	1.1 ha	1991			N	N	N	Experimental

Table 2. Cont.

Area	Habitat	Stocked	Kg/Ha	>500 Fish	Reproduction of GBC	Other Species	Stable 1991	Comments
Spruce Lk. RMNP	1.5 ha 0.2 km	1991			N	N	N	
Husted Lk. RMNP.	3.1 ha	1991			N	N	N	Experimental

SUMMARY	Sites	Hectares (Acres)	Kilometers (Miles)
Total	30	63.8 (158)	95.7 (59)
Angling	18	51.9 (128)	62.4 (39)
Stable	13	41.3 (102)	31.7 (20)

Table 3. Summary of Arkansas River Greenback Cutthroat Trout Restoration Projects and Determination of Stability. 1970-1992.

Area	Habitat	Stocked	Kg/Ha	>500 Fish	Reproduction of GBC	Other Species	Stable 1991	Comments
Lytle Pond Lytle inlet Duck Pond	0.4 ha 1.0 km 1.7 ha	1981	150	N	Y	BKT DART.	N	Open to C&R angling
Cottonwood Cr. NF	6.4 km	1983-1989	13.4	N	?	N	N	140 GBC estimate.
Greenhorn Cr. NF	3.2 km	1988-1989	10	N	N	N	N	Fishless area prior to 1988.
Boehmer Res. City, Col. Spr.	10.1 ha	1985-1989	?	N	?	N	N	Closed to angling.
Virginia Lk NF	1.2 ha	1987-1990	?	N	Y	N	N	Open to C&R angling, 1990. and harvest, 1993.
Timberline NF	10.1 ha 0.4 km	1987-1990	?	Y	Y	BKT	N	Bkt present in inlet and lake. Open to angling, 1990. and harvest, 1993.

Table 3. Cont.

Area	Habitat	Stocked	Kg/Ha	>500 Fish	Reproduction of GBC	Other Species	Stable 1991	Comments
Lake Fork Cr. NF	3.0 km	1987-1990	35	Y	Y	BKT	N	Bkt 25% of population above 3200 m. Open to angling, 1990.
Zac Bog	1.0 km	1987-1990	35	Y	?	N	N	Experimental population, open to C&R angling, 1990.
Rainbow Lake NF	3.5 ha	1991-1993				N	N	Experimental population, open to angling, 1991.
Native Lake and inlet/ outlet, NF	2.3 ha 1.0 km	1991-1993				N	N	Open to C&R angling, 1991.
Swamp Lakes and stream, NF	2.5 ha 1.1 km	1991-1993				N	N	Open to C&R angling, 1991.
Rock Cr. Elk Cr. Cascade Cr. Bog Cr. Leadville NFH	5.8 km 1.2 km 0.9 km 0.3 km	1991-1993			Y	N	N	Open to angling, 1991.

Table 3. Cont.

SUMMARY	Sites	Hectares (Acres)	Kilometers (Miles)
Total	12	31.8 (78.6)	25.3 (15.7)
Angling	9	21.7 (53.6)	15.7 (9.7)
Stable	0	0.0	0.0

Table 4. Summary of Total Greenback Historic Populations, Restoration Projects, Areas Open to Angling and Stable Populations. 1992.

South Platte Drainage	Number	Hectares	Kilometers
Total Restoration Projects	30	63.5	95.7
Open to Angling	18	51.9	62.4
Stable Restoration Projects	13	41.3	31.7
Historic Populations	Number	Hectares	Kilometers
Total Historic Populations	7	4.7	8.6
Open to Angling	2	4.7	0.0
Stable Historic Populations	4	4.7	4.9
South Platte Summary	**Number**	**Hectares**	**Kilometers**
Populations	**37**	**68.2**	**104.3**
Open to Angling	**20**	**56.6**	**62.4**
Stable Populations	**17**	**46.0**	**36.6**

Arkansas Drainage	Number	Hectares	Kilometers
Total Restoration Projects	12	31.8	25.3
Open to Angling	9	21.7	15.7
Stable Restoration Projects	0	0.0	0.0
Historic Populations	Number	Hectares	Kilometers
Total Historic Populations	3	0.0	15.0
Open to Angling	0	0.0	0.0
Stable Historic Populations	2	0.0	15.0
Arkansas Summary	**Number**	**Hectares**	**Kilometers**
Populations	**15**	**31.8**	**40.3**
Open to Angling	**9**	**21.7**	**15.7**
Stable Populations	**2**	**0.0**	**15.0**

Table 4. Cont.

Grand Total

Grand Total (metric)	Number	Hectares	Kilometers
Populations	52	100.0	144.6
Open to Angling	29	78.3	78.1
Stable populations	19	46.0	51.6

Grand Total (English)	Number	Acres	Miles
Sites	52	247	89.8
Open to Angling	29	193	48.5
Stable	19	114	32.6

Table 5. Hybrid Populations of Greenback Cutthroat Trout. 1992.

