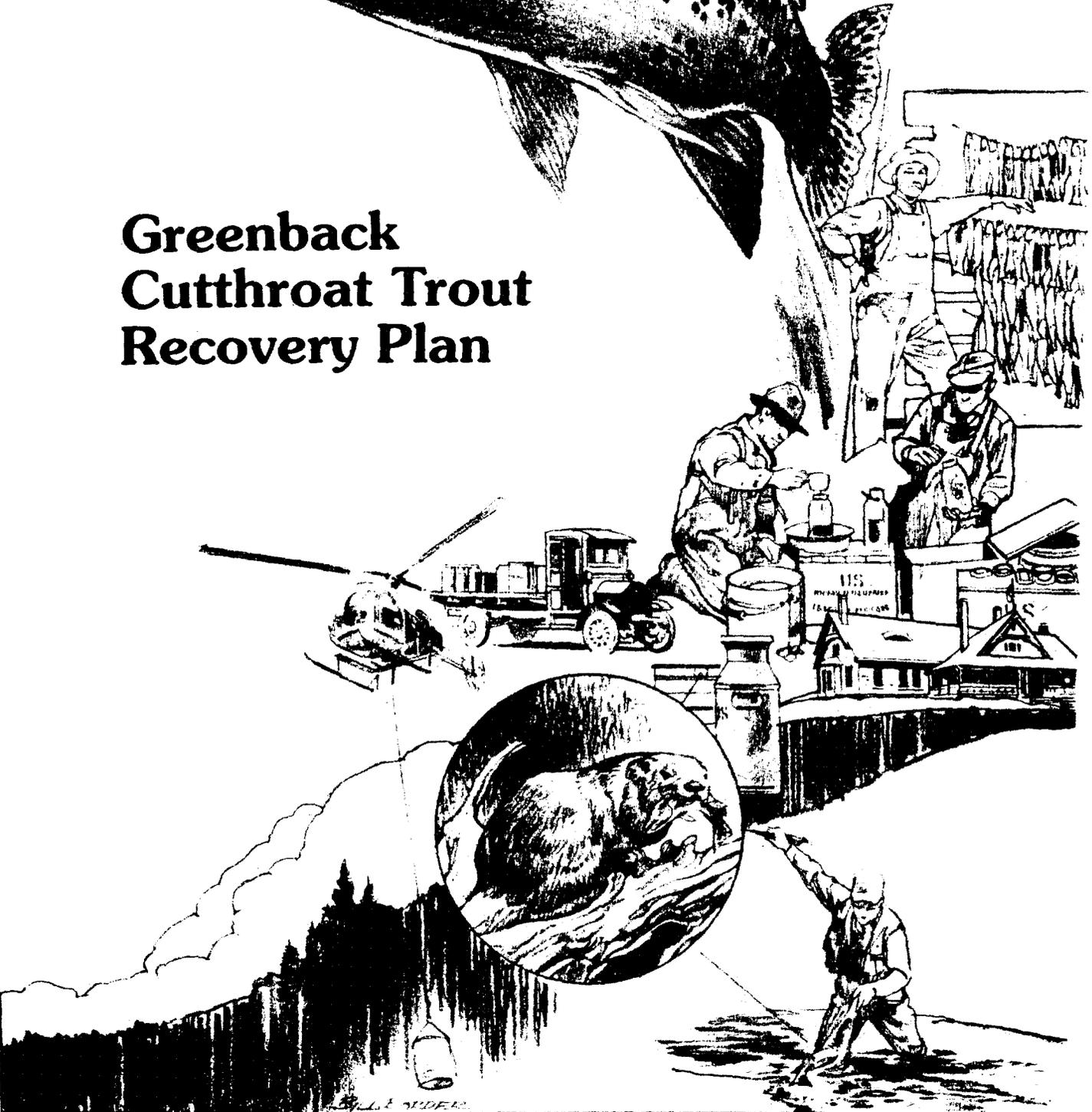


# Greenback Cutthroat Trout Recovery Plan



BILL TIDEL

# Greenback Cutthroat Trout Recovery Plan

Prepared by:  
Greenback Cutthroat Trout Recovery Team

for

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

  
**DEPUTY** Regional Director

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# 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:

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# Executive Summary

**Current Species Status:** The greenback cutthroat trout (*Oncorhynchus clarki stomias*) is the only trout 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 loss of habitat caused by mining and agriculture, over-harvest, and the introduction of non-native 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 4.6 km of stream. The subspecies was listed as "endangered" in 1973, and downlisted to "threatened" in 1978. As a result of recovery efforts, captive broodstocks were established, non-native trout were removed from suitable habitat, greenbacks were reintroduced, stable populations were developed and catch-and-release fisheries were initiated.

Greenback cutthroat trout are present in 62 sites that total 179 hectares (442 acres) of lakes and ponds and 164 kilometers (102 miles) of stream habitat. Forty seven sites are open to catch-and-release fishing and 20 populations are considered to be stable. Seventeen stable populations are located in the South Platte drainage, and three stable populations are located within the Arkansas drainage. These numbers may change as new projects are accomplished.

**Habitat Requirements and Limiting Factors:** This species inhabits cold water streams and cold water lakes with adequate stream spawning habitat present in the spring of the year. Limiting factors include other spring spawning trout species that hybridize with greenbacks, and fall spawning species that compete with greenbacks for food and space, combined with over-harvest of greenbacks.

**Recovery Objective:** Delisting.

**Recovery Criteria:** The goal of this Plan is to restore the greenback cutthroat trout to non-threatened status within its native range. Delisting of this subspecies is considered to be possible by the year 2000. This may be accomplished through maintaining at least 20 stable greenback populations occupying at least 50 hectares (124 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:**

1. Maintain existing populations of greenbacks.
2. Establish or document, 20 stable populations of greenbacks.
3. Establish captive and wild greenback broodstocks within Colorado.
4. Conduct research on greenback angling programs and hatchery programs.
5. Conduct greenback information and education programs.
6. Promote partnerships, and expand efforts to obtain non-agency funding.
7. Prepare a long-term greenback management plan and cooperative agreement.

**Date of Recovery:** 2000.

**Cost of Recovery:** \$634,000.



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 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 four sections:**

- I. Introduction - Historic distribution, type specimens, taxonomy, current distribution, reasons for decline, habitat requirements, reproduction, food and feeding, size and growth, disease and parasites, sensitivity to pH, heavy metals, management practices, fish culture, stocking and angling.
- II. Recovery - Recovery objectives, and tasks considered vital to the successful recovery of the greenback.
- III. Implementation Schedule - An itinerary of scheduled recovery tasks assigning agency responsibility and estimated costs.
- IV. Figures, Tables and Appendices

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.



# Part I Introduction

The greenback cutthroat trout, (*Oncorhynchus clarki stomias*, formerly *Salmo clarki stomias*), is one of the most colorful subspecies of cutthroats (Figure 1), and 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. Since then, seven additional historic populations have been identified, five populations in the South Platte River drainage and two populations in the Arkansas River drainage. The historic populations are listed in Table 1.

Contrary to the common name of the fish, the back of the greenback is not especially green in color. In older age classes (4 years or more), 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). The greenback was known to occur within these drainages at lower elevations than it occupies today, however, little is known of its exact historic lake and stream distribution and the range in elevation it once occupied. The only other trout 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 became extinct in the early 1900's.

## 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 *S. stomias* is the Kansas River at Fort Riley, Kansas.



Figure 1. Mature South Platte drainage greenbacks from stream and lake environments, Rocky Mountain National Park, 1992.



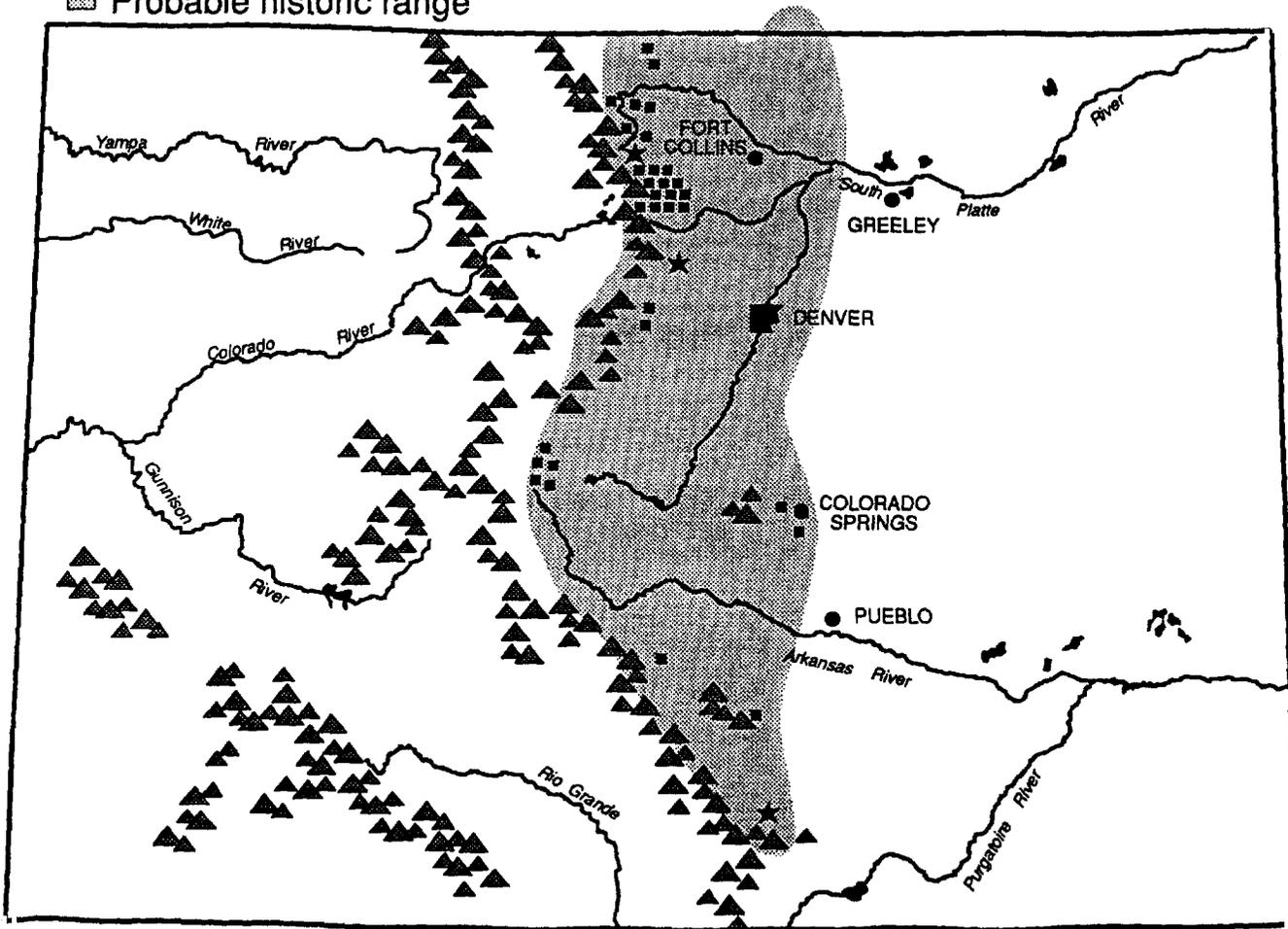
Mature female greenback with typical non-spawning coloration and spotting pattern from a small stream environment, Hunters Creek, RMNP



Mature male greenback with typical spawning coloration and spotting pattern from 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. 1994.

