

## I. SPECIES DESCRIPTION

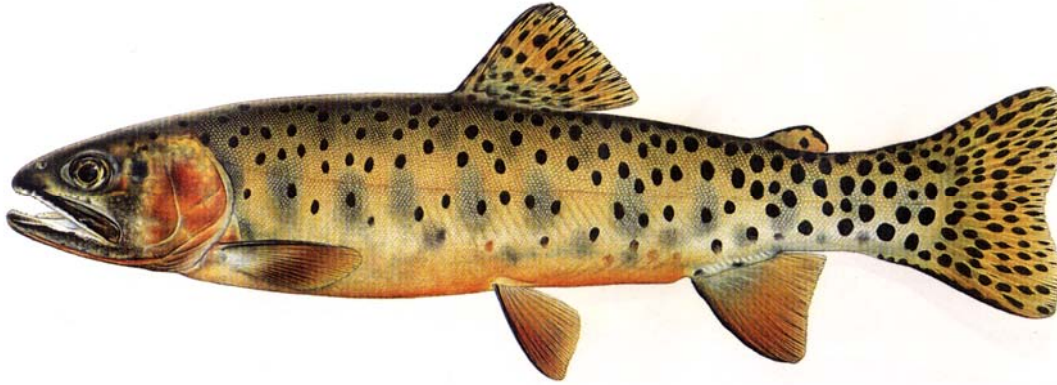
### Non-technical

During the breeding season, the Colorado River cutthroat trout (*O.c. pleuriticus*) is a striking crimson color along the lateral line, ventral surface, and gill covers, often with equally striking shades of orange and golden yellow laid over a yellowish or brassy background color (Figure 1). These colors become darker with age. Juveniles and non-breeding adults typically have white bellies which gradually take on color as fish increase in size (Behnke 1979 and 1992, Smith 1984). A variety of forms of Colorado River cutthroat have been observed, with specimens from isolated populations showing widely varying patterns of coloration and spotting, reflecting long-standing geographic isolation. The spotting pattern of fish from the uppermost Green River system, for example, is more typical of interior cutthroat trout in general --pronounced, rounded spots no larger than the pupil of the eye, concentrated on the caudal peduncle and above the lateral line anterior to the dorsal fin. Alternately, fish from the Yampa River Basin, farther to the east and originally abutting the Continental Divide, more closely resemble the greenback cutthroat trout, with spots larger than the pupil of the eye (Binns 1977; Behnke 1979). Historical accounts indicate individual Colorado River cutthroat were commonly as large as 20 lbs.(Benke 1979), whereas most adult fish today are under 5 lbs. because of reduced habitat quality.

### Technical

The Colorado River cutthroat trout has no single unique meristic trait, but rather a broad group of distinctive features, some shared with the greenback cutthroat trout. For example, both subspecies consistently show the highest scale counts of any recognized cutthroat subspecies. Lateral series scale counts in the Colorado River cutthroat range from 170 to well over 200. Pure populations average more than 180 scales in the lateral series and more than 43 scales above the lateral line. Vertebrae numbers range from 60 to 63, averaging 61 to 62. Gillrakers number from 17 to 21, with a mean values of 19. Pyloric caeca range from 25 to 45 and average 30 to 40. Accepted pure-strain specimens are so rare as to make a valid, unambiguous diagnosis of the subspecies difficult (Behnke, 1979).

Because of extensive hybridization with rainbow trout (*O. mykiss*), Binns (1977) published a rating system to determine the purity of *pleuriticus* populations in Wyoming, based on meristic traits. He assigned grades ranging from "A" (purest) to "F" (least pure). Specimens of purity A through C were considered acceptable representatives of the subspecies, and specimens currently considered by examination of meristic traits to be of "pure strain" correspond to a Binns rating of "A." These specimens have more than 180 scales along the lateral line, fewer than 40.9 pyloric caeca, with 0 to 10 percent of the specimens lacking basibranchial teeth, and with no variation in spotting patterns. "F" specimens, by contrast, have 120-141 scales, more than 53.1 pyloric caeca, with 75-100 percent of the specimens lacking basibranchial teeth and obviously variant spotting patterns differing from those quoted above. Determination of the subspecies purity on meristics alone, however, has been determined to be unreliable and subjective. Thus, genetic analysis is now commonly applied (Conservation Agreement and Strