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Recovery History of Greenback Cutthroat Trout: Population Characteristics, Hatchery Involvement, and Bibliography

Version 1.0

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Abstract

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The greenback cutthroat trout (*Oncorhynchus clarki stomias*) is native to the mountain and foothill waters of the South Platte and Arkansas river basins in Colorado. This taxon declined rapidly beginning near the turn of the century and was listed under the Endangered Species Act in 1973. We assembled all available information from a variety of sources to document recovery efforts from 1957 to 1999. For each greenback cutthroat trout population, we noted (1) the characteristics of recovery waters and dates of population discovery or introduction; (2) fish abundance estimates; (3) analyses of genetic purity; (4) salmonid fauna, removal efforts, and reinvasions; and (5) dates, sources, and numbers of fish used to establish populations. For each hatchery used to assist recovery, we noted (1) sources and numbers of fish delivered to them; (2) sources, sex ratios, and production of fish used to create particular year classes; and (3) dates, numbers, and sizes of hatchery fish shipped to establish wild populations or supplement other hatchery stocks.

Keywords: threatened species, greenback cutthroat trout, *Oncorhynchus clarki stomias*, recovery

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Introduction

The greenback cutthroat trout (*Oncorhynchus clarki stomias*) is native to the mountain and foothill waters of the South Platte and Arkansas river basins in Colorado (Behnke and Zarn 1976). This taxon was abundant in the late 19th century when large numbers of European immigrants arrived in and along the Front Range of Colorado. At that time, fish from 2 to 4.5 kg were relatively common historically and were notable for their extensive migrations to spawn, rear, and overwinter (Wiltzius 1985). Subsequent mining in the Arkansas River basin and southern tributaries of the South Platte River (Ubbelohde and others 1976) introduced large amounts of sediment and toxic runoff that reduced or exterminated many greenback cutthroat trout populations, as did agricultural development in river valleys because of water diversions (Jordan 1891). Furthermore, harvest of greenback cutthroat trout, often with explosives, was sufficiently widespread to have eliminated additional populations (Wiltzius 1985). Although by 1919 greenback cutthroat trout were still found in many tributaries of the upper Arkansas River (Carhart 1950), there are no reports on the status of populations in other locations at that time.

Concomitant with the extensive commercial and recreational harvest of greenback cutthroat trout in the late 1880s was the appearance of private and government fish hatcheries in Colorado. Initially, greenback cutthroat trout were frequently cultured, but their use diminished by the 1900s (Wiltzius 1985), possibly because few wild fish were still extant. Brook trout (*Salvelinus fontinalis*) were the first nonnative salmo-

nids cultured in Colorado in 1872, but other species soon followed. Because cutthroat trout are often replaced by brook trout and brown trout (*Salmo trutta*) and readily hybridize with rainbow trout (*O. mykiss*) and nonindigenous subspecies of cutthroat trout (Behnke 1992; Behnke and Zarn 1976; Wang and White 1994), introductions of nonnative trout, or the invasion of stocked populations into new waters, are believed to have eliminated greenback cutthroat trout from nearly all of their remaining historical range.

By the 1930s, the subspecies was considered extinct (Green 1937), but an apparently pure population in a portion of the Big Thompson River in Rocky Mountain National Park was found in 1957 (U.S. Bureau of Sport Fisheries and Wildlife 1957). Though this population was later thought to be introgressed with nonnative species, additional populations detected in 1965 and 1970 were deemed pure. Consequently, the greenback cutthroat trout was listed as endangered in 1973 under the U.S. Endangered Species Act, and downlisted to threatened in 1978 (USFWS 1998). The original recovery plan was completed in 1977 (Greenback Cutthroat Trout Recovery Team 1977), and revisions were adopted in 1983 (USFWS 1983) and 1998 (USFWS 1998).

Although surveys for remaining populations continue and are occasionally successful, most recovery efforts have focused on establishing new populations (USFWS 1998). By 1999, introductions had been attempted in 44 waters (Harig and others 2000). Many of these attempts have been successful, to the extent that the greenback cutthroat trout may soon be proposed for

delisting under the Endangered Species Act within all or part of its historical range (USFWS 1998).

A requirement for delisting is the completion of a long-term plan to guide management, and central to that plan is a compilation of the conservation and recovery history of this subspecies. Although some of this information is readily obtainable (USFWS 1998 and references therein), many data relevant to the discovery, establishment, and monitoring of wild populations and the establishment, maintenance, and distribution of hatchery broodstocks are difficult to find. Consequently, our objective was to compile existing data from 1957 to 1999 on population characteristics of greenback cutthroat trout in waters used for recovery and on hatchery participation in recovery. Additional information on habitat surveys, habitat modification, and fishing regulations was excluded. The bibliography contains materials cited in this document as well as available literature pertinent to the biology and recovery of greenback cutthroat trout.

Methods

Information was assembled from peer-reviewed manuscripts, unpublished reports, student theses, the Aquatic Data Management System (ADAMAS) database (CDOW 2000), field data sheets, correspondence, and other paper records in agency offices. Where data were in conflict, original sources (typically field data sheets or hatchery logs) were considered the most accurate, though these were not always obtainable. Otherwise, conflicts were resolved by using the most frequently reported data. All entries were checked against the source data at least twice.

For each greenback cutthroat trout population, we noted (1) the characteristics of recovery waters and dates of population discovery or introduction; (2) fish abundance estimates; (3) analyses of genetic purity; (4) salmonid fauna, removal efforts, and reinvasions; and (5) dates, sources, and numbers of fish used to establish populations. For each hatchery, we noted (1) sources and numbers of fish delivered to them; (2) sources, sex ratios, and production of fish used to create particular year classes; and (3) dates, numbers, and sizes of hatchery fish shipped to establish wild populations or supplement other hatchery stocks. Results were presented separately for the Arkansas and South Platte river basins because these stocks may be considered separately for delisting.

Results and Discussion

Greenback cutthroat trout were found or introduced in 68 waters as part of recovery activities (table 1).

Only waters used in an attempt to create a self-sustaining population were included – we did not consider waters used solely to provide a sport fishery. We also restricted this list to waters that were believed to contain genetically pure fish during recovery, though some of these populations now appear to be hybridized. Nearly all waters were qualitatively surveyed during recovery efforts, and quantitative estimates were obtained in 53 waters (table 2). In streams, the mean abundance of greenback cutthroat trout greater than 100 mm was 24 fish/100 m (SD, 12). In lakes, the mean catch rate was 12 fish/gill-net-hour (SD, 9).

Samples from 22 waters were subjected to genetic analyses (table 3). Most evaluations before 1995 relied on meristic and morphometric analyses, with more advanced techniques employed thereafter. It seems likely that the precision and accuracy of these approaches will continue to improve, and that current tallies of pure and hybridized populations will change. For example, the most recent analyses (Evans and Shiozawa 2001) determined that four populations -- previously used to found broodstocks and other wild populations -- were introgressed to varying degrees with Yellowstone cutthroat trout (*O. c. bouvieri*) or rainbow trout. The proposed federal policy of protecting hybridized populations (USFWS 1996) may assume a greater role as the ability to estimate the amount and source of introgression increases.