- ★ Historic populations known prior to 1978
- Populations, 1991
- ▣ Probable historic range



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 difficult to unravel the myriad of systematic problems within inland *O. clarki* (Gold 1977).

The taxonomy of the greenback cutthroat trout (*O. c. stomias*) has been described by Wernsman (1973), Behnke (1973, 1979), and Behnke and Zarn (1976). The following description of the subspecies is 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 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" (see Figure 1).

A summary of meristic characteristics for various Colorado subspecies of *O. clarki* (*Salmo clarki*) are provided in Figure 3.

Although there is a close relationship between greenbacks and Colorado River cutthroat trout, recent mitochondrial DNA studies indicate that both the Arkansas River and South Platte River greenbacks are more closely related to each other, than to populations of Colorado River cutthroat. Greenbacks from the Arkansas and South Platte River drainages are nearly identical in DNA fragment patterns (Proebstel 1993). However, because of the geographic separation of the drainages, greenbacks from the two drainages should not be mixed for restoration purposes.

Since greenback cutthroat trout hybridize with other species and subspecies of *Oncorhynchus*, 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 C (obvious hybrids).

Only Type A populations are considered for recovery purposes in this plan (Tables 1-4). However, known type B and C greenback populations (Table 5) 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.

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)	
<i>S. clarki stomias</i> (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
<i>S. clarki virginalis</i> (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
<i>S. clarki pleuriticus</i> (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
<i>S. clarki macdonaldi</i> (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
<i>S. clarki lewisi</i> (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)	
<i>S. gairdneri</i> (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.

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

## Current Distribution

The greenback cutthroat trout currently occurs in 61 sites that total 166 hectares of lakes and 165 kilometers of stream habitat in the upper tributaries of the South Platte and Arkansas river drainages. Nine “historic” populations remain that have been identified through recovery efforts conducted since 1973. Pure greenbacks have been introduced into 52 additional streams and lakes within the species historic range (as described in Objective 2, Part II of the Recovery section).

At present, twenty populations (including both historic and restoration populations) are believed to be stable self-sustaining populations (See definition in Part II), but only three of these stable populations occur in the Arkansas River drainage. The “historic” populations are located in the higher elevations of the species’ historic range, probably because of less habitat disturbance and less accessibility to humans than occurred in the lower elevations.

## Reasons for Decline

### **Fate of Historic Populations**

Four cutthroat trout subspecies are known to have existed in Colorado when European settlers first arrived: greenback cutthroat trout, yellowfin cutthroat trout, Rio Grande cutthroat trout, and the Colorado River cutthroat trout. The yellowfin cutthroat occurred in the upper Arkansas River drainage in Twin Lakes, the Rio Grande cutthroat occurred in the Rio Grande drainage, and the Colorado River cutthroat occurred in the Colorado River drainage. Unfortunately, all four cutthroat trout subspecies proved quite

susceptible to negative influences associated with 19th century development of Colorado. Land and water exploitation, mining, agriculture, 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 endemic trout subspecies than the introduction of non-native salmonids which hybridized and competed with native fishes. Shortly after the turn of the century, greenbacks had declined to a point that Greene (1937) believed them to be extinct.

The fate of the greenback population native to Twin Lakes, in the Lake Creek drainage, illustrates the effects of subsistence harvest and stocking of nonnative fish, and typifies the response 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 fish culture combined to make large numbers of fish eggs and fry readily available and transportable in a relatively short period of time. The greenback's 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 greenback's limited native range.

## Hybridization

Greenbacks hybridize readily with rainbow trout and other subspecies of cutthroat.

Several hybridized populations known to occur in Colorado are shown in 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 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 and Zarn 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 through larger brook trout young-of-the-year (YOY). Brook trout spawn in the fall. Their fry emerge from the redds much earlier in the year than do the spring spawning greenbacks, and the YOY brook trout can be 30 mm longer than YOY greenbacks by their first October. In Hidden Valley Creek, Rocky Mountain National Park (RMNP), YOY brook trout (65 mm) and YOY greenbacks (35 mm) 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% of fish numbers) 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 unnamed falls on the upper North Fork of the Big



Thompson River, RMNP in 1970, and established a reproducing population. 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, though greenbacks reached 304 mm.

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.

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. Brown trout even outcompeted greenbacks that were 1.27 times longer and 1.69 times heavier. Slow current combined with dim light significantly increased attack frequency of brown trout on greenbacks. Few greenback restoration projects involve former brown trout habitat. However, the dominance of brown trout over greenbacks (as indicated by Wang's study) is evident in George and Cornelius Creeks, where brown trout appear to be displacing greenbacks (Steve Puttmann, Colorado Division of Wildlife, pers. comm., 1991).

## Angler Harvest

The removal of adult greenbacks by anglers, may have had a negative impact upon greenbacks, especially when non-native salmonids were present. Cutthroat trout are more easily caught than other species. Removal of the older, larger greenbacks might favor brook trout, which 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, (Ouzel, Hidden Valley, George and Cornelius Creeks) brook trout continue to expand into populations of greenbacks despite no legal angler harvest of greenbacks.

## 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 trout will require their removal prior to the introduction of greenbacks to prevent hybridization and competition.

Stable reproducing populations of greenbacks in Colorado are rarely found above 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. Currently, the highest known elevation of a long-term reproducing population is the Upper Hucheson Lake population at 3,402 m. Due to the availability of surplus greenbacks, experimental introductions are being conducted in high elevation 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 the non-native fish stocking, were subsequently stocked with native greenbacks. In one of these lakes (Lake Odessa at 3,048 m), greenbacks spawned from late June to early July and established a reproducing population. Greenbacks stocked in the other lake, Crystal Lake (3,511 m) spawned by mid-July, but survival past the egg stage was not documented through 1995.

The lower elevation limit of greenback survival is not known. However, greenbacks stocked in a low elevation lake (1,889 m) on Fort Carson, Colorado, have survived and attained a size of 2.0 kg. Future experimental stocking should involve lower elevation projects to determine greenback survival in low elevation habitats, and in association with native non-salmonid forage species in low elevation habitats.

## Reproduction

Spawning is generally initiated in the spring when water temperatures reach 5C-8C. 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 Hucheson Lake (3,402 m) spawn by 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 in 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 (Type B), averaging 270+mm in length, had a mean value of 299 eggs per fish (Nelson 1972). Como Creek greenbacks (Type A) 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 slightly hybridized (Type B) greenback fry emerging on August 26.



## Food and Feeding

Jordan (1891) mentioned that *O. c. 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, analysis of greenback stomach contents revealed that terrestrial invertebrates comprised a relatively constant proportion of the diet through September, but the proportion of terrestrial invertebrates in the diet declined rapidly in October as temperatures declined. None of the stomachs contained YOY greenbacks.

The stomach of an 1.19 kg pure (type A) Cascade Creek greenback, illegally taken from Lytle Pond, Fort Carson contained a 114 mm tiger salamander (*Amystoma tigrinum*) in 1982. Variations in the Arkansas darter population that co-exists with the greenbacks in Lytle pond indicate that greenbacks eat these native darters, 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."

Nonetheless, the size and growth of greenbacks varies, based upon the elevation and population size. In small headwater habitats, the greenback has attained 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 pure (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.

The growth rate of adult greenbacks at higher elevations can be much lower depending on a variety of factors including population density. This is demonstrated by two alpine lakes in RMNP (Sandbeach and Pear) where the non-native trout population had been removed. The lakes were stocked with 161 mm greenbacks at the rate of 22.7 to 26.0 kg/ha on June 30, 1989. After 10 weeks, the fish increased in length by an average of 57 mm (range 47-68 mm). Both 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 on the Hunters Creek historic population, indicated that growth for six greenbacks (178-252 mm in length), averaged only 6 g from June 1988 to June 1989, with no measurable change in length. 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 64 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 1996, 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 Health 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, Farag, Little, Steadman, and Yancik (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. Reduced pH is a concern, because most of the historic greenback populations and greenback restoration projects are located in alpine habitats that are susceptible to acid precipitation.

## Heavy Metals

Bard Creek was a fishless montane stream that was known to have elevated levels of heavy metals due to past mining activity.

Experimental stocking of greenbacks into the fishless habitat of Bard Creek 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 mature fish deposited by late June did not 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.

## Management Practices

### 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 subspecies 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. bouvieri*) from Yellowstone Lake, led to the abandonment of the greenback by early fish culturists 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 64 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, the loss of males due to fungus, and the failure to accept feed 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. Fungus 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 and Rosenlund, 1988). This action also helped enhance the genetic diversity of the broodstock. 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. Interestingly, eggs from the Poudre River population required much less time to develop and hatch than did those of the greenbacks from the Arkansas River 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 eggs from Cascade Creek (J. Hammer, Saratoga NFH, personal communication).

New South Platte and Arkansas greenback broodstocks 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, and eggs were collected again from the Poudre River in July 1992. Eggs were collected from the CDOW Experimental Hatchery broodstock in 1991 and 1992, with problems of 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. The Greenback Recovery Plan also calls for development of an Arkansas River greenback broodstock. To develop this broodstock, greenbacks from Cascade Creek were introduced into McAlpine Pond (privately owned) and Lytle Pond (on Ft. Carson Army Base). In 1984, eggs were collected from the greenbacks spawning in McAlpine Pond and in Lytle Pond and were sent to Saratoga NFH. Fry and catchable-sized greenbacks were produced at Saratoga NFH from 1987 through 1992. Due to FWS funding problems and the predominance of old adults within the Saratoga broodstock, the Arkansas River broodstock program was transferred from Saratoga NFH to the CDOW Experimental Hatchery. To facilitate establishment of the new broodstock at the CDOW Experimental Hatchery, 3,200 eggs from South Apache Creek and 10,000 eggs





### **Leadville National Fish Hatchery Egg Collection, Circa 1890**

from Saratoga NFH were shipped to the CDOW Experimental Hatchery in 1992. Following the collection of eggs at the Saratoga NFH in 1992, the remaining greenbacks at Saratoga NFH were 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 methods usually involved stocking low numbers (64 to 84) of adult and sub-adult greenbacks into renovated habitats during the fall of the year. Only small numbers of greenbacks were stocked due to the limited number of fish available from

Como Creek. Unfortunately, colonization of the habitat was slow and genetic diversity was impaired due to the limited numbers of fish stocked. These problems also undermined confidence in the ability to establish fishable populations. The captive broodstock programs were initiated to allow more rapid establishment of new populations, to protect the small historic populations from over utilization as broodstock sources, and to allow for genetic management. The captive broodstock program produced enough greenback fry to support stocking within each restoration site for at least three consecutive years. This multi-year stocking facilitated establishment of several year classes within the new restoration sites, and, by using milt from different historic populations to fertilize the hatchery eggs, enhanced the genetic diversity of the reestablished populations.

Initially, stocking rates for hatchery fry were 2,500 fry/ha per year in fishless lakes, and 1,666 fry/1.0 km per year in fishless streams, with each area to be stocked for three consecutive years. These rates were believed to be necessary to compensate for the stress and mortality of 12 hours of trucking required to move the fish from Bozeman, Montana to Ft. Collins, Colorado, followed by final stocking by horseback or helicopter. However, the stocking rates for fry in lakes were found to be excessive, and were reduced to 1,000 fry/ha per year. The reduced stocking rate facilitated increased growth rates and the production of catchable size fish within four years.