Type B Populations of Greenbacks: Essentially pure, with a trace of influence from other spring spawning trout species:

Arkansas River Drainage
- South Fork, Huerfano River (Strawberry Creek, Dutch Creek, Deep Creek)

South Platte Drainage
- Island Lake
- Goose Lake
- Forest Canyon, Big Thompson River, RMNP
- Caddis lake (transplant of Forest Canyon greenbacks, RMNP)
- Sawmill Creek
- Roaring Creek

Type C Populations of Greenbacks: Good representatives of greenback stock, but with noticeable influence from other spring spawning trout species:

South Platte Drainage
- Rabbit Creek

North Platte Drainage (outside of the historic range)
- Nunn Creek

Table 6. South Platte Greenback Restoration Projects and Stocking Schedule. Includes year proposed for renovation (R), year and number of greenback fry to be stocked, and year to open to catch-and-release (C&R) angling based upon the stocking of fry. 1990-2006.

Site	Ha/Km	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Loomis Lake, RMNP	1.1 ha	R	1000	1100	1100	C&R						
Spruce Lake, RMNP	1.5 ha	R	1000	1500	1500	C&R						
	0.2 km			200	200							
Husted Lake, RMNP	3.1 ha	R	4000	4000	4000	C&R						
Dream Lake, RMNP	2.2 ha				R	2200	2200	2200	C&R			
Sandbeach Cr., RMNP	1.5 km				R	2000	2000	2000	C&R			
Muddy Pass Cr. RMNP	1.0 km					R	1000	1000	1000	C&R		
Hague Creek, RMNP	1.0 km					R	1000	1000	1000	C&R		
Caddis Lake, RMNP	0.3 ha					R	300	300	300	C&R		
	0.5 km						500	500	500			
Lake Haiyaha, RMNP	6.3 ha						R	6300	6300	6300	C&R	
	1.5 km							1500	1500	1500		
Ypsilon Lake and	2.9 ha							R	2900	2900	2900	C&R
Creek, RMNP	2.5 km								2500	2500	2500	C&R
Mirror Lake and	12.1 ha								R	12000	12000	12000 C&R
Cascade Cr., RMNP	6.0 km									6000	6000	6000
Fall River above	6.0 km								R	6000	6000	6000
Chasm Falls, RMNP												

Table 6 Cont.

Site	Ha/Km	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Thunder Lake and	6.7 ha										R	6700
Lion Cr., RMNP	1.5 km											1500
Summary, 1990-2000			6000	6800	6800	4200	7000	14800	16000	37200	29400	32200

Site	Ha/Km	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Thunder Lake and	6.7 ha	6700	6700								
Lion Cr., RMNP	1.5 km	1500	1500								
Black Lake, RMNP	3.7 ha	R	3700	3700	3700	C&R					
Willow Creek, RMNP	5.0 km		R	5800	5800	5800					
Cow Creek, RMNP	2.0 km			R	2000	2000	2000				
Summary, 2001-2006		8200	11900	9500	11500	7800	2000				

Table 7. Arkansas River Greenback Restoration Projects and Stocking Schedule. Includes year proposed for renovation (R), year and number of greenback fry to be stocked, and year to open to catch-and-release (C&R) angling based upon the stocking of greenback adults* and fry. 1990-2000.

Site	Ha/Km	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Rainbow Lake, NF	8.6 ha	R	500*/C&R									
			1600	1600	1600							
Native Lake, NF & Inlet	5.7 ha/1.0	R	500*/C&R									
			1640	1640	1640							
Swamp Lakes, NF	6.1 ha	R	200*/C&R									
Swamp Creek, NF	1.1 km	R	1000	1000	1000		C&R					
Elk Creek, LVNFH	1.2 km	R	300*/C&R									
			750	750	750							
Cascade Creek, LVNFH	0.9 km	R	200*/C&R									
			1000	1000	1000							
Bog Creek, LVNFH	0.3 km	R	2500	500	500							
	0.5 ha											
Rock Creek, LVNFH	5.8 km	R	744*/C&R									
			4600	5000	5000							
Greenhorn Cr.	3.2 km			1000	1000	1000	(only if 127 mm fish are available)					
N. Apache Cr.	1.9 km			R	1000	1000	1000	(stock from S. Apache)				
Cottonwood Cr.	6.4 km			1000	1000	(only if 127 mm fish are available)						
Sayres Gulch	2.4 km				R	1200	1200	1200				

Table 7. Cont.

Site	Ha/Km	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
South Fk. Arkansas	4.8 km				R	3000	3000	3000				
Pass Cr. and Lk	3.7 km 2.3 ha					R	5000	5000	5000			
Eight Mile Creek	24.0 km					R	15000	15000	15000			
Stanley Canyon Res.	3.2 ha						R	9000	9000	9000		
Stanley Canyon Cr.	2.7 km											
W. Monument Cr.	5.2 km											
Summary			13290	13490	14490	6200	25200	33200	29000	9000		

Table 8. South Platte River Drainage Greenback Research Cutthroat Trout Stocking Sites. 1990-2000.