Of the 68 recovery waters, 41 were treated with antimycin or rotenone to remove nonnative salmonids prior to introductions of greenback cutthroat trout (table 4). Because of this intensive use of toxicants, many protocols for their application were developed (for example, Tiffan 1992). Although most nonnative salmonid populations were successfully eliminated, periodic failures of artificial barriers, illegal introductions by anglers, or incomplete removals have permitted invasions in 15 waters (cf. Harig and others 2000).

Transfers of fish from different waters and different hatcheries have been extensive (table 5). The median number of fish introduced into streams was 4,862 (range, 900-28,456) and into lakes 4,696 (range 85-59,500). We caution that there is substantial uncertainty in these estimates because of the consistent lack of consensus among literature sources. Most transfers involved fish reared or produced by three hatcheries: the Bellvue Fish Research Hatchery (BFRH) in Bellvue, Colorado; the Bozeman Fish Technology Center (BFTC) in Bozeman, Montana; and the Saratoga National Fish Hatchery (SNFH) in Saratoga, Wyoming. The Pueblo State Fish Hatchery in Pueblo, Colorado, also distributed limited numbers of fish beginning in 1997, but did not develop broodstocks,

hence we did not include it in our analysis of hatchery activities. Roaring Creek was historically stocked, though the population appears to be genetically pure.

Greenback cutthroat trout arrived in hatcheries as juveniles, adults, fertilized eggs, and milt (table 6). Attempts to minimize inbreeding depression involved the use of milt from wild males to fertilize eggs of hatchery females at the BFTC (Dwyer and Rosenlund 1988) or avoidance of sister-brother spawning at the BFRH by using 3-year-old females and 2-year-old males (Schler, personal communication). Strategies for developing broodstocks varied among hatcheries (table 7), as did protocols for selecting spawning groups. Typical spawning practice at the BFRH was to spawn three females with two males with milt from males added sequentially to the eggs of all females, though 1:1 matings were conducted when fish were abundant (Schler, personal communication). One:one ratios of females to males were typically attempted at the SNFH. At the BFTC, milt from males was frequently limited and occasionally as many as six females were fertilized with the milt from one male (Dwyer, personal communication). In addition, milt from wild males was generally stored individually but occasionally mixed in a single vial.

Records of the origin and number of fish spawned were inconsistent for the BFRH and BFTC. Particularly for the latter, many females were respawed, thus reports of total spawnings exaggerated the number of females used. Also, shipments of milt to this hatchery were occasionally unsuccessful, as were the attempts to fertilize eggs of hatchery females with milt from wild males, which accounts for the differences in fish shipped to hatcheries (table 6) and those used to produce year classes (table 7).

From 1985 to 1996, over 639,000 fish were distributed as part of the recovery of greenback cutthroat trout (table 8). Unfortunately, discrepancies between the number of fish shipped from hatcheries and the number of fish reported as stocked were typical. In some cases, more fish were shipped than reported stocked, which was partly attributable to fish being sent to nonrecovery waters. In other instances, mortality of fish in transport was reported and ranged from 5 to 40 percent, in which case our estimates of fish stocked (table 5) relied on reports from biologists responsible for stocking. Alternatively, if fewer fish were reported shipped than reported stocked, stocking totals were adjusted proportionately downward. Hatchery records were regarded as more reliable because the weight of fish shipped and the number of fish per unit weight were usually measured.

The bibliography contains materials that could be attributed to specific individuals, groups, or agencies; with few exceptions this material was not peer-reviewed. Much additional information that could not be cited was made available through personal communications or from agency files. Although we attempted to obtain all data relevant to the recovery of greenback cutthroat trout, we undoubtedly have overlooked some sources. We trust that our omissions will be corrected by others with access to additional information. Also, despite repeated checking of data, there most assuredly are errors in the tables that we hope will be remedied in later revisions.

After undergoing this effort, our primary recommendation is the creation of a formal process for reporting data and establishment of an easily accessible database to assist with future management of greenback cutthroat trout, as has been recommended for other federally listed species (James 1999; Safford 1995; Tear and others 1995). The often obscure and disparate sources of data (frequently limited to hand-written notes and in at least one instance, on a napkin) consulted to prepare this document are a reminder that current data reporting strategies risk the loss of much precious information, and that the availability of such data to all participants in endangered species management will lead to better-informed decisions.

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Tables

Table 1 -- Waters used for recovery of greenback cutthroat trout from 1957 to 1999. We identified the major river basin, name, drainage, and Colorado Division of Wildlife (CDOW) water code of each recovery water. Additional information on each water can be obtained by searching for this water code in the ADAMAS database (CDOW 2000). Elevations (m) were obtained from U.S. Geological Survey 1:24,000 topographic maps or the ADAMAS database. For streams, elevations are the downstream limits of allopatric populations of greenback cutthroat trout. If populations were largely sympatric with nonnative species or consisted of hybridized fish, the downstream-most location where regularly reported is given. Lake sizes (ha) were obtained from the ADAMAS database. Short reaches of lake inlets or outlets that also contained greenback cutthroat trout were not included. The lengths (km) of occupied portions of streams were obtained from reports. Single values for streams indicate a field measurement of fish distribution or consensus on a single value, whereas ranges reflect different estimates given in the absence of field measurements. The year that fish were discovered or introduced into recovery waters is also noted. If establishment of greenback cutthroat trout was attempted more than once in a water (e.g., following a chemical treatment to remove all fish), additional dates are included. An asterisk (*) indicates that recovery efforts have been abandoned or greenback cutthroat trout have been extirpated in a water because of invasion by nonnative salmonids, unsuitable habitat, or a lack of reproduction by greenback cutthroat trout. Missing data are denoted by a dashed line.

Water	Drainage	CDOW Code	Elevation (m)	Area (ha)	Length (km)	Found	Founded
Arkansas Basin							
North Apache Creek	Huerfano River	31616	2,424		3.9		1996
South Apache Creek	Huerfano River	31618	2,195		4.2	1977	
Lake Fork Arkansas River	Arkansas River	33821	3,069		6.2		1987,99
Boehmer Reservoir	Beaver Creek	82076	3,438	9.0			1985
Cascade Creek (1)	Huerfano River	29315	3,109		1.6-1.8	1976	
Cascade Creek (2)	Rock Creek	29320	3,341		0.9		1991
Cottonwood Creek*	Grape Creek	32742	2,847		5.3		1983
Duck Pond	Turkey Creek	83078	1,896	1.0			1995
Elk Creek	Rock Creek	29712	3,359		1.2-2.5		1991
Greenhorn Creek	St. Charles River	29884	3,109		3.4		1989
South Prong Hayden Creek	Arkansas River	32487	---		---	1996	
South Fork Huerfano River*	Huerfano River	30154	2,926		---	1963	
Lytle Pond	Turkey Creek	82949	1,905	0.8			1981
Mason Reservoir	Beaver Creek	79966	3,325	45.4			1996
McAlpine Lake*	Deer Creek	82672	2,868	0.3			1980
Native Lake	Rock Creek	80919	3,417	2.0			1991
Newlin Creek	Hardscrabble Creek	30514	2,020		6.9		1997
Rainbow Lake	Rock Creek	81315	3,654	3.3			1991
Rock Creek	Arkansas River	30659	2,975		5.8-9.0		1991
East Branch Sayers Gulch	South Fork Lake Creek	31890	3,218		2.4		1996
Severy Creek	Cascade Creek (3)	31312	2,682		1.2-2.0	1997	
Swamp Lakes	Rock Creek	81276	3,310	0.7			1991
Timberline Lake	Lake Fork Arkansas River	81341	3,309	11.0			1987, 99
Virginia Lake	Lake Fork Arkansas River	81416	3,481	1.0			1987
South Platte Basin							
Albion Creek*	Boulder Creek	10001	3,121		2.4	1955	
Bard Creek	Clear Creek	10051	2,780		6.1-8.0		1982
Bear Lake	Big Thompson River	53811	2,888	3.9			1975
Black Hollow Creek	Cache la Poudre River	12916	2,323		1.6	1963	1969,80
Bruno Gulch*	South Platte River	13920	2,975		3.0-9.0		1986
Caddis Lake	Big Thompson River	57340	3,290	0.2			1959
Como Creek	Boulder Creek	13184	2,658		3.5	1969	
Cony Creek	St. Vrain Creek	10621	2,865		4.9		1989
Cornelius Creek*	Cache la Poudre River	12827	2,390		6.6		1983
Crystal Lake	Big Thompson River	57338	3,508	10.3			1984
Dream Lake	Big Thompson River	54685	3,081	1.4			1997
Fern Creek	Big Thompson River	11019	2,713		2.4		1982
Fern Lake	Big Thompson River	57326	2,905	2.9			1982
George Creek	Cache la Poudre River	11003	2,500		10		1983
Hidden Valley Creek	Big Thompson River	12954	2,727	2.4			1973
Hourglass Creek*	Cache la Poudre River	13627	2,865		2.8		1966
Hunters Creek	St. Vrain Creek	11205	2,865		1.8	1985	
Husted Lake	Big Thompson River	57415	3,380	4.4			1986,91
Lower Hutcheson Lake	St. Vrain Creek	60385	3,308	2.7			1989
Middle Hutcheson Lake	St. Vrain Creek	60397	3,411	0.6		1987	
Upper Hutcheson Lake	St. Vrain Creek	60400	3,509	1.8		1986	
Lake Louise	Big Thompson River	59801	3,362	2.5			1989
Lawn Lake	Big Thompson River	57403	3,349	17.3			1984
Loomis Lake	Big Thompson River	57352	3,118	1.2			1991
Lost Lake	Big Thompson River	57439	3,266	2.9			1987
May Creek	Cache la Poudre River	12978	2,926		4.1		1980
Odessa Lake	Big Thompson River	55827	3,054	3.3			1984

(con.)

Table 1 (Con.)

Water	Drainage	CDOW Code	Elevation (m)	Area (ha)	Length (km)	Found	Founded
Ouzel Creek	St. Vrain Creek	14085	2,865		4.4		1981
Ouzel Lake	St. Vrain Creek	59572	3,048	2			1981
Pear Lake	St. Vrain Creek	59584	3,225	6.4			1989
Pennock Creek	Cache la Poudre River	11736	2,609		3.4		1986
Little South Fork Poudre River	Cache la Poudre River	11940	2,780		1.6	1965	
Roaring Creek	Cache la Poudre River	12081	2,609		13.2	1963	
Roaring River	Big Thompson River	13069	2,774		6.9		1984
Sandbeach Lake	St. Vrain Creek	59609	3,134	4			1989
East Fork Sheep Creek	Cache la Poudre River	13730	2,880		5.4		1982
West Fork Sheep Creek	Cache la Poudre River	13742	2,880		7.5		1982
Spruce Lake	Big Thompson River	57364	2,947	1.6			1991
Big Thompson River	Big Thompson River	12372	2,573		12.5	1957	
North Fork Big Thompson River	Big Thompson River	13300	3,011		4.7		1970
West Creek	Big Thompson River	12524	2,499		5		1979
Williams Gulch	Cache la Poudre River	14263	2,804		4.7		1996
Zimmerman Lake	Cache la Poudre River	57059	3,199	4.3			1996
Zinn Ranch Ponds*	Plum Creek	60943	2,505	0.2-0.7			1985

Table 2 – Abundance estimates for greenback cutthroat trout in recovery waters from 1955 to 1999. Only surveys detecting greenback cutthroat trout are included. We defined qualitative surveys as visual, angling, or one-pass electrofishing counts used to estimate relative abundance, or as samples taken for other purposes (e.g., genetic analyses, but not including creel surveys). Quantitative surveys comprised two- or three-pass depletion or mark-recapture counts in streams and catches per gill-net-hour in lakes. Numbers in parentheses denote the number of quantitative estimates that were reported to exist in additional reaches or years but were unavailable. Sampling intensity is the length (m) of stream sampled or number of nets used in a lake per year. Mean abundance is the estimated number of greenback cutthroat trout per 100 m in streams or per gill-net-hour in lakes for fish greater than 100 mm total length. The few mark-recapture estimates for lakes (Bergersen 1988a,b; Shively 1989b) are not included. Means were obtained by taking an average for all reaches or nets for each year, then calculating a mean for all years. (Standard deviations, SD, are given.) Missing data are denoted by a dashed line.

Water	Qualitative	Quantitative	Sampling intensity (m)	Mean	SD
Arkansas Basin					
South Apache Creek	1977,80-84,92	1989,94,95	191	60	34
Lake Fork Arkansas River	1987,89,97	1995(4)	845	16	
Boehmer Reservoir	1987,94-97,99	(3)			
Cascade Creek (1)	1976,78,80,81,96,99	1994(8)	78	19	
Cascade Creek (2)		1995(1)	165	10	
Cottonwood Creek	1984,89,95,96,99				
Duck Pond	1987				
Dutch Creek	1978				
Elk Creek		1995(1)	130	20	
Greenhorn Creek	1997	1992,94,95(3)	274	33	16
South Prong Hayden Creek	1996,99				
South Fork Huerfano River	1963,76,78				
Lytle Pond	1982-88				
McAlpine Lake	1981-85				
Native Lake	1991,92	1991-93,95	1	5	5
Newlin Creek	1998				
Rainbow Lake		1991-93,95	1	5	1
Rock Creek	1992,99	1993,95(3)	330-350	15	3
East Branch Sayres Gulch		1998	---	6	
Severy Creek	1997	(1)			
Swamp Lakes		1993,94	2-3	7	9
Timberline Lake		1989,95	1-2	2	2
Virginia Lake		1989,95	1	1	1
South Platte Basin					
Albion Creek	1955,57,63,64,69				
Bard Creek	1983	1985,94,99(3)	100-275	33	17
Bear Lake	1977-82,84-89				
Black Hollow Creek	1963,64,66,67,71,72,78,79,82,83,96	1985-89,99(1)	91-261	21	9
Bruno Gulch	1991	(1)			
Caddis Lake	1972	1979,88,99	1	12	5
Como Creek	1969,70,73,75,77-80,82-89	1982,85,91,95,99	201-425	30	4
Cony Creek	1996,98				
Cornelius Creek	1984	1985-89,99	91-675	11	5
Crystal Lake	1991-93	1986,88,91-93,98	1-2	1	2
Dream Lake		1998,99	2	9	5
Fern Creek	1985,96	1988,91	45-91	33	11
Fern Lake	1993,98	1984,85,87,90-93	1	7	6
George Creek	1984	1985-89,99	91-750	30	11
Hidden Valley Creek	1974-86,88-90,95,97-99				
Hourglass Creek	1969,81,82	1984	100	7	
Hunters Creek	1985-89,92,93,97	1988,99	183-450	32	6
Husted Lake	1998	1993,98	1-2	21	2
Lower Hutcheson Lake	1989,91,97	1989,91,98	1	7	5
Middle Hutcheson Lake	1987	1981,86,87,98	1-2	3	6

(con.)