Stocking of sub-adult (161 mm) greenbacks in June 1989 facilitated more rapid reestablishment of fishable populations, and allowed these areas to be reopened to angling the following year. However, there were logistical problems in transporting the larger fish (over 386 total kg of fish) into inaccessible alpine lakes within the RMNP. To resolve these problems, helicopter fire buckets aerated with oxygen were used to transport the fish. These lakes were stocked at the rate of 18.5 to 36 kg of fish/ha. This same technique was used on the Rock Creek drainage, above the Leadville National Fish Hatchery in 1991. Stocking in the Rock Creek drainage used larger greenbacks (234 mm), and allowed the area to immediately be reopened to catch-and-release angling.

## Angling

As with most subspecies of cutthroat trout, the greenback is easily caught by sport anglers. This feature makes the greenback a good fish for catch-and-release fisheries today,

but severely impacted the abundance and distribution of the subspecies during the 1800's. Wiltzius quoted 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. A few of these studies are described below:

### South Platte drainage, mixed-trout fisheries.

In September 1973, brook trout and longnose suckers were removed from Hidden Valley Creek, RMNP, using antimycin. This was followed by the stocking of 82 greenbacks from Como Creek in October 1973. The greenbacks established a reproducing population in both ponded (beaver ponds) and non-ponded stream habitats; but by 1976, brook trout were once again collected in Hidden Valley. Brook trout numbers continued to increase in the beaver pond habitats within the creek 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; however the ratio varied between ponds from 1:1 to 1:50. During the first week of fishing in 1982, anglers fishing in the beaver ponds 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. This demonstrated that although greenbacks were the minority of the fish in the ponds, they represent the majority of the fish caught. Fifteen percent of the greenbacks captured in fyke nets during September 1983 exhibited visible damage attributed to angler's hooks.

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 1984-1993. Although anglers must release all greenbacks, as many as seven percent of the greenbacks were kept due to mistaken identification of subspecies in 1986.

South Platte drainage, greenback-only fisheries. Several lakes and streams within the Roosevelt National Forest and RMNP are open to catch-and-release angling for greenbacks (see Tables 1-4). Greenback biomass in restoration projects is usually greater under catch-and-release regulations than that found under the previous catch-and-kill regulations. Angler success rates for greenbacks ranged from 0.3 to 6.4 fish per hour in streams within RMNP in the period from 1986-1989, and

ranged from 1.7 to 12 fish per hour on National Forest and RMNP waters in the period from 1990 to 1993.

Arkansas River drainage. The first catch-and-release greenback fishery in the Arkansas River drainage 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 for this pond. 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. In this census anglers ranked themselves as "experienced" anglers, and indicated the following angler success and satisfaction:

**Fort Carson Creel Census, 1990-1991**

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

As in RMNP, about 16% of the fish examined showed some signs of hooking or hooking damage. Although brook trout were present in Lytle Pond, none were reported caught in the 1990-1991 creel census. This again demonstrates the greater susceptibility to angling exhibited by greenbacks.





The purpose of this plan is the reestablishment of pure greenback cutthroat trout to population levels where the subspecies will not likely become extinct throughout all or a significant portion of their historic range. Overall, an ecosystem management approach will be used, with special considerations for impacts to listed species, other native species, water quality and public use. For a summary of previous recovery accomplishments and activities, please see Appendix I.

## Objective

*THE OBJECTIVE OF THE GREENBACK CUTTHROAT TROUT RECOVERY PLAN IS THE REMOVAL OF THIS SUBSPECIES FROM THE LIST OF THREATENED AND ENDANGERED SPECIES. THIS SUBSPECIES WILL BE CONSIDERED RECOVERED WHEN 20 STABLE GREENBACK CUTTHROAT TROUT POPULATIONS ARE DOCUMENTED REPRESENTING A MINIMUM OF 50 HECTARES OF LAKES AND PONDS AND 50 KILOMETERS OF STREAM HABITAT WITHIN ITS NATIVE RANGE. A MINIMUM OF FIVE OF THESE POPULATIONS WILL EXIST IN THE ARKANSAS RIVER DRAINAGE. ONCE RECOVERY OBJECTIVES HAVE BEEN MET, A LONG RANGE MANAGEMENT STRATEGY WILL BE IMPLEMENTED FOR THE CONTINUED RESTORATION OF THE SPECIES.*

For delisting purposes, 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 adults (individuals greater than 120 mm in total length), and represent a minimum of two year classes within a five-year period that are established through natural reproduction. A minimum of 120 breeding pairs (240 adult fish) was considered necessary to maintain genetic diversity within a population (Leary, pers com), and the team has set a minimum of 500 adults as necessary to insure maximum genetic diversity for each wild greenback population. Twenty stable reproducing populations, along with the above population criteria, are needed to quantify an adequate population to meet the stated recovery objectives. This strategy distributed into two separate drainages (the Arkansas and the South Platte), will provide a minimum viable population goal that can be monitored and maintained.

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 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 stable population should contain at least two hectares of habitat that is separated by barriers to upstream fish migration. Each stable population within a drainage must meet the previously stated requirements for biomass, population size and reproduction.

The locations the team has selected for recovery sites have concentrated on headwater streams and high elevation lakes. These sites provide the most likely sites for successful recovery of this species due 1) to presence of barriers; 2) ease of removing non-native fish; 3) inaccessibility which reduces problems with reintroduction of non-native species; and 4) the fact that existing remnant populations were discovered in headwater habitats. As the recovery progresses, both larger and lower elevation habitats may be renovated.

Previous editions of the Greenback Cutthroat Trout Recovery Plan identified recovery actions that have resulted in significant improvements in the status of the greenback. Twenty stable populations now exist, however only three stable populations occur in the Arkansas River drainage. Two major actions that need to be accomplished before the species can be delisted are:

1. **The establishment of two additional stable populations in the Arkansas River drainage and**
2. **The preparation of a long-term management plan and a cooperative management agreement for greenback cutthroat trout to guide management of the greenback after delisting.**



## Stepdown Outline

1. Maintain or enhance all known Type A greenback cutthroat trout populations and their habitats.
  - 1.1. Conduct population and habitat monitoring.
  - 1.2. Enhance or restore habitat.
  - 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 subspecies' historic range.
  - 2.1. Conduct surveys for historic populations.
  - 2.2. Prepare and maintain a list of candidate habitats.
  - 2.3. Consult with land owners and management agencies.
  - 2.4. Prepare habitats listed in Tables 6 and 7 for reintroduction.
    - 2.41. Conduct habitat manipulation.
    - 2.42. Construct or improve barriers.
    - 2.43. Remove all non-native salmonids.
  - 2.5. Introduce pure (Type A) greenback cutthroat trout.
    - 2.51. Use appropriate stocking rates for fish from wild populations.
    - 2.52. Use appropriate stocking rates for larval hatchery fish.
  - 2.6. Monitor and document the success of each introduction.
  - 2.7. Annually update greenback cutthroat trout population status.
  
3. Establish hatchery and wild populations of pure (Type A) greenback trout for broodstock.
  - 3.1. Establish a South Platte River wild broodstock.
  - 3.2. Establish an Arkansas River wild broodstock.
  - 3.3. Establish captive broodstocks.
    - 3.31. Collect and utilize milt from wild populations.
    - 3.32. Establish South Platte River and Arkansas River greenback broodstocks at Colorado Division of Wildlife hatcheries.
    - 3.33. Prepare reports on the status of the hatchery program.
    - 3.34. Provide fish culture information necessary for the development of the long-term management plan and cooperative agreement.



4. Document response to angler pressure, stocking rates, fish diseases, fishing regulations, and native non-salmonids.
  - 4.1 Assess mixed greenback/non-native salmonid recreational fisheries under a variety of harvest regulations.
  - 4.2 Implement catch-and-release greenback fisheries programs on public lands.
  - 4.3 Complete research on fish diseases, stocking, and angling programs.
  - 4.4 Complete research on stocking of greenbacks into waters with native non- salmonids, or, introduce native non-salmonids to greenback projects.
  
5. Conduct an information and education program.
  - 5.1 Encourage information and education programs.
  - 5.2 Promote interagency cooperation and understanding of recovery activities whenever possible.
  - 5.3 Present current activities at 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-traditional agency funds and private funds.
  - 6.2 Market 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 long-term 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.**

*Type A greenback populations are those that are considered to be genetically pure. Other populations (Type B-C) are believed to have varying degrees of hybridization with non-native trout species. All known Type A populations and their habitats will need to be maintained to ensure the continued health and survival of greenback populations. This will involve regular censusing of populations, restoration and enhancement of habitat, and maintenance of stream barriers.*

- 1.1. Conduct population and habitat monitoring. All streams that contain populations of pure (Type A) 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. Increased public education as described in Objective 5 will help to meet this objective.
- 1.5. Promote sound land and water use guidelines. Promote and support mining, grazing, logging, and agricultural and silvicultural techniques that do not adversely affect the greenback cutthroat trout habitat. The establishment and maintenance of buffer strips along streams should be encouraged to help protect habitat from human and livestock impacts. The land use practices listed below should be reviewed to ensure that they are not negatively affecting greenback populations:
  - a. Grazing practices.
  - b. Maintaining riparian vegetation.
  - c. Silvicultural practices.
  - d. Mining activities.
  - e. Instream flow maintenance.
  - f. Water diversion and reservoir operations.
  - g. Road construction.
- 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, Fish and Wildlife Service, U.S. Army, Ft. Carson and U.S. Air Force, Air Force Academy is necessary to ensure that the populations are protected from overharvest.





## **2. Establish or document the existence of 20 stable populations of pure (Type A) greenback cutthroat trout within the subspecies' historic range.**

*In order to meet the recovery goal for delisting the subspecies, the existence of 20 stable populations of pure (Type A) greenback populations, representing a minimum of 50 hectares of lakes and ponds and 50 kilometers of stream habitat which has a minimum biomass of 22 km/ha, will need to be established or documented within the subspecies historic range. A minimum of five populations will be in the Arkansas River drainage.*

*This Task has largely been completed, with 20 stable populations documented, representing 53.9 hectares of lake habitat and 50.7 kilometers of stream habitat, Table 4. However, only three stable populations currently exist within the Arkansas River drainage.*

*Thus, the major task that needs to be accomplished under this revision of the Greenback Cutthroat Trout Recovery Plan is the documentation of at least five stable reproducing populations within the Arkansas River drainage (see 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. Prepare and maintain a 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 (Type A) South Platte and Arkansas River greenback cutthroat trout. A list of candidate habitats has been developed (see Tables 6 and 7). These tables will need to be updated as new habitat areas are identified. The selection of candidate aquatic habitats is 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.

- 2.3. Consult with landowners or agencies responsible for land management of candidate habitats. Determine if the establishment of a greenback cutthroat trout population in a candidate area would be compatible with landowner or agency management goals.
- 2.4. Prepare habitats listed in Tables 6 and 7 for reintroduction. Carry out remedial actions necessary and appropriate to make candidate waters listed in Tables 6 and 7 suitable for the introduction of pure (Type A) greenback cutthroat trout. Aquatic habitats that have been 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 three stable reproducing populations currently exist in this drainage.
  - 2.41. Conduct habitat manipulation. If necessary and appropriate, enhance candidate habitat to restore pool/riffle ratios, riparian vegetation, spawning habitat, water quality and protection from excessive disturbance.
  - 2.42. Construct or improve barrier(s). Although natural fish migration barriers are preferred, some areas may require the construction of artificial barriers or improvement of existing barriers.
  - 2.43. Remove all non-native salmonids. Use piscicides to remove all non-native salmonids from the candidate habitats. Review the success of this removal and repeat the application of piscicides, if necessary. Special emphasis should be given to completing removal of non-native salmonids in candidate habitats within the Arkansas River drainage. Allow treated habitats to remain fishless for a minimum of 6 months prior to proceeding with the reintroduction of greenbacks and other native fish (Task 2.5).



- 2.5. Introduce pure (Type A) greenback cutthroat trout. 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 (Table 6) 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.

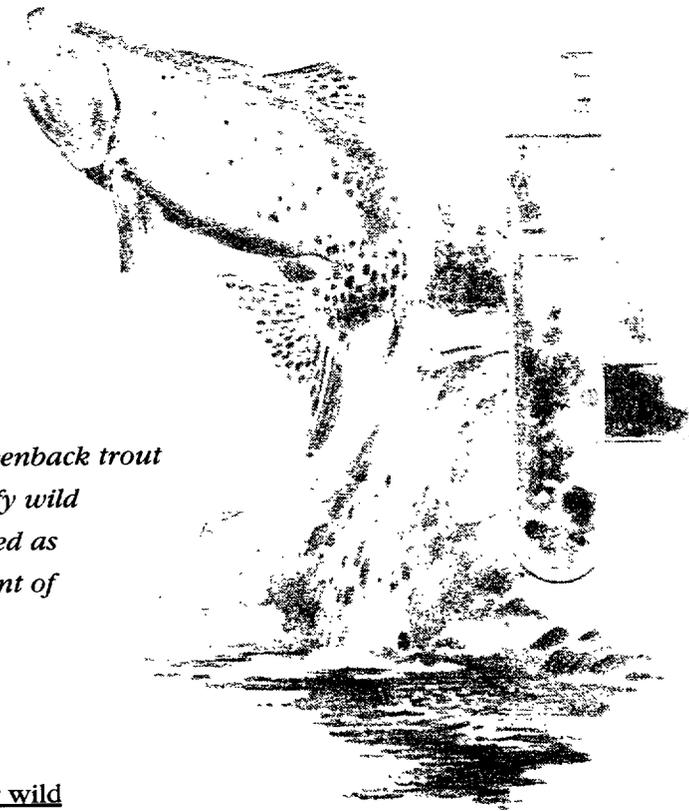
Greenback cutthroat trout populations established within the Arkansas drainage (Table 7) should be established with trout from Cascade Creek, South Fork Apache Creek, their descendants, or from yet to be determined Type A Arkansas River populations.

- 2.51. Use appropriate stocking rates for fish from wild populations. Stocking rates for greenbacks from wild populations should be 240-500 sub-adults or adults per site, with 500 being the most desirable number. Removal of any greenbacks from pure (type A) populations will require approval from the Service and from responsible management agencies.
- 2.52. 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.
- 2.6. Monitor and document the success of each introduction of greenbacks into candidate waters. Greenback trout reintroduction 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 the criteria defining stability. Monitoring and reporting of each project's success will be the responsibility of the lead agency on the project.
- 2.7. Annually update greenback cutthroat trout population status. Prepare annual updates of the list of historic populations (Table 1), the restoration projects (Tables 2 and 3), the summary of total greenback populations (Table 4), list of hybrid populations (Table 5), the candidate list of restoration projects (Tables 6 and 7), and the list of research stocking projects, (Tables 8 and 9).



### **3. Establish hatchery and wild populations of pure (Type A) greenback cutthroat trout for broodstock.**

*Efforts will be pursued to establish greenback trout populations in captivity and to identify wild greenback populations that can be used as broodstock to support the establishment of additional greenback populations within the subspecies' historic range.*



- 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 wild broodstock source. These broodstocks can also constitute one or more of the 20 stable populations under Task 2.0. This Task has been completed; wild greenback populations in Como Creek, Hunters Creek, Bear Lake and Upper Hutcheson Lake are identified as suitable egg sources. Zimmerman Lake was renovated in 1995, and will serve as a wild broodstock lake.
- 3.2. **Establish an 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 or more of the 20 stable populations under Task 2.0. This task has been completed. Eggs have been collected from Lytle Pond on Ft. Carson, from South Apache Creek and Boehmer Reservoir.
- 3.3. **Establish captive broodstocks.** 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 restoration sites in Colorado will be done in accordance with current State and Federal fish disease policies and good fisheries management practices. Use greenback fry from this source to reintroduce greenbacks into candidate habitats as outlined in Task 2.4.



In addition to the Bozeman program, another successful hatchery program was demonstrated at the Saratoga NFH in Wyoming. Both of these greenback hatchery programs ended in 1992. A hatchery program at the CDOW Experimental Hatchery was initiated in 1989.

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 broodstocks to minimize genetic drift within the hatchery. This task has been completed. Milt from Hidden Valley Creek, Como Creek, Poudre River and Hunters Creek broodstocks have been used since 1982.

3.32. Establish South Platte River and Arkansas River greenback broodstocks at Colorado Division of Wildlife hatcheries. 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. Greenback eggs and fry have been produced at the Experimental Hatchery, but 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. Recently, raceways have been covered to provide shade, with the shading of raceways appearing to greatly reduce fungus problems.

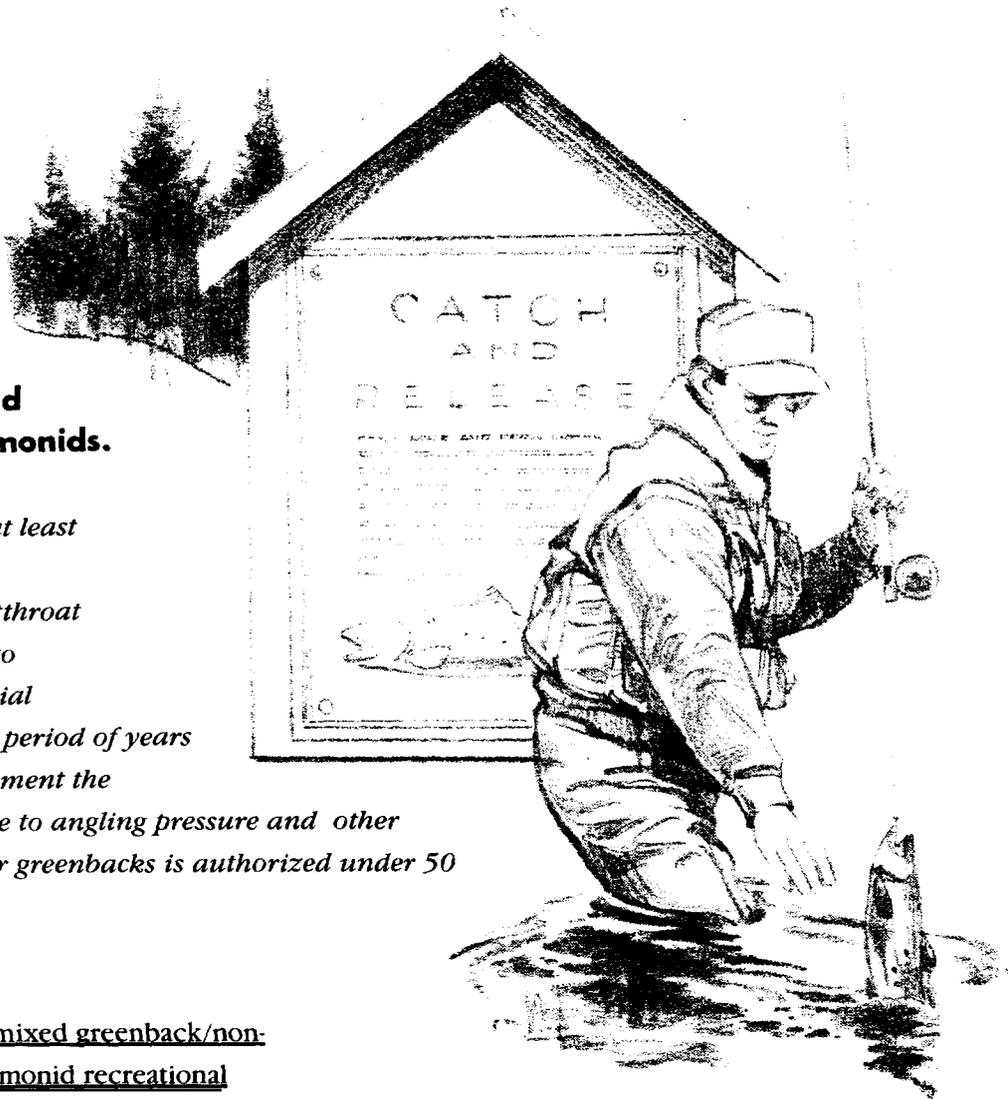
3.33. Prepare reports on the status of the hatchery program. Annual reports have been prepared by each hatchery operating a greenback broodstock.

3.34. Provide information necessary for development of a long-term management plan and cooperative agreement. The Bozeman FTC and the CDOW Experimental Hatchery should prepare a report which addresses management topics pertinent to the long-term management plan discussed in Task 7.0, and provide additional information detailing hatchery aspects of managing greenbacks.



**4. Document response to angler pressure, stocking rates, fish diseases, fishing regulations, and native non-salmonids.**

*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 subspecies' response to angling pressure and other factors. Angling for greenbacks is authorized under 50 CFR 17.44 (f).*



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

This task is completed. A mixed brook trout-greenback cutthroat trout fishery exists within the beaver pond habitat of Hidden Valley Creek, RMNP. This area was 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 angling program did not result in a significant long-term improvement in the Hidden Valley greenback population, although it may have slowed the decline of the greenback population.

4.2. Implement catch-and-release greenback fisheries programs on public lands.

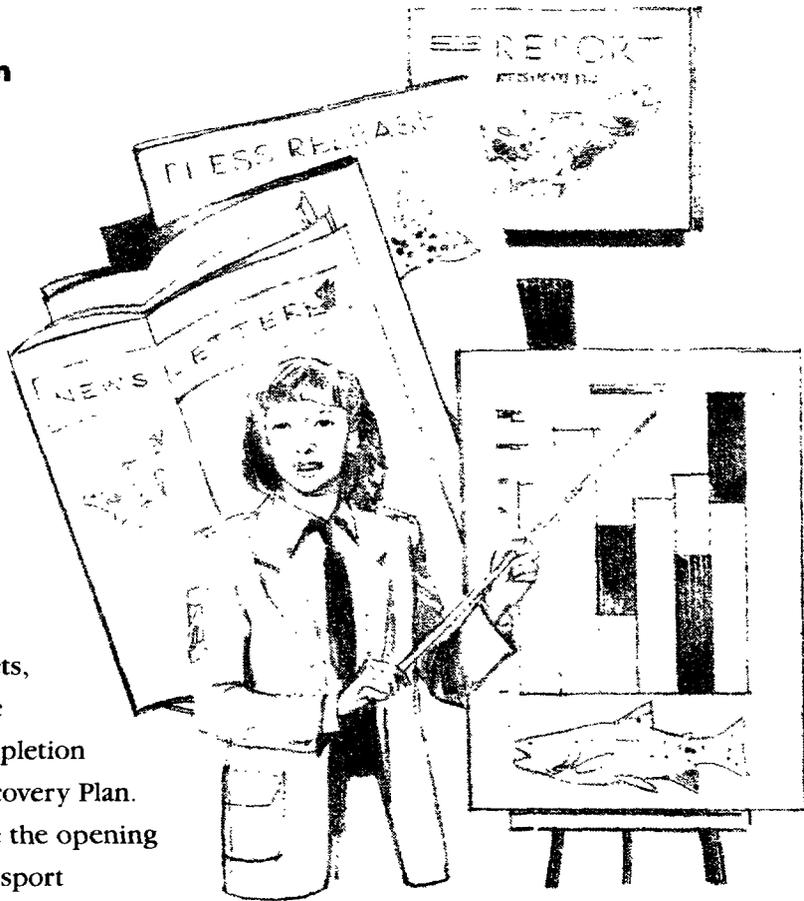
This task is completed. Areas opened to catch-and-release fishing are listed in Tables 1-4. Monitoring is needed in these areas to determine angler success rates and population status. The purpose of this task is to allow sport fishing for greenbacks, and therefore engender public support for further reintroductions of greenbacks, without impacting the stability of greenback populations.