Area	Habitat	Elevation	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Rocky Mountain National Park:													
Lily Lake, RMNP	5.0 ha		2668	4895	2500								
Arrowhead Lk.	14.8 ha				3700	3700	3700	3700	3700	3700	3700	3700	3700
Subtotal, RMNP			2668	4895	6200	3700	3700	3700	3700	3700	3700	3700	3700
Private													
Manchester, Lk.	5.0 ha		500			500		500					
Arapaho/Roosevelt National Forest, Central Region, CDOW:													
Up. Diamond Lk.					600	600	600	600	600	600	600	600	600
N. Iceberg Lk.					1000	1000	1000	1000	1000	1000	1000	1000	1000
Heart Lk.					1700	1700	1700	1700	1700	1700	1700	1700	1700
Up. Crater Lk.					850	850	850	850	850	850	850	850	850
Ice Lake					1100	1100	1100	1100	1100	1100	1100	1100	1100
Caroline Lk.					850	850	850	850	850	850	850	850	850
Ethel Lk.					500	500	500	500	500	500	500	500	500
Silver Dollar Lk.					1850	1850	1850	1850	1850	1850	1850	1850	1850

Table 8. Cont.

Area	Habitat	Elevation	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Dorothy Lake					2400	2400	2400	2400	2400	2400	2400	2400	2400
Deep Lk.					1000	1000	1000	1000	1000	1000	1000	1000	1000
Bob Lake					1275	1275	1275	1275	1275	1275	1275	1275	1275
King Lake					1400	1400	1400	1400	1400	1400	1400	1400	1400
Byron Lake					300	300	300	300	300	300	300	300	300
Up. Chicage Lk.					1000	1000	1000	1000	1000	1000	1000	1000	1000
Bard Creek					5000	5000	5000	5000	5000	5000	5000	5000	5000
Subtotal, Central	CDOW				20825	20825	20825	20825	20825	20825	20825	20825	20825
National Forest, Northeast Region CDOW:													
Up. Agnes Lk.	1.2				300	300	300	300	300	300	300	300	300
Up. Carey Lk.	1.6				400	400	400	400	400	400	400	400	400
Clear Lk.	4.0				500	500	500	500	500	500	500	500	500
Iceberg Lk.	2.4				600	600	600	600	600	600	600	600	600
Island Lk.	5.7				1400	1400	1400	1400	1400	1400	1400	1400	1400
Kathleen Lk.	1.2				400	400	400	400	400	400	400	400	400
Lower Longs Lk.	0.8				200	200	200	200	200	200	200	200	200

Table 8. Cont.

Area	Habitat	Elevation	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Up. Longs Lk.	0.8				200	200	200	200	200	200	200	200	200
Rock Hole Lk.	2.4				600	600	600	600	600	600	600	600	600
Rolfs Lk. #1	6.4				1600	1600	1600	1600	1600	1600	1600	1600	1600
Rolfs Lk. #2	4.4				1100	1100	1100	1100	1100	1100	1100	1100	1100
Up. Roxy Anne Lk.	1.6				400	400	400	400	400	400	400	400	400
Ruby Jewel Lk.	1.6				400	400	400	400	400	400	400	400	400
Seven Lks. #1	5.6				1400	1400	1400	1400	1400	1400	1400	1400	1400
Slip Lk.	1.2				300	300	300	300	300	300	300	300	300
Snow Lk.	6.9				1700	1700	1700	1700	1700	1700	1700	1700	1700
Subtotal, NE CDOW					11500	11500	11500	11500	11500	11500	11500	11500	11500

Summary

RMNP					6200	3700	3700	3700	3700	3700	3700	3700	3700
Private						500		500					
Central Region					20825	20825	20825	20825	20825	20825	20825	20825	20825
Northeast Region					11500	11500	11500	11500	11500	11500	11500	11500	11500
Total					38525	36525	36025	36025	36025	36025	36025	36025	36025

Table 9. Arkansas River Drainage Research Greenback Cutthroat Trout Stocking Sites. 1990-2000.

Area	Habitat	Elevation	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
U.S. Army, Fort Carson:													
Lt. Turkey Cr. Pond, Ft. Carson	0.5 ha			250	250	250	250	250	250	250	250	250	250
Subtotal, US Army				250	250	250	250	250	250	250	250	250	250
National Forest, Southeast Region CDOW:													
L. Dry Lake	1.6 ha				400	400	400	400	400	400	400	400	400
Mid. Dry Lake	2.4 ha				600	600	600	600	600	600	600	600	600
Up. Dry Lake	1.2 ha				300	300	300	300	300	300	300	300	300
Kroenke Lake	12.1 ha				3000	3000	3000	3000	3000	3000	3000	3000	3000
Arthur Lake	2.4 ha					600	600	600	600	600	600	600	600
Up. Hancock Lk.	2.8 ha					700	700	700	700	700	700	700	700
Grassy Lake	2.4 ha					600	600	600	600	600	600	600	600
L. Venerable Lk.	3.6 ha					900	900	900	900	900	900	900	900
Up. Venerable Lk.	2.0 ha					500	500	500	500	500	500	500	500