Table 2 (Con.)

Water	Qualitative	Quantitative	Sampling intensity (m)	Mean	SD
Upper Hutcheson Lake	1986,96,97	1963,81,86,90,98	1	18	18
Lake Louise		1993,98	1	16	10
Lawn Lake	1986,89,91-93	1986-89,91,92,96	1-2	10	6
Loomis Lake	1998	1993,95	1	16	4
Lost Lake	1993	1989,90,93,98	1	14	16
May Creek	1982,83,96	1986-89,99(1)	91-450	18	14
Odessa Lake	1986,91-93,98	1987,91-93,98	1-2	5	3
Ouzel Creek	1982-89,91,93,97-99	1998	110	39	
Ouzel Lake	1985-89,93,98	1983-89,91,93,98	1-2	20	21
Pear Lake	1989,90	1989,98(1)	1	27	27
Pennock Creek	1987,88	1989,98	88-450	11	11
Little South Fork Poudre River	1965,70,75,78-81,84-86,89,90,92,93	1983,86-89,98,99	91-560	13	9
Roaring Creek	1963,64,77,81,97	1999(1)	825	47	
Roaring River	1986,91	1988,89	99-183	23	10
Sandbeach Lake	1990,91,93,98	1989-91,93,98	1	34	45
East Fork Sheep Creek	1983,98	1986-89,99(2)	91-475	30	9
West Fork Sheep Creek	1983,98	1986-89,99(2)	91-575	34	11
Spruce Lake	1993,95,98	1992,93,95	1	19	21
Big Thompson River	1957-59,65,67-69,75,78,80,81,85,99	1980(2)	671	29	
North Fork Big Thompson River	1973,78,83,84,89,93,97	1986	---	16	
West Creek	1980,83,85-89,98	1999	91	12	
Williams Gulch	1982,83,96,97	1985-89,99(1)	100-475	26	12
Zimmerman Lake	1996,97				
Zinn Ranch Ponds	1986,87,89				

Table 3 -- Genetic assessments of greenback cutthroat trout. Under results, h denotes that the sample was believed to contain hybridized fish and p denotes the sample was deemed genetically pure. Method refers to the technique used to ascertain genetic status: m, meristic-morphometric assessment; e, electrophoretic analysis of allozymes; and d, examination of mitochondrial or nuclear DNA. For each analysis, the year or years from which samples were drawn and the sample size (N) are noted. Within a particular water, identical samples evaluated on more than one occasion are marked with an asterisk (*). Missing data are denoted by a dashed line.

Water	Results	Method	Year	N
<i>Arkansas Basin</i>				
South Apache Creek	h	m	1977	26
	p	e	1987	30
	h	m	1996	10*
	p	d	1996	10*
	p	e	1999	16
	h	d	2001	32
Boehmer Reservoir	p	m,d	1996	30
	h	e	1999	30
	h	d	2000	30
	h	d	2000	28
	h	d	2001	27
Cascade Creek (1)	p	m	1976	15*
	p	m	1976	15*
	p	m,d	1996	12
	h	d	2001	20
Cottonwood Creek	h	e	1999	7
South Prong Hayden Creek	h	m	1998	10*
	p	d	1998	10*
	p	e	1999	12
South Fork Huerfano River	h	m	1963	15
	p	m	1976	15
	h	m	1978	2
Severy Creek	p	m,d	1999	12
	p	d	2001	2
<i>South Platte Basin</i>				
Albion Creek	p	m	1957-64	39
Black Hollow Creek	p	m	1963	40*
	h	m	1963	40*
	h	m	1964-72	---
	p	m	1978	8
	h	d	1996	5
Caddis Lake	h	m	1972	6
	p	d	1999	15

(con.)

Table 3 (Con.)

Water	Results	Method	Year	N
Como Creek	p	m	1969	18
	p	m	1978	10
	p	d	2001	30
Hidden Valley Creek	p	e	1985	28
Hunters Creek	p	m	1985	7
	p	d	2001	25
Middle Hutcheson Lake	p	m	1986	3
Upper Hutcheson Lake	p	m	1987	27
	h	d	2001	25
	h	d	1996	10
May Creek	h	d	1996	10
Ouzel Creek	p	e	1985	25
Little South Fork Poudre River	p	m	1965-70	18
	p	d	2001	32
Roaring Creek	h	m	1977	8
	p	e	1998	25
	p	d	2001	32
Sheep Creek	h	d	1996	15
Big Thompson River	h	m	1959-67	40
	p	m	1968	---
	p	m	1978	12
	h	m	1982	43
	h	d	1999	15
Williams Gulch	h	d	1996	5

Table 4 -- Salmonid fauna of recovery waters for greenback cutthroat trout. For species present at the time recovery efforts began in a particular water, abbreviations are: b, historically barren; gbct, greenback cutthroat trout; bk, brook trout; bn, brown trout; ct, hybridized or nonnative cutthroat trout; lk, lake trout; and rb, rainbow trout. We also note when a water was chemically treated to remove nonnative species, and if nonnative species reappeared, the year they were detected. Systems that were chemically treated more than once have multiple entries. For the form of barrier inhibiting upstream migration by nonnative fish, abbreviations are: a, artificial; g, geomorphic; and n, none. Artificial barriers consist of dams, water diversions, weirs, constructed ponds, or toxic mine outflows, whereas geomorphic barriers include waterfalls, cascades, dry stream channels, or naturally landlocked waters.

Water	Species present	Treatment year	Nonnative species detected	Barrier
<i>Arkansas Basin</i>				
North Apache Creek	b			g
South Apache Creek	gbct			g
Lake Fork Arkansas River	bk,bn,ct	1986	1987	a
	bk,bn	1998		
Boehmer Reservoir	ct	1984		a
Cascade Creek (1)	gbct			g
Cascade Creek (2)	b			g
Cottonwood Creek	b			g
Duck Pond	bk	1984		a
Elk Creek	bk	1990	1995	a
Greenhorn Creek	b			g
South Prong Hayden Creek	gbct			g
South Fork Huerfano River	bk			n
Lytle Pond	b		1982(bk)	a
McAlpine Lake	b			a
Native Lake	bk	1990	1995	a
Newlin Creek	b			a
Rainbow Lake	bk	1990		g
Rock Creek	bk	1990	1995	a
East Branch Sayres Gulch	b			a
Severy Creek	gbct			g
Swamp Lakes	bk	1990		g
Timberline Lake	bk,ct,lk	1986	1987	a
	bk	1998		
Virginia Lake	bk	1986		g
<i>South Platte Basin</i>				
Albion Creek	bk			n
Bard Creek	b			g
Bear Lake	bk	1975		g

(con.)

Table 4 (Con.)