- 4.3. Complete research in fish diseases, stocking, and angling resolutions. Research on fish diseases, stocking, and angling programs will be conducted using surplus captive reared greenbacks to explore their response to a wide range of habitat types, estimated fish diseases, 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. The purpose of this research is to evaluate the opportunity for greenbacks and other native non-salmonids to coexist, and to provide information on survivability of greenbacks in lower elevation waters. One project has been completed at Lytle Pond, U.S. Army, Ft. Carson, Colorado. In this project, Arkansas darters were released in 1980, into an area occupied by greenbacks. Both species have coexisted since 1980. Other proposed projects include evaluation of greenback survival with white suckers and creek chubs in Monument Creek and Crow Creek. However, due to the proximity of these streams to urban areas and the increased potential for harm to any introduced greenbacks from increased human intrusion, these projects may have to be completed after delisting to prevent conflicts due to the current listed status of the subspecies.

## 5. Conduct an information and education program.

*An information and education program is needed to promote public support. This program should explain the goal, objectives, recovery activities, and public fishing programs for the greenback cutthroat trout.*



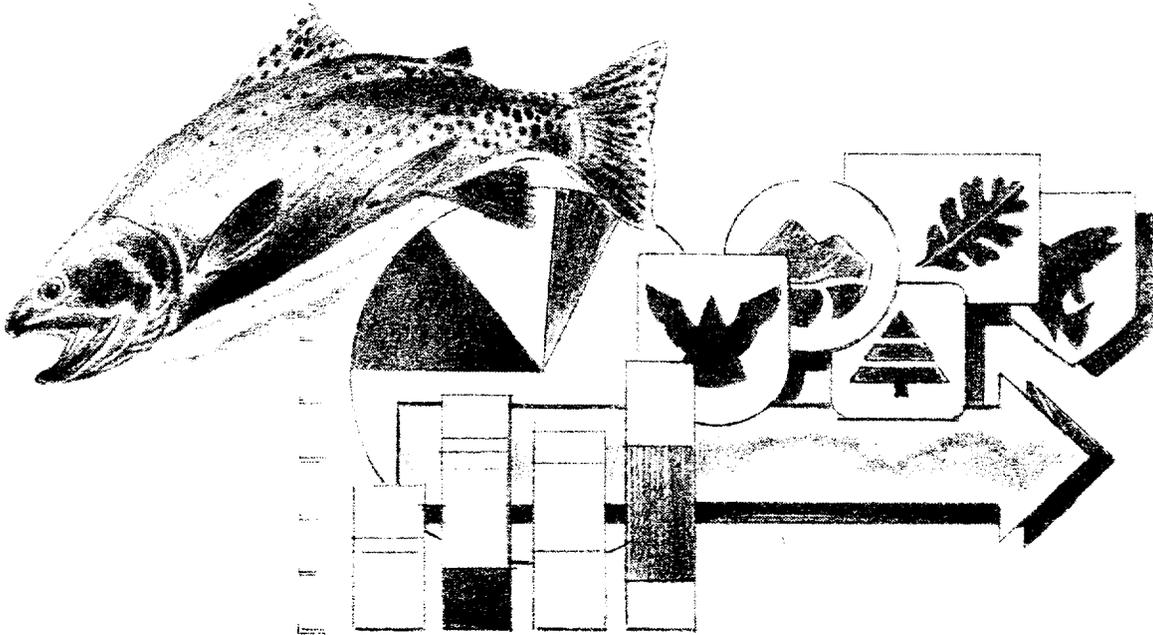
- 5.1. Encourage I&E programs. Make newsworthy activities available to media outlets, particularly when these activities mark the completion of objectives of the Recovery Plan. These activities include the opening of lakes and streams to sport fishing, local hatchery greenback activities, and watchable fish programs. Public understanding and support of propagation, reintroduction, and angling management needs, as discussed in Tasks 2, 3 and 4 of this Plan, will promote efforts to recover the greenback cutthroat trout.
- 5.2. Promote interagency cooperation and understanding of recovery activities. Whenever possible, efforts should be made to promote interagency cooperation and understanding of activities needed for recovery of the greenback cutthroat trout. This should include sponsoring interagency coordination meetings, preparing agency reports and publications, and providing 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. Programs to provide viewing opportunities for the public to view greenback trout and their habitats should be promoted throughout 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.



- 5.5. 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. This task was completed in 1994.
  
- 5.6. Prepare a greenback display. Develop a greenback display for use in public relations and education programs describing the history, biology, and ecology of greenback cutthroat trout and of sympatric native species. This task was completed in 1993.



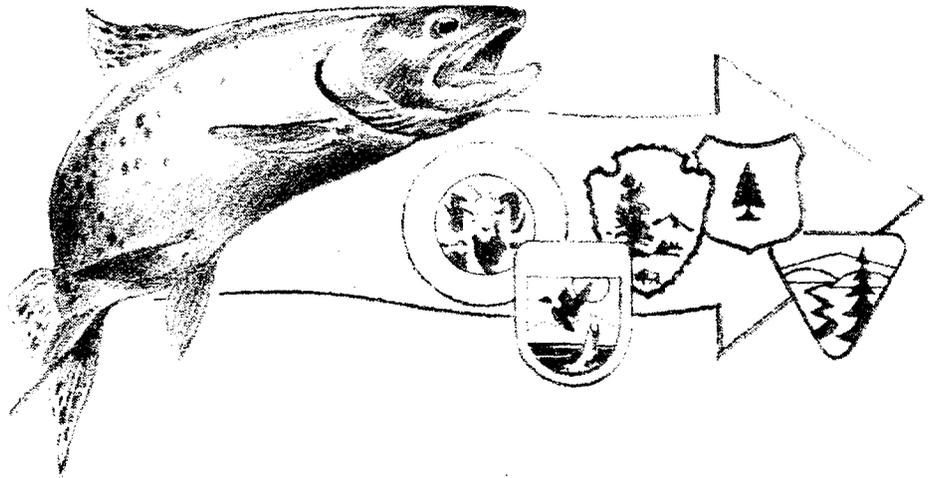
**6. Promote partnerships with conservation groups and explore alternative management and funding strategies.**



- 6.1. Increase the use of non-traditional agency funds and private funds. Explore opportunities to increase funds available for completion of greenback recovery programs, by using non-traditional or private sources, such as inter-agency funding, challenge grants, and Fish American funding of restoration work.
- 6.2. Market art work. Produce art work based upon greenbacks that promote public awareness and support for the recovery of the subspecies. Market art work such as a limited edition greenback print, postcards and shirts to produce funds for greenback restoration activities. This task has been completed.
- 6.3. Produce a greenback brochure. Produce a greenback brochure with funding from Colorado Trout Unlimited. This task has been completed.



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



*Prior to delisting the greenback cutthroat trout, a long-term management plan and cooperative agreement for the management of greenback cutthroat trout will need to be prepared. This plan should be approved and utilized by 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 and B greenbacks.*

*The 1992 Amendments to the Endangered Species Act require delisted species to be monitored for a period of five years following their delisting. A monitoring program describing how the greenback will be monitored after delisting will be included in the long-term management plan.*

- 7.1. **Prepare a long term-management plan.** A management plan should be prepared that will incorporate all the information obtained through completion of the recovery plan tasks. All agencies will need to maintain records on their recovery activities and provide pertinent information in development of the management plan. The purpose of this management plan is to ensure that adequate regulatory mechanisms and management programs remain in existence after delisting to ensure that adequate populations of greenback cutthroat trout are maintained. The plan will need to provide pertinent biological and management information on the greenback for use in maintaining greenback populations. It must identify how populations will be monitored to document the status and condition of populations and habitats, and should identify conditions that would warrant relisting the greenback. The plan



should also address interagency cooperation and agency responsibilities and cooperative agreements established under Task 7.2. The plan should be developed before the delisting of the greenback is proposed. The plan should be reviewed and approved by all parties with jurisdiction over greenback trout populations before the greenback is delisted. The plan should be written based on the following outline:

I. Life History and Ecology

- a. Habitat requirements
- b. Reproduction
- c. Food preference
- d. Community ecology
- e. Fish diseases

II. Present Status of Greenbacks

- a. Brief history of recovery
- b. List of current Type A and B populations
- c. Criteria for stable populations

III. Management Goals and Objectives

- a. Conservation Management
  1. Future population goal and objectives
  2. Population monitoring
  3. Isolated population concern/action
  4. Genetic monitoring of wild population
  5. Habitat
  6. Future populations (Metapopulations)
  7. Impacts
- b. Recreation/Public Use
  1. Quality fisheries
  2. Limited harvest fisheries
  3. Protected areas
  4. Watchable fisheries programs
  5. Aquatic education programs

IV. Maintenance

- a. Habitat management guidelines
  1. Resource management activities
  2. Habitat improvement structures



b. Species Management

1. Broodstock maintenance
2. Stocking
3. Angling regulations
4. Methods for removing non-natives
  - a) with greenbacks present
  - b) for new sites

V. Implementations Strategies

List of activities, dates, and responsibilities

- 7.2. Prepare a cooperative agreement. Cooperative management agreements should be prepared to define the role of the management agencies in maintaining populations of pure greenback cutthroat trout established or documented under Task 2.0 of this Plan. This agreement will need to be approved and signed by all involved management agencies with greenback populations on areas under their jurisdiction. Review of this cooperative agreement and an evaluation of the status of the subspecies can be reviewed at interagency coordination meetings.



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. Tasks will only be completed and funds expended contingent upon appropriations, priorities, and other budgetary constraints that apply to each agency or organization.

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.

**Agency Abbreviations Used in Implementation Schedule and Tables:**

- ARNF - Arapaho Roosevelt National Forests
- CCBLM - Canon City District of BLM
- CDOW - Colorado Division of Wildlife
- CTU - Colorado Trout Unlimited
- DOD - Department of Defense (Fort Carson)
- FS - U.S. Forest Service
- BLM - Bureau of Land Management
- FWS - U.S. Fish and Wildlife Service
- P&SINF - Pike & San Isabel National Forests
- Priv - Private property
- RMNA - Rocky Mountain Nature Association
- RMNP - Rocky Mountain National Park

**Fish Abbreviations Used in Tables:**

- BKT - Brook Trout
- GBC - Greenback Cutthroat Trout
- RBT - Rainbow Trout
- BNT - Brown Trout

**Other Definitions:**

On-going, task or action which will need to be conducted on a regular basis throughout the Recovery program.