Water	Species present	Treatment year	Nonnative species detected	Barrier
Black Hollow Creek	bk	1967	1973	a
	bk	1979		
Bruno Gulch	bk	1985	1985	a
Caddis Lake	ct	1958		g
Como Creek	gbct			g
Cony Creek	ct,rb	1987,88		g
Cornelius Creek	bk,bn	1981,82	1985	a
Crystal Lake	ct	1983		g
Dream Lake	ct	1996		g
Fern Creek	bk,ct	1982		g
Fern Lake	bk,ct	1982		g
George Creek	bk,bn	1981,82	1985(bk)	a,g
Hidden Valley Creek	bk	1973	1976	g
Hourglass Creek	b		1977(bk)	g
Hunters Creek	gbct			g
Husted Lake	bk,ct	1986	1989	g
	bk	1990		
Lower Hutcheson Lake	ct,rb	1986		g
Middle Hutcheson Lake	gbct			g
Upper Hutcheson Lake	gbct			g
Lake Louise	b			g
Lawn Lake	bk	1983		g
Loomis Lake	bk	1990		g
Lost Lake	bk,ct	1986		g
May Creek	bk	1979		g
Odessa Lake	b			g
Ouzel Creek	bk	1980	1985	g
Ouzel Lake	bk	1980	1985	g
Pear Lake	ct,rb	1988		g
Pennock Creek	bk,bn	1979,85	1989	a
Little South Fork Poudre River	gbct			g
Roaring Creek	gbct			g
Roaring River	bk	1983		g
Sandbeach Lake	rb	1988		g
East Fork Sheep Creek	rb	1980		g
West Fork Sheep Creek	rb	1980		g
Spruce Lake	rb	1990		g
Big Thompson River	b			g
North Fork Big Thompson River	bk	1986	1993	g
West Creek	bk	1978		g
Williams Gulch	b			g
Zimmerman Lake	b			g
Zinn Ranch Ponds	bk	1984		n

Table 5 -- Destination, date, source, number, and mean length (mm) of greenback cutthroat trout stocked for purposes of recovery. Only waters receiving fish from elsewhere are included. Dates are given to the nearest day, when known. Under source, year taken from a contributing water (and whether it was held or reared at another location) or year classes from each hatchery are noted (see tables 7 and 8 for more information on hatchery year classes). Stocking in lake inlets or outlets is included with lake totals. Abbreviations are: BFRH, Bellvue Fish Research Hatchery; BFTC, Bozeman Fish Technology Center; CNRL, Columbia National Research Lab; PSFH, Pueblo State Fish Hatchery; and SNFH, Saratoga National Fish Hatchery. Also noted are cases where nonnative or unknown sources of cutthroat trout were stocked. In some instances, fish lengths were not specified in the literature, but were given as fry, juveniles, adults, or mixtures. Missing data are denoted by a dashed line.

Water	Date	Source	Number	Length (mm)
Arkansas Basin				
North Apache Creek	6/27/1996	1995 Boehmer Reservoir (via BFRH)	360	111
	9/24/1997	1997 Boehmer Reservoir (via PSFH)	600	75
Lake Fork Arkansas River	9/9/1987	1987 SNFH	1,500	50
	9/12/1988	1988 SNFH	2,000	25
	8/30/1989	1988-1989 SNFH	2,000	121
	8/28/1990	1990 SNFH	18,000	33
	7/23/1996	1995 Boehmer Reservoir (via BFRH)	3,548	116
	9/18/1997	1997 Boehmer Reservoir (via PSFH)	1,000	71
Boehmer Reservoir	9/19/1985	1984 McAlpine Lake (via SNFH)	1,670	93
	9/19/1985	1984 Lytle Pond (via SNFH)	125	124
	10/3/1985	Lytle Pond	100	267
	9/9/1987	1987 SNFH	3,500	50
	9/12/1988	1988 SNFH	2,500	25
	8/30/1989	1989 SNFH	15,320	38
Cottonwood Creek	8/1983	Cascade Creek	32	126
	7/25/1985	1984 Lytle Pond (via SNFH)	225	120
	7/25/1985	1984 McAlpine Lake (via SNFH)	456	97
	9/12/1988	1988 SNFH	3,000	25
	8/30/1989	1989 SNFH	1,149	38
Duck Pond	7/25/1985	Lytle Pond	77	240
	6/3/1987	Lytle Pond	7	363
	1988	Lytle Pond	143	---
	5/19/1993	1992 South Apache Creek & 1992 SNFH (via BFRH)	---	150
	7/18/1994	1993 Boehmer Reservoir (via BFRH)	1,523	147
Elk Creek	6/26/1991	1989 SNFH	300	235
	9/17/1991	1991 SNFH	750	49
	9/22/1992	1992 SNFH	750	38
	7/23/1996	1995 Boehmer Reservoir (via BFRH)	728	116
Greenhorn Creek	8/30/1989	1989 SNFH	153	38
	9/24/1997	1997 Boehmer Reservoir (via PSFH)	1,000	75
South Fork Huerfano Creek	9/1/1976	Pikes Peak cutthroat trout	4,500	30
Lytle Pond	9/22/1981	Cascade Creek	40	mixture
	7/1983	1983 Lytle Pond (via unknown hatchery)	92	fry
	6/9/1984	1984 Lytle Pond (via CNRL)	1,100	fry
	7/25/1985	1984 McAlpine Lake (via SNFH)	50	97
	5/19/1993	1992 South Apache Creek & 1992 SNFH (via BFRH)	2,350	150
McAlpine Lake	1980	Cascade Creek	25	mixture
	9/19/1985	1884 Lytle Pond (via SNFH)	30	124
	9/19/1985	1984 McAlpine Lake (via SNFH)	30	97
Native Lake	6/26/1991	1989 SNFH	400	235
	9/17/1991	1991 SNFH	1,140	49
	9/22/1992	1992 SNFH	1,400	38
	7/23/1996	1995 Boehmer Reservoir (via BFRH)	728	116

(con.)

Table 5 (Con.)