## PART III - IMPLEMENTATION SCHEDULE FOR RECOVERY OF THE GREENBACK CUTTHROAT TROUT FROM 1995 TO 2000

Task Number	Priority	Task Description	Task Duration	Cost Estimates (X \$1,000)							Comments	
				FWS	FS	BLM	RMNP	CDOW	DOD	RMNA		CTU
1.1	1	Conduct population and habitat monitoring	Ongoing	20.0	10.0	5.0	40.0	30.0				
1.2	1	Enhance or restore habitat	Ongoing									Costs will be determined as needs are identified.
1.3	1	Maintain stream barriers	Ongoing									Costs will be determined as needs are identified.
1.4	1	Prevent introduction of non-native species	Ongoing									Will be conducted as part of ongoing agency programs.
1.5	1	Promote sound land and water use.	Ongoing	5.0	12.0	5.0	5.0	5.0				Will be conducted as part of ongoing agency programs.
1.6	1	Enforce regulations	Ongoing	5.0			5.0	5.0				Will be conducted as part of ongoing agency programs.
TASK 1 - Maintain/enhance known populations			SUBTOTAL	30.0	22.0	10.0	50.0	40.0	0.0	0.0	0.0	152.0
2.1	3	Survey for historic populations	Ongoing		5.0	2.0	10.0	8.0				
2.2	3	Maintain list of candidate habitats	Ongoing	5.0	5.0	1.0	5.0	5.0				Agencies will need to maintain and update the list as necessary.
2.3	3	Consult with landowners and agencies	Ongoing	5.0	10.0			5.0				
2.41	3	Manipulate habitat of reintroduction areas	Ongoing		5.0	5.0		5.0				Some costs cannot be determined until needed projects are identified.
2.42	3	Improve barriers in reintroduction areas	Ongoing									Costs cannot be determined until projects are identified.
2.43	3	Remove non-native salmonids in reintroduction areas.	Ongoing	5.0			50.0	15.0				
2.51	3	Use stocking rates for wild populations	Ongoing									Will be conducted as part of ongoing agency programs.
2.52	3	Use stocking rates for larval hatchery fish	Ongoing									Will be conducted as part of ongoing agency programs.
2.6	3	Monitor success of greenback reintroductions	Ongoing	5.0	5.0	2.0	25.0	15.0				

Task Number	Priority	Task Description	Task Duration	Cost Estimates (X \$1,000)								Comments	
				FWS	FS	BLM	RMNP	CDOW	DOD	RMNA	CTU		
2.7	3	Annually update greenback population status	Ongoing	10.0	10.0	3.0	5.0	5.0					
TASK 2 - Establish/document 20 stable populations			SUBTOTAL	30.0	40.0	13.0	95.0	58.0	0.0	0.0	0.0	236.0	
3.1	3	Establish South Platte River wild broodstock	complete										Involved agencies will need to conduct regular monitoring of the wild broodstock populations.
3.2	3	Establish Arkansas River broodstock	complete										Involved agencies will need to conduct regular monitoring of the wild broodstock populations.
3.31	3	Collect milt from wild populations	Ongoing		5.0		5.0	20.0					
3.32	3	Establish broodstocks at CDOW hatcheries	Ongoing		60.0		15.0						Work will be accomplished by CDOW with funding from other involved agencies.
3.33	3	Prepare reports on status of hatchery program	Ongoing				5.0						Will be conducted as part of hatchery programs.
3.34	3	Provide information for long-term management plan and cooperative agreement	1 year	1.0	1.0	1.0	1.0	1.0					To be completed prior to species delisting.
TASK 3 - Establish populations for broodstocks			SUBTOTAL	1.0	66.0	1.0	26.0	21.0	0.0	0.0	0.0	115.0	
4.1	3	Assess mixed recreation fisheries	complete										
4.2	3	Implement catch-and-release programs on public lands	complete										
4.3	3	Complete research stocking, angling regulations, etc.	Ongoing	10.0			10.0	5.0					
4.4	3	Complete research stocking of greenbacks into waters with native non-salmonids	Ongoing	5.0					5.0				Additional costs will be incurred in later years as restoration projects are identified.
TASK 4 - Document response to angler pressure, etc.			SUBTOTAL	15.0	0.0	0.0	10.0	5.0	5.0	0.0	0.0	35.0	
5.1	3	Encourage I&E programs	Ongoing	5.0	5.0	5.0	5.0	5.0	5.0				
5.2	3	Promote interagency cooperation	Ongoing										Will be conducted as part of ongoing agency programs.
5.3	3	Present recovery information at meetings	Ongoing	5.0	5.0	5.0	5.0	5.0	5.0				Will be conducted as part of ongoing agency programs.

Task Number	Priority	Task Description	Task Duration	Cost Estimates (X \$1,000)							Comments		
				FWS	FS	BLM	RMNP	CDOW	DOD	RMNA		CTU	
5.4	3	Promote watchable greenback programs	Ongoing									Will be conducted as part of ongoing agency programs.	
5.5	3	Promote adoption of greenback as Colorado State fish.	Complete									Accomplished with sponsorship by CTU.	
5.6	3	Prepare a traveling greenback display	Complete									Funding provided by FS & BLM.	
TASK 5 - Conduct an information/education program SUBTOTAL				10.0	10.0	10.0	10.0	10.0	10.0	0.0	0.0	60.0	
6.1	3	Increase use of non traditional agency and public funds	Ongoing									Part of agency programs	
6.2	3	Market art work	Ongoing		2.0					1.0	1.0		
6.3	3	Produce a greenback brochure	complete									Accomplished with assistance from CDOW, BLM, FS, & FWS.	
TASK 6 - Promote partnerships and alternative funding SUBTOTAL				0.0	2.0	0.0	0.0	0.0	0.0	1.0	1.0	4.0	
7.1	3	Prepare a long term management plan	2 years	3.0	3.0	3.0	3.0	3.0	3.0		3.0	To be completed prior to delisting.	
7.2	3	Prepare a cooperative agreement	1 year	1.0	1.0	1.0	1.0	1.0	1.0		1.0	To be completed prior to delisting. Costs will be part of ongoing agency programs.	
TASK 7 - Prepare a long-term management plan SUBTOTAL				4.0	6.0	4.0	4.0	4.0	4.0	1.0	5.0	32.0	
TOTAL				90.0	146.0	38.0	195.0	138.0	19.0	2.0	6.0	634.0	

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## PUBLIC REVIEW

This recovery plan was made available to the public for comments as required by the 1988 amendments to the Endangered Species Act of 1973. The public comment period was announced in the Federal Register 29 April 1993, and closed 28 June 1993. Press releases were sent to the print media.

During the public comment period, five letters were received. The comments provided in these letters have been considered, and incorporated as appropriate. Comments that address recovery tasks that are the responsibility of an agency other than the U.S. Fish and Wildlife Service have been sent to that agency as required by the 1988 amendments to the Act. The recovery plan was prepared in 1993, updated to reflect current population status through 1997, signed and printed in 1998.

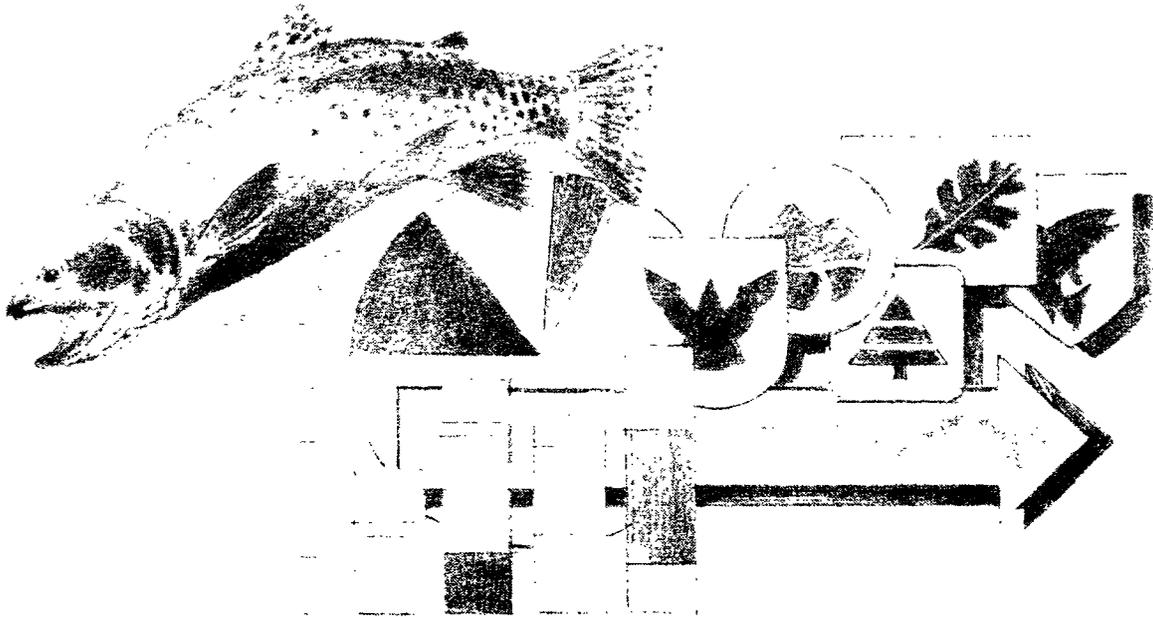


Table 1. Summary of Known Historic Greenback Cutthroat Trout Sites and Stability of Population. 1970-1997.

LOCATION	HABITAT		CRITERIA						COMMENTS
	km	ha	Survey	Kg/Ha	> 500 fish	GBC Repro-duction	Other species present	Stable as of Last Survey	
<b>South Platte Drainage</b>									
Como Creek, ARNF	2.9		1991	46.0	Y	Y	N	Y	
Hunters Creek, RMNP	2.0		1996	118.0	Y	Y	N	Y	
Up. Hutch. Lake, RMNP	0.5	3.0	1997	50.0	Y	Y	N	Y	Open to C&R angling
Mid. Hutch. Lake, RMNP	0.2	1.7	1990	50.0	Y	Y	N	Y	Open to C&R angling
SUBTOTAL South Platte Drainage -stable	5.6	4.7							
S.F. Poudre R., ARNF, RMNP	1.7		1991	17.8	N	Y	N	N	Population is improving
Upper Hague Creek, RMNP	2.0		1990	Unk	N	Y	N	N	Very few fish
Tarryall Creek, near Boreal Pass, private	2.0		1991	Unk	N	Unk	BKT	N	Below private mining claims.
SUBTOTAL South Platte Drainage	11.3	4.7							
<b>Arkansas River Drainage</b>									
Cascade Creek, P&SINF	2.8		1995	38.3	Y	Y	N	Y	
S. Apache Creek, P&SINF, Priv, CCBLM	12.2		1995	127.1	Y	Y	N	Y	3900 GBC estimate
SUBTOTAL Arkansas Drainage	15.0	0							
<b>TOTAL</b>	<b>26.3</b>	<b>4.7</b>							

Table 2. Summary of South Platte Greenback Cutthroat Trout Restoration Projects, 1970-1997.

LOCATION		HABITAT		STOCKED	CRITERIA						COMMENTS
		km	ha		Sur-vey date	Kg/Ha	> 500 fish	GBC Reprod- tion	Other species present	Stable as of last survey	
<b>Stable Habitats</b>											
N.F. Thompson Creek, RMNP	NF Thompson Ck, above 3274 m	1.7	1.0	1970		62.0	Y	Y	N	Y	Opened to C&R angling, 1990. GBC to 400mm
	Lake Louise		2.6	1989	1993	55.0	Y	N	N		
Bear Lake, RMNP		0.1	4.5	1975-1987	1991	50.0	Y	Y	N	Y	No angling due to heavy use of lake trail.
Williams Gulch, ARNF		2.0		1981-1982	1993	84.0	Y	Y	N	Y	Closed to angling
E. & W. Forks Sheep Creek ARNF		11.2		1982-1987	1993	67.0	Y	Y	N	Y	Opened to C&R angling, 1988.
Fern Lake Fern Creek, RMNP		1.4	3.7	1982-1984	1991	45 24	Y N	Y Y	N N	Y	Opened to C&R angling, 1986.
Odessa Lake, RMNP		0.2	4.5	1984-1989	1993	27.0	Y	Y	N	Y	Opened to C&R angling in 1987.
Lawn Lake, and inlet below Big Crystal Lake, RMNP		0.9	9.5	1984-1986	1992	60.0	Y	Y	N	Y	Opened to C&R angling in 1988.
Roaring River, RMNP		6.5		1984-1986	1991	81.0	Y	Y	N	Y	Opened to C&R angling, 1991.
Lower Hutch. Lake and outlet stream above 3048 m. RMNP		1.0	1.7	1986-1991	1991	138.0	Y	Y	N	Y	Opened to C&R angling in 1991.
Pear Lake, RMNP		1.2	6.1	1989-1990	1991	80.0	Y	Y	N	Y	Opened to C&R angling in 1991.
Sandbeach Lake, RMNP		0.1	4.0	1989-1990	1992	69.0	Y	Y	N	Y	Opened to C&R angling, 1991.
Cony Creek, RMNP		3.5		1989-1990	1996	25	Y	Y	N	Y	Opened to C&R angling, 1991.
Spruce Lake, RMNP		0.3	1.5	1991-1992	1995	60.0	Y	Y	N	Y	Opened to C&R angling, 1993.
SUBTOTAL - Stable Habitat		30.1	39.1								
<b>Potentially Stable Habitats</b>											
Hidden Valley Creek, and beaver ponds RMNP		1.6	2.5	1973	1989	50.0	Y	Y	BKT	P	Brook trout dominate beaver pond habitat. Opened to angling 1982.

LOCATION	HABITAT		STOCKED	CRITERIA						COMMENTS
	km	ha		Survey date	Kg/Ha	> 500 fish	GBC Reproduction	Other species present	Stable as of last survey	
West Creek, above West Creek Falls, RMNP	2.4		1979-1987	1996			Y	N	P	
May Creek, ARNF	1.7		1980-1987	1994	50.0	N	Y	N	P	
Ouzel Creek above Ouzel Falls, RMNP	4.7		1981-1983	1991	34-229	Y	Y	BKT	P	Opened to C&R angling, 1986.
Ouzel Lake and Stream below Bluebird Lake, RMNP	1.4	2.6	1981-1983	1996	69.0	Y	Y	Y	P	Opened to C&R angling, 1986.
Lost Lake N.F. Big Thompson Creek, above Lost Falls, RMNP	3.0	3.7	1987-1989 1987-1990	1993 1993	30.0 15.0	Y Y	Y Y	Y Y	P P	Opened to C&R angling, 1990.
Loomis Lake and Pond, RMNP	0.4	1.5	1991-1992	1995	28	Y	N	N	P	Opened to C&R angling, 1993.
Zimmerman Reservoir, ARNF	0.4	4.6	1996	1997				N	P	Opened to C&R angling, 1997.
Husted Lake, RMNP	0.1	4.1	1991	1993				N	P	Open to C&R angling, 1995
Dream Lake, RMNP	0.1	2.2	1997	1997				N	P	Open to C&R angling, 1998.
SUBTOTAL - Potentially Stable Habitats	15.8	21.2								
Unstable Habitats										
Black Hollow, ARNF	5.2		1981-1983	1994	8.5	N	N	BKT, RBT	N	
Hourglass Creek, ARNF	2.0		1981-1982	1992	0	N	N	N	N	Unsuccessful project. GBC no longer present.
Bard Creek, ARNF	6.1		1982-1986	1994	43.0	Y	N	N	N	Opened to C&R angling, 1993. No reproduction due to heavy metals. Maintained as GBC fishery through stocking.
Cornelius Creek, ARNF	6.9		1983-1985	1993	5.0	N	N	BKT, BNT	N	Opened to C&R angling, 1988. Population declining due to competition with exotics. Unsuccessful project.
George Creek, ARNF	12.7		1983-1985	1993	3.6	N	Y	BKT, BNT	N	Opened to C&R angling, 1988. Population declining due to competition with exotics. Unsuccessful project.

LOCATION	HABITAT		STOCKED	CRITERIA						COMMENTS
	km	ha		Survey date	Kg/Ha	> 500 fish	GBC Reproduction	Other species present	Stable as of last survey	
Big Crystal Lake, RMNP	0.2	10.0	1984-1986	1995	114.0	Y	N	N	N	High elevation experimental population opened to C&R angling, 1990. No reproduction documented. Still under evaluation.
N. Fork Jackson Creek, P&SINF		0.3	1985-1987	1991	2.0	N	N	BKT	N	BKT dominate, opened to standard regulations., 1993. Unsuccessful project.
Bruno Gulch, P&SINF	9.0	1.4	1986-1990	1991	8.0	N	N	BKT	N	No reproduction due to heavy metals. Opened to standard regulations., 1993. Unsuccessful project.
Lily Lake, RMNP		6.8	1980-1992	1997		Y	N	N	N	Experimental fisheries, maintained by stocking.
Pennock Creek, ARNF	8.0		1986-1988	1993	9.4	N	Y	BKT	N	Unsuccessful project.
SUBTOTAL - Unstable Habitats	50.1	18.5								
TOTAL - South Platte Basin	96.0	78.8								

Table 3. Summary of Arkansas River Greenback Cutthroat Trout Restoration Projects, 1970-1997.

LOCATION	HABITAT		STOCKED	CRITERIA						COMMENTS	
	km	ha		Survey date	Kg/Ha	> 500 fish	GBC Reproduction	Other species present	Stable as of last survey		
Stable Habitats											
Boehmer Res., City, Co Springs		10.1	1985-1989	1996	20.0	Y	Y	N	Y	City of Co Springs water supply. Closed to angling.	
SUBTOTAL - Stable populations		0.0	10.1								
Potentially Stable Habitats											
Ft. Carson	Lytle pond		0.4	1981-1993	1994	50.0	N	Y	BKT, DART	P	Opened to C&R angling 1989.
	Lytle inlet	1.0									
	Duck Pond		1.7								
LAKE FORK COMPLEX, P&SINF	Virginia Lake,		1.2	1987-1990	1991	20.0	N	Y	N	P	Open to C&R angling, 1990 and harvest, 1993.
	Timberline Lake,		10.1	1987-1990	1991	20.0	Y	Y	BKT	N	BKT 25% of population above 3200 m. Open to angling, 1990.
	Timberline Inlet	0.4		1987-1990							Open to C&R angling, 1990.
	Lake Fork Cr. & 3 lks. Trib.	4.8		1987-1996	1991	35.0	Y	Y	BKT	N	
	Zac Bog,	1.0		1987-1990	1991	35.0	Y	Unk	N	P	
ROCK CREEK COMPLEX Leadville NFH & P&SINF	Rainbow Lake,		3.5	1991-1996	1995	20.0	N	Unk	N	P	Opened to C&R angling, 1991.
	Native Lake, and inlet/outlet	1.0	2.3	1991-1996	1995	12.0	N	Y	BKT	P	Opened to C&R angling, 1991.
	Swamp Lake & outlet	1.1	2.5	1991-1992	1994	10.0	N	Y	BKT	P	BKT only in stream below the lakes by 1995
	Rock Creek	5.8		1991-1996	1994	5.0-35.0	Y	Y	BKT	P	Opened to C&R angling, 1991.
	Elk Creek	1.2		1991-1996	1995	22.1	N	Y	BKT	P	
	Cascade Creek	0.9		1991-1992	1993	37.9	N	Y	N	P	
	Bog Creek	0.3		1991	1991	Unk	Unk	Unk	BKT	Unk	



Table 4. Summary of Greenback Historic Populations, Restoration Projects, Areas Open to Angling and Stable Populations. 1997.

TYPE OF POPULATION		NUMBER	HECTARES	KILOMETERS
<b>SOUTH PLATTE RIVER DRAINAGE</b>				
Restoration Projects	Total Restoration Projects	33	78.8	96.0
	Open to Angling	31	74.3	93.9
	Stable Restoration Projects	13	39.1	30.1
Historic Populations	Total Historic Populations	7	4.7	11.3
	Open to Angling	2	4.7	0.0
	Stable Historic Populations	4	4.7	5.6
South Platte Summary	Total Populations	40	83.5	107.3
	Open to Angling	33	79.0	93.9
	Stable Populations	17	43.8	35.7
<b>ARKANSAS RIVER DRAINAGE</b>				
Restoration Projects	Total Restoration Projects	20	95.3	41.5
	Open to Angling	14	21.7	25.3
	Stable Restoration Projects	1	10.1	0.0
Historic Populations	Total Historic Populations	2	0.0	15.0
	Open to Angling	0	0.0	0.0
	Stable Historic Populations	2	0.0	15.0
Arkansas Summary	Total Populations	22	95.3	56.5
	Open to Angling	14	21.7	25.3
	Stable Populations	3	10.1	15.0
<b>GRAND TOTAL</b>	Total Populations	62	178.8	163.8
	Open to Angling	47	100.7	119.2
	Stable Populations	20	53.9	50.7

Table 5. Hybrid Populations of Greenback Cutthroat Trout. 1994.

SITE NAME/DRAINAGE		RIVER DRAINAGE	OWNERSHIP	COMMENTS
TYPE B POPULATIONS: Essentially pure, with a trace of influence from other spring spawning trout species:				
Arkansas River	South Fork of the Arkansas River	Arkansas River	P&SINF	
	Strawberry Creek	Huerfano River	P&SINF	
	Dutch Creek	Huerfano River	P&SINF	
	Deep Creek	Huerfano River	P&SINF	
South Platte River	Island Lake	Boulder Creek	City of Boulder	Still awaiting DNA analysis
	Goose Lake	Boulder Creek	City of Boulder	Still awaiting DNA analysis
	Forest Canyon	Big Thompson River	RMNP	
	Caddis Lake	Fall River	RMNP	transplant of Forest Canyon greenbacks
	Sawmill Creek	Poudre River	ARNF	
	Roaring Creek	Poudre River	ARNF	
TYPE C POPULATIONS: Good representatives of greenback stock, both with noticeable influences from other spring spawning trout species:				
South Platte River	Rabbit Creek	N.F. Poudre River	Private	

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. 1995-2007.

SITE	Habitat		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
	km	ha													
Sandbeach Creek, RMNP	1.5					R	2000	2000	2000	C&R					
Hidden Valley Creek, RMNP		2.5				R	1500	1500	1500	C&R					
	1.6					R	1600	1600	1600	C&R					
Mummy Pass Creek, RMNP	1.0						R	1000	1000	1000	C&R				
Poudre Lake, RMNP		3.0					R	5000	5000	5000	C&R				
Lake Haiyaha, RMNP		6.3					R	6300	6300	6300	C&R				
	1.5						R	1500	1500	1500	C&R				
Hague Creek, RMNP	1.0							R	2000	2000	2000	C&R			
Black Lake, RMNP		3.7									R	3700	3700	3700	C&R
Willow Creek, RMNP	5.0											R	5800	5800	5800
Cow Creek, RMNP	2.0												R	2000	2000
Thunder Lake and		6.7												R	6700
Lion Creek, RMNP	1.5													R	1500
SUMMARY	15.1	22.2	0	0	0	0	5,100	18,900	20,900	15,800	2,000	3,700	9,500	11,500	16,000

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, 1995-2007.