Water	Date	Source	Number	Length (mm)
	7/23/1996	1996a BFRH	700	41
Newlin Creek	9/24/1997	1997 Boehmer Reservoir (via PSFH)	900	75
Rainbow Lake	6/26/1991	1989 SNFH	500	235
	9/17/1991	1991 SNFH	1,660	49
	9/22/1992	1992 SNFH	1,600	38
	7/23/1996	1995 Boehmer Reservoir (via BFRH)	936	116
Rock Creek	6/26/1991	1989 SNFH	1,044	235
	9/17/1991	1991 SNFH	8,600	49
	9/22/1992	1992 SNFH	4,900	38
	7/23/1996	1995 Boehmer Reservoir (via BFRH)	1,612	116
East Branch Sayres Gulch	7/23/1996	1995 Boehmer Reservoir (via BFRH)	728	116
	7/23/1996	1996a BFRH	700	41
	9/18/1997	1997 Boehmer Reservoir (via PSFH)	1,500	71
Swamp Lakes, Upper and Lower	6/26/1991	1989 SNFH	200	235
	9/17/1991	1991 SNFH	1,600	49
	9/22/1992	1992 SNFH	900	38
Timberline Lake	9/9/1987	1987 SNFH	7,000	50
	9/12/1988	1988 SNFH	12,500	25
	8/30/1989	1989 SNFH	20,000	38
	8/28/1990	1990 SNFH	20,000	33
Virginia Lake	9/9/1987	1987 SNFH	2,500	50
	9/12/1988	1988 SNFH	1,000	25
	8/30/1989	1989 SNFH	1,000	38
	8/28/1990	1990 SNFH	250	33
South Platte Basin				
Bard Creek	10/5/1982	1982 BFTC	6,900	43
	11/16/1982	1982 BFTC	980	---
	9/28/1983	1983 BFTC	2,056	46
	7/11/1984	1983 BFTC	400	140
	9/11/1984	1984 BFTC	1,600	36
	9/25/1985	1985 BFTC	5,000	36
	9/16/1987	1987 BFTC	5,000	34
	9/23/1992	1992 BFTC	5,000	67
	6/21/1993	1992 BFRH	1,350	127
Bear Lake	11/4/1975	Como Creek	51	adults
	11/4/1975	Como Creek	14	fry
	6/26/1981	1980 BFTC	432	155
	7/11/1984	1983 BFTC	200	140
	9/16/1987	1987 BFTC	500	34
	6/30/1989	1988 BFTC	271	161
	5/19/1993	1992 Little South Fork Poudre River (via BFRH)	54	99
Big Thompson River	1922-23	Yellowstone cutthroat trout	---	---
	9/23/1992	1992 BFTC	2,700	67
	9/23/1992	1992 BFRH	100	fry
N.F. Big Thompson River	10/19/1970	Como Creek	50	125
	9/16/1987	1987 BFTC	3,000	34
	6/30/1989	1988 BFTC	90	161
	9/14/1989	1989 BFTC	7,000	40
	10/11/1990	1990 BFTC	1,500	64
Black Hollow Creek	9/1969	Albion Creek	10	mixture
	1970	Como Creek	40	mixture
	8/15/1980	Como Creek	37	115
	10/6/1982	1982 BFTC	850	43
	9/26/1983	1983 BFTC	935	46
	7/11/1984	1983 BFTC	75	140
	9/11/1984	1984 BFTC	600	36
	9/16/1987	1987 BFTC	3,000	34
Bruno Gulch	9/1986	Zinn Ranch Ponds	30	100
	9/24/1986	1986 BFTC	1,180	36
	9/16/1987	1987 BFTC	6,750	34
	9/14/1989	1989 BFTC	5,120	40
	10/11/1990	1990 BFTC	5,000	64
Caddis Lake	8/6/1959	Big Thompson River	97	175
	9/4/1959	Big Thompson River	112	175
	1962	Pikes Peak cutthroat trout	---	---
Cony Creek	9/14/1989	1989 BFTC	8,500	40
	10/11/1990	1990 BFTC	1,500	64

Table 5 (Con.)

Water	Date	Source	Number	Length (mm)
	7/2/1991	Pear Lake	130	224
Cornelius Creek	9/26/1983	1983 BFTC	2,308	46
	7/11/1984	1983 BFTC	310	140
	9/11/1984	1984 BFTC	2,000	36
Crystal Lake	9/11/1984	1984 BFTC	685	36
	9/25/1985	1985 BFTC	1,300	36
	9/24/1986	1986 BFTC	1,090	36
	9/14/1989	1989 BFTC	11,764	40
Dream Lake	7/11/1997	Upper Hutcheson Lake	190	adults
	7/11/1997	Upper Hutcheson Lake	5	juveniles
Fern Creek	9/26/1983	1983 BFTC	560	46
	9/11/1984	1984 BFTC	414	36
	9/25/1985	1985 BFTC	1,100	36
Fern Lake	10/5/1982	1982 BFTC	900	43
	9/26/1983	1983 BFTC	4,699	46
	9/11/1984	1984 BFTC	3,679	36
George Creek	9/26/1983	1983 BFTC	2,618	46
	7/11/1984	1983 BFTC	200	140
	9/11/1984	1984 BFTC	2,000	36
Hidden Valley Creek	10/16/1973	Como Creek	82	155
	6/30/1989	1988 BFTC	814	161
	10/11/1990	1990 BFTC	736	64
Hourglass Creek	10/1966	Black Hollow Creek	54	mixture
	8/15/1980	Como Creek	34	115
	7/15/1981	1980 BFTC	158	155
	10/5/1982	1982 BFTC	1,110	43
Husted Lake	9/24/1986	1986 BFTC	1,820	36
	9/16/1987	1987 BFTC	2,000	34
	9/25/1991	1991 BFTC	4,000	58
	9/23/1992	1992 BFTC	2,740	67
	9/23/1992	1992 BFRH	260	fry
Hutcheson Lake, Lower	6/30/1989	1988 BFTC	1,340	161
	9/14/1989	1989 BFTC	1,700	40
	9/25/1991	1991 BFTC	1,600	58
Hutcheson Lake, Upper	1952	Cutthroat trout	1,200	---
	1964	Cutthroat trout	3,000	---
Lake Louise	9/14/1989	1989 BFTC	3,500	40
Lawn Lake	9/11/1984	1984 BFTC	6,415	36
	9/25/1985	1985 BFTC	8,000	36
	9/24/1986	1986 BFTC	6,830	36
	9/14/1989	1989 BFTC	1,000	40
Loomis Lake	9/25/1991	1991 BFTC	1,000	58
	9/23/1992	1992 BFTC	639	67
	9/23/1992	1992 BFRH	361	fry
Lost Lake	9/16/1987	1987 BFTC	4,000	34
	6/30/1989	1988 BFTC	1,356	161
	9/14/1989	1989 BFTC	3,000	40
May Creek	8/15/1980	Como Creek	54	115
	10/5/1982	1982 BFTC	1,700	43
	9/27/1983	1983 BFTC	701	46
	7/11/1984	1983 BFTC	90	140
	9/11/1984	1984 BFTC	800	36
	9/16/1987	1987 BFTC	3,000	34
Odessa Lake	9/11/1984	1984 BFTC	619	36
	9/25/1985	1985 BFTC	1,100	36
	9/14/1989	1989 BFTC	4,000	40
Ouzel Creek	9/15/1981	1981 BFTC	8,570	29
	10/6/1982	1982 BFTC	1,733	43
	9/26/1983	1983 BFTC	970	46
Ouzel Lake	9/15/1981	1981 BFTC	6,420	29
	10/6/1982	1982 BFTC	3,467	43
	9/26/1983	1983 BFTC	3,269	46
Pear Lake	6/30/1989	1988 BFTC	3,164	161
	9/14/1989	1989 BFTC	5,000	40
	10/11/1990	1990 BFTC	1,500	64
Pennock Creek	9/24/1986	1986 BFTC	4,560	36
	9/16/1987	1987 BFTC	8,400	34

(con.)

Table 5 (Con.)