SITE	Habitat		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
	km	ha													
Greenhorn Creek, P&SINF	3.2			*											
N. Apache Creek, P&SINF	1.9			1000	1000										
Cottonwood Creek, P&SINF	6.4			1000											
Turkey Creek, P&SINF	9.7					R	6000	6000	6000						
Stanley Canyon Res		3						R	3000	3000	3000				
Stanley Canyon Creek, W. Monument Creek	2.7							R	2000	2000	2000				
	5.2							R	2500	2500	2500				
Lake Fork Creek Timber Lake	6.0	10				R	7000	7000	7000						
Severly Creek	1.6						?								
Graneros Creek	4.8						?								
<b>SUMMARY</b>	<b>41.5</b>	<b>13</b>	<b>0</b>	<b>2,000</b>	<b>1,000</b>	<b>0</b>	<b>13,000</b>	<b>13,000</b>	<b>20,500</b>	<b>7,500</b>	<b>7,500</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

\* - stock from S. Apache

Table 8. South Platte River Drainage Greenback Research Cutthroat Trout Stocking Sites, 1995-2007.

SITE	Habitat		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
	km	ha													
<b>ROCKY MOUNTAIN NATIONAL PARK:</b>															
Lily Lake		6.8	500		500		500		500		500		500		500
Arrowhead Lake		14.8	2000		2000		2000		2000		2000		2000		2000
Subtotal, RMNP	0.0	21.6	2,500		2,500		2,500		2,500		2,500		2,500		2,500
<b>PRIVATE PROPERTY:</b>															
Manchester Lake		5.0	500		500										
Subtotal, Private	0.0	5.0	500		500	0	0	0	0	0	0	0	0	0	0
<b>PIKE &amp; SAN ISABEL NATIONAL FOREST/ ARAPAHO &amp; ROOSEVELT NATIONAL FOREST, FORMER CDOW CENTRAL REGION</b>															
Upper Diamond Lake		2.4	600	600	600	600	600	600	600	600	600	600	600	600	600
North Iceberg Lake		4.0	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Heart Lake		6.9	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Upper Crater Lake		3.4	850	850	850	850	850	850	850	850	850	850	850	850	850
Ice Lake		4.9	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
Caroline Lake		3.5	850	850	850	850	850	850	850	850	850	850	850	850	850
Ethel Lake		2.0	500	500	500	500	500	500	500	500	500	500	500	500	500
Silver Dollar Lake		7.5	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Dorothy Lake		6.5	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400
Bob Lake		3.4	1275	1275	1275	1275	1275	1275	1275	1275	1275	1275	1275	1275	1275
King Lake		4.6	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
Deep Lake		2.0	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Abyss Lake		7.3	900	900	900	900	900	900	900	900	900	900	900	900	900
Frozen Lake		2.8	500	500	500	500	500	500	500	500	500	500	500	500	500
Shelf Lake		3.4	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

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SITE	Habitat		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
	km	ha													
Snow Lake		6.9	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
SUBTOTAL	0.0	47.8	11,500	11,500	11,500	11,500	11,500	11,500	11,500	11,500	11,500	11,500	11,500	11,500	11,500
TOTAL	0.0	151.5	41,325	40,825	41,325	40,825	40,825	40,825	40,825	40,825	40,825	40,825	40,825	40,825	40,825

Table 9. Arkansas River Drainage Research Greenback Cutthroat Trout Stocking Sites, 1995-2007.

SITE	Habitat		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
	km	ha													
US ARMY, FORT CARSON:															
Fort Carson		21	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Air Force Academy		26	51,000	51,000	51,000	51,000	51,000	51,000	51,000	51,000	51,000	51,000	51,000	51,000	51,000
Subtotal US ARMY	0.0	47.0	91000	91,000	91,000	91,000	91,000	91,000	91,000	91,000	91,000	91,000	91,000	91,000	91,000
PIKE & SAN ISABEL NATIONAL FOREST/ SOUTHEAST REGION, CDOW:															
Little Dry Lake		1.6	400	400	400	400	400	400	400	400	400	400	400	400	400
Middle Dry Lake		2.4	600	600	600	600	600	600	600	600	600	600	600	600	600
Upper Dry Lake		1.2	300	300	300	300	300	300	300	300	300	300	300	300	300
Kroenke Lake		12.1	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
Arthur Lake		2.4	600	600	600	600	600	600	600	600	600	600	600	600	600
Upper Hancock Lake		2.8	700	700	700	700	700	700	700	700	700	700	700	700	700
Grassy Lake		2.4	600	600	600	600	600	600	600	600	600	600	600	600	600
Lower Venerable Lake		3.6	900	900	900	900	900	900	900	900	900	900	900	900	900
Upper Venerable Lake		2.0	500	500	500	500	500	500	500	500	500	500	500	500	500
Horn Lake		9.7	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400
North Horn Lake		1.2	300	300	300	300	300	300	300	300	300	300	300	300	300
Lower Macey Lake		3.6	900	900	900	900	900	900	900	900	900	900	900	900	900
South Macey Lake		5.7	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200
West Macey Lake		4.9	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
SUBTOTAL	0.0	55.6	14400	14400	14400	14400	14400	14400	14400	14400	14400	14400	14400	14400	14400
TOTAL	0.0	102.6	105400	105400	105400	105400	105400	105400	105400	105400	105400	105400	105400	105400	105400

## Appendix 1. Summary of Recovery History, 1959-1994.

### **Recovery History**

Conservation efforts started in 1959, and have resulted in considerable accomplishments in the preservation of the greenback. Additional detail of some subjects discussed in this recovery history can be found in Part I.

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 was not establish in Fay Lakes, but the descendants established a reproducing population in Caddis Lake. Unfortunately, the Forest Canyon population was later classified as slightly hybridized with Yellowstone cutthroat trout, therefore both the Forest Canyon and Caddis Lake greenback populations are now classified as B populations (see Table 5).

Analysis of all specimens obtained prior 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 FS, 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.

Hidden Valley Creek in RMNP was treated to remove brook trout, and greenbacks were introduced in 1973. In 1975, brook trout were removed and greenbacks were introduced into Bear Lake in RMNP. This population is considered to be stable.

Recovery, 1976-1982. A Recovery Plan was completed in 1977, and an Arkansas River population of pure greenbacks was confirmed in 2.8 km of Cascade Creek. The Recovery Team recommended downlisting the subspecies to allow for angling opportunities and to assist in habitat acquisition. The Federal classification of the greenback changed from endangered to threatened in 1978.

A total of 64 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 the South Platte River drainage in 1981. Milt from wild South

Platte populations were taken from wild populations and shipped to Bozeman by 1982. The taking of milt from wild fish was originally used to compensate for asynchronization 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 were stocked into Black Hollow (second restoration), May Creek, Hourglass Creek, Williams Creek, Sheep Creek, and Bard Creek on the Arapaho/Roosevelt National Forest lands, and into West Creek, Ouzel Lake and Ouzel Creek and Fern Lake and Fern Creek within RMNP.

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

Recovery, 1983-1986. A new Recovery Plan was completed in 1983 that capitalized upon the successes of the broodstock programs and the chemical techniques for removing non-native fish species. This recovery plan identified an objective for delisting the subspecies upon establishment of 20 stable reproducing populations. The plan identified six recovery goals. Achievements for these goals are described below:

1. Protect Historic Populations and Stable Populations. New historic populations were confirmed in Hunters Creek and the Hutcheson Lakes in RMNP (see Table 1). 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 and 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 angling for greenbacks in 1986.

5. Increase I&E Program. In 1984, the Recovery Team was awarded the Colorado National Wildlife Federation Researcher of the Year Award in recognition of the success of the greenback recovery program.

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

Recovery 1987-1994. 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 since 1987. Problems with fish control permits further complicated the problem of completing restoration projects.

The recovery plan was revised and public reviewed in 1993, and used the six goals established in the 1983 Recovery Plan. (This plan was updated, signed and printed in 1998).

1. Protect Historic Populations and Stable Populations. New historic populations were confirmed in South Apache Creek (Leary, 1987) in the Arkansas River drainage, and in Upper Hague Creek in the South Platte River drainage (see Table 1). Tarryall Creek in the South Platte River drainage has a small greenback population that is believed to be historic. Additional genetic research is being conducted on this population. A site near Rollinsville, also in the South Platte River drainage, needs to be evaluated as a possible historic population.

2. Establish 20 stable populations. Due to funding problems, restoration projects were limited to Rocky Mountain National Park and the Rock Creek drainage above the Leadville National Fish Hatchery (NFH). In the South Platte drainage, Rocky Mountain National Park restoration projects conducted through 1990, included Lost Lake, North Fork Big Thompson River, Husted Lake, Lower Hutcheson lake, Pear Lake, Coney Creek, Sandbeach Lake, Loomis Lake and Spruce Lake. No additional South Platte restoration projects were completed from 1991 through 1994.

In the Arkansas River drainage, the occurrence of a fish disease, introduced by infected non-native salmonids, within the watershed of the Leadville NFH resulted in the removal of fish from this area in August 1990. This was accomplished with funding from Colorado Trout Unlimited, Texaco Foundation and with assistance from the Forest Service and Colorado Division of Wildlife. 20.4 ha of lakes and ponds and 10.3 km of stream habitat in the Rock Creek drainage above the Leadville NFH was restocked with catchable greenbacks from the Saratoga NFH in June 1991, and immediately opened to catch-and-release fishing. No additional Arkansas restoration projects were completed from 1991 through 1994.



3. Establish Wild and Captive Broodstocks. Due to the expense of maintaining native Colorado fish in National Fish Hatcheries in Wyoming and Montana, and the 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. Activities at these hatcheries 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. Malachite green could not be used to control fungus in 1992, and the entire 1989 year class of greenback broodstock was lost.

Attempts were made to start a CDOW Arkansas broodstock at Ft. Collins by collecting eggs from Cascade Creek in 1991. However, the Cascade Creek egg collection was not successful. In 1992, 3,200 eggs were collected from South Apache Creek. In addition to South Apache Creek eggs, 10,000 eggs were shipped from the Saratoga NFH to Ft. Collins in August 1992. These two groups of eggs led to the successful establishment of an Arkansas River drainage greenback broodstock. Due to problems associated with construction at the Saratoga NFH in 1992, the majority of their adult Arkansas greenback broodstock was lost, and the Saratoga program was terminated by September 1992.

4. Response to Angling. Within Arapaho/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. Spruce and Loomis Lakes opened to catch-and-release angling by 1993.

Catch-and-release fishing for Arkansas River greenbacks is allowed on Ft. Carson, and in the Pike National Forest at Virginia Lake, Timberline Lake, Zac Bog, Lake Fork Creek, Rainbow Lake, Native Lake, Swamp Lakes and Rock Creek above the Leadville NFH by 1991.

5. Improve I&E Programs. The team increased its 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 and Colorado Trout Unlimited by 1991, to make the greenback the Colorado State Fish. In 1994, the greenback replaced the non-native rainbow trout as the official Colorado State Fish.

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