Water	Date	Source	Number	Length (mm)
Roaring Creek	1912	Cutthroat trout	9,000	---
Roaring River	9/11/1984	1984 BFTC	1,000	36
	9/25/1985	1985 BFTC	3,700	36
	9/24/1986	1986 BFTC	3,640	36
	9/16/1987	1987 BFTC	6,000	34
Sandbeach Lake	6/30/1989	1988 BFTC	1,862	161
	9/14/1989	1989 BFTC	4,000	40
East Fork Sheep Creek	10/5/1982	1982 BFTC	3,600	43
	9/27/1983	1983 BFTC	1,100	46
	7/11/1984	1983 BFTC	150	140
	9/11/1984	1984 BFTC	500	36
	9/25/1985	1985 BFTC	2,500	36
	9/16/1987	1987 BFTC	3,000	34
West Fork Sheep Creek	10/5/1982	1982 BFTC	3,600	43
	9/27/1983	1983 BFTC	1,000	46
	7/11/1984	1983 BFTC	150	140
	9/11/1984	1984 BFTC	500	36
	9/25/1985	1985 BFTC	2,500	36
	9/16/1987	1987 BFTC	3,000	34
Spruce Lake	9/25/1991	1991 BFTC	1,000	58
	9/23/1992	1992 BFTC	1,005	67
	9/23/1992	1992 BFRH	495	fry
West Creek	6/20/1979	Hidden Valley Creek	58	180
	7/11/1984	1983 BFTC	100	140
	9/11/1984	1984 BFTC	276	36
	9/16/1987	1987 BFTC	2,000	34
	9/14/1989	1989 BFTC	1,500	40
Williams Gulch	6/26/1981	1980 BFTC	48	155
	10/6/1982	1982 BFTC	1,700	43
	9/29/1983	1983 BFTC	421	46
	7/11/1984	1983 BFTC	230	140
	9/11/1984	1984 BFTC	800	36
	9/16/1987	1987 BFTC	500	34
Zimmerman Lake	7/2/1996	1995 Hunters Creek-Little South Fork Poudre River (via BFRH)	1,622	137
Zinn Ranch Ponds	9/25/1985	1985 BFTC	810	36
	9/24/1986	1986 BFTC	730	36
	9/16/1987	1987 BFTC	700	34

Table 6 -- Characteristics of greenback cutthroat trout delivered to hatcheries, including hatchery used, year spawned, and source and number of eggs or milt sent to hatcheries for recovery efforts. If eggs were used, the number of females and males is given in parentheses. A number followed by a plus sign (+) indicates the minimum number of a sex that was used. If milt was used, the number of males providing milt is noted, and the number of containers used to ship the milt is given in parentheses. Hatchery abbreviations are: BFRH, Bellvue Fish Research Hatchery; BFTC, Bozeman Fish Technology Center; and SNFH, Saratoga National Fish Hatchery. Missing data are denoted by a dashed line.

Hatchery	Year	Source	Eggs	Milt	Comments
Arkansas Basin					
BFRH	1992	South Apache Creek	2,622 (---,---)		
	1992	SNFH	12,006 (264,264)		
	1993	Boehmer Reservoir	29,700 (---,---)		
	1994	Boehmer Reservoir	58,996 (---,---)		In 1996, 660 offspring were mixed with 56, 1993 Boehmer Reservoir offspring.
	1995	Boehmer Reservoir	89,472 (---,---)		
	1996	Boehmer Reservoir	9,824 (---,---)		
SNFH	1984	Lytle Pond	1,743 (---,---)		Fish from both sources originated from Cascade Creek.
	1984	McAlpine Lake	5,556 (5,6)		In 1985, 504 offspring from both sources were mixed.
South Platte Basin					
BFRH	1989	Como Creek	847 (4,18)		In 1989, 1020 offspring (77 from Como Creek, 688 from Hunters Creek, and 255 from Bear Lake) were mixed.
	1989	Bear Lake	602 (1,---)		
	1989	Hunters Creek	3,688 (11,10)		
	1989	Little South Fork Poudre River	282 (1,---)		Eggs infertile.
	1990	Upper Hutcheson Lake	305 (---,---)		
	1992	Hunters Creek	1,185 (9,---)		
	1992	Little South Fork Poudre River	760 (2,2)		
	1993	Hunters Creek	1,768 (11,23)		
	1994	Como Creek	580 (6,3+)		In 1996, 10 offspring were mixed with 100, 1993 Hunters Creek offspring.
	1995	Hunters Creek	4,734 (27,---)		In 1996, 800 offspring were mixed with 45, 1995 Little South Fork Poudre River offspring.
	1995	Little South Fork Poudre River	1,632 (---,---)		
	1996	Upper Hutcheson Lake	6,948 (20,---)		In 1996, mixed with offspring of fish spawned in hatchery.
	1997	Hunters Creek	2,016 (13,18)		
	BFTC	1997	Upper Hutcheson Lake	4,600 (---,---)	
1977		Como Creek ^a			
1982		Hidden Valley Creek		12	
1983		Como Creek		8	
1983		Hidden Valley Creek		21	
1984		Como Creek		12(8)	
1984		Hidden Valley Creek		46(40)	
1985		Como Creek		40(---)	Up to 3 males per vial.
1985		Hidden Valley Creek		24	
1986		Como Creek		18	
1986		Hunters Creek		9	
1986		Little South Fork Poudre River		2	
1987		Como Creek		16	
1987		Hunters Creek		17	
SNFH	1988	Como Creek		26(23)	
	1988	Hunters Creek		14	
	1989	Como Creek		22	
	1984	Little South Fork Poudre River	500 (3,1)		All eggs died.
	1985	Little South Fork Poudre River	353 (9,24)		All fry died by February 1986.

^a In 1977, 66 juvenile and adult fish -- of which 64 survived -- were sent from Como Creek to the BFTC to found its South Platte Basin broodstock.

Table 7 -- Characteristics of greenback cutthroat trout spawned in hatcheries as part of recovery efforts, including hatchery used, year spawned, source, year class name, number, and sex of fish used, and eggs and fry produced. Source denotes the origin of fish being spawned. If the hatchery received fish or eggs from a wild population to support a broodstock, the year of arrival in the hatchery and the water providing the fish are noted. If fish were derived from spawning in a hatchery, the year of spawning and hatchery are noted. To the extent possible, only numbers of fish successfully producing viable offspring are included. If the sexes of fish of different sources were known, it is indicated in parentheses (F, female; M, male) or overall in the following column. Abbreviations are: BFRH, Bellvue Fish Research Hatchery; BFTC, Bozeman Fish Technology Center; and SNFH, Saratoga National Fish Hatchery. Missing data are denoted by a dashed line.

Hatchery	Year	Source	Year class	F,M	Eggs	Fry	Comments
Arkansas Basin							
BFRH	1996	1993 Boehmer Reservoir	1996a BFRH	118,201	75,688	---	
SNFH	1987	1984 Lytle Pond-McAlpine Lake	1987 SNFH	169,219	182,336	---	
	1988	1984 Lytle Pond-McAlpine Lake	1988 SNFH	151,200	281,626	---	
	1989	1984 Lytle Pond-McAlpine Lake	1989 SNFH	108,190	244,422	---	
	1990	1984 Lytle Pond-McAlpine Lake	1990 SNFH	32,40	76,930	---	
	1991	1988 SNFH	1991 SNFH	236,225	273,383	---	
	1992	1988 SNFH	1992 SNFH	150,150	292,113	---	All fry produced this year were combined.
	1992	1989 SNFH	1992 SNFH	114,114	94,280	---	
South Platte Basin							
BFRH	1991	1989 Bear Lake-Como Creek-Hunters Creek	1991 BFRH	7,---	4,006	446	
	1992	1989 Bear Lake-Como Creek-Hunters Creek	1992 BFRH	17,---	9,590	3,500	
	1993	1990 Upper Hutcheson Lake-1991 BFRH	1993 BFRH	30,---	33,406	2,250	
BFTC	1996	1993 Hunters Creek	1996b BFRH	52,62	41,993	---	
	1978	1977 Como Creek	1978 BFTC	2,---	1,005		
	1979	1977 Como Creek	1979 BFTC	2,---	1,377	268	
	1980	1977 Como Creek	1980 BFTC	7,---	3,704	900	
	1981	1978 BFTC	1981 BFTC	11,---	6,065	---	
	1981	1979 BFTC	1981 BFTC	90,---	35,021	---	
	1982	1979 BFTC(F),1982 Hidden Valley Creek(M)	1982 BFTC	30,12	---	---	
	1982	1979 BFTC	1982 BFTC	---,---	---	---	In 1982, 32,000 fry produced overall.
	1983	1979 BFTC	1983 BFTC	25,13	---	---	
	1983	1979 BFTC(F),1983 Como Creek(M)	1983 BFTC	7,8	---	---	
	1983	1979 BFTC(F),1983 Hidden Valley Creek(M)	1983 BFTC	35,18	---	---	
	1984	Mixed BFTC(F),1984 Hidden Valley Creek(M)	1984 BFTC	25,33	---	---	
	1984	Mixed BFTC	1984 BFTC	126,58	---	---	
	1985	Mixed BFTC(F),1985 Como Creek(M)	1985 BFTC	95,25	---	---	
	1985	Mixed BFTC(F),1985 Hidden Valley Creek(M)	1985 BFTC	120,24	---	---	
	1986	Mixed BFTC(F),1986 Como Creek(M)	1986 BFTC	52,18	---	---	
	1986	Mixed BFTC(F),1986 Hunters Creek(M)	1986 BFTC	20,9	---	---	
	1986	Mixed BFTC(F),1986 LSF Poudre River(M)	1986 BFTC	5,2	---	---	
	1986	Mixed BFTC	1986 BFTC	164,---	---	---	In 1986, 210 females used overall.
	1987	Mixed BFTC,1987 Como Creek(M)	1987 BFTC	64,16	75,087	---	
	1987	Mixed BFTC,1987 Hunters Creek(M)	1987 BFTC	65,17	36,825	---	
	1987	Mixed BFTC	1987 BFTC	95,60	37,621	---	In 1987, 63,633 fry produced overall.
	1988	Mixed BFTC,1988 Como Creek(M)	1988 BFTC	53,26	---	---	
	1988	Mixed BFTC,1988 Hunters Creek(M)	1988 BFTC	---,14	---	---	
	1988	Mixed BFTC	1988 BFTC	146+,70+	---	---	
	1989	Mixed BFTC,1989 Como Creek(M)	1989 BFTC	---,22+	---	---	
	1989	Mixed BFTC	1989 BFTC	---,---	---	---	In 1989, 315 females used overall.
	1990	Mixed BFTC	1990 BFTC	51,86	85,000	---	
	1991	Mixed BFTC	1991 BFTC	65,---	98,000	---	
	1992	Mixed BFTC	1992 BFTC	50,---	60,000	---	

Table 8 -- Characteristics of greenback cutthroat trout distributed by hatcheries as part of recovery efforts, including hatchery used, year shipped, year class name, number, and mean length (mm) of fish shipped. Shipments for disease testing, for genetic analyses, for fish collections, or to support sport fisheries were excluded when possible. See tables 6 and 7 for origins of year classes. Multiple shipments of single sources in one year were distributed on different dates. Hatchery abbreviations are: BFRH, Bellvue Fish Research Hatchery; BFTC, Bozeman Fish Technology Center; and SNFH, Saratoga National Fish Hatchery. Missing data are denoted by a dashed line.

Hatchery	Year	Year class	Number	Length
<i>Arkansas Basin</i>				
BFRH	1992	1992 SNFH	5,100	38
	1993	1992 South Apache Creek	1,750	150
	1993	1992 SNFH	600	150
	1994	1993 Boehmer Reservoir	6,750	147
	1995	1994 Boehmer Reservoir	2,080	---
	1995	1994 Boehmer Reservoir	4,020	---
	1996	1994 Boehmer Reservoir	4,445	---
	1996	1995 Boehmer Reservoir	360	111
	1996	1995 Boehmer Reservoir	26,140	116
	1996	1996a BFRH	1,400	41
SNFH	1985	1984 Lytle Pond	225	120
	1985	1984 McAlpine Lake	506	97
	1985	1984 Lytle Pond	155	124
	1985	1984 McAlpine Lake	1,700	93
	1987	1987 SNFH	14,581	50
	1988	1988 SNFH	23,162	eggs
	1988	1988 SNFH	59,334	25
	1989	1989 SNFH	66,684	38
	1989	1988 SNFH	2,394	203
	1989	1988 SNFH	1,680	213
	1990	1989 SNFH	2,157	120
	1990	1989 SNFH	3,505	120
	1990	1990 SNFH	15,843	33
	1990	1989 SNFH	1,250	141
	1991	1989 SNFH	2,273	235
	1991	1991 SNFH	22,983	49
	1991	1991 SNFH	34,514	50
	1992	1992 SNFH	12,006	eggs
1992	1992 SNFH	9,800	38	
1992	1992 SNFH	2,962	43	
1992	1989 SNFH	15	---	

(con.)

Table 8 (Con.)

Hatchery	Year	Year class	Number	Length
<i>South Platte Basin</i>				
BFRH	1992	1992 BFRH	2,000	---
	1993	1992 Little South Fork Poudre River	54	99
	1993	1992 Hunters Creek	900	---
	1993	1992 BFRH	1,350	127
	1993	1993 BFRH	2,250	---
	1996	1995 Hunters Creek	1,600	137
	1996	1995 Little South Fork Poudre River	200	137
BFTC	1981	1980 BFTC	865	155
	1981	1981 BFTC	16,570	29
	1982	1982 BFTC	26,200	43
	1982	1982 BFTC	1,150	---
	1983	1983 BFTC	23,000	46
	1984	1983 BFTC	1,859	140
	1984	1984 BFTC	39,623	36
	1985	1985 BFTC	27,000	36
	1986	1986 BFTC	29,724	36
	1987	1987 BFTC	60,220	34
	1989	1988 BFTC	9,221	161
	1989	1989 BFTC	55,764	40
	1990	1990 BFTC	12,920	64
	1991	1991 BFTC	12,498	58
	1992	1992 BFTC	19,448	67

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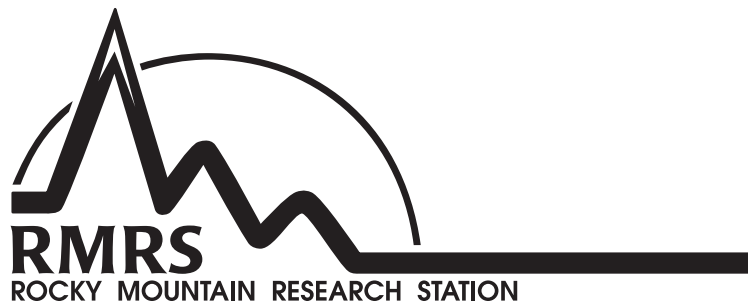
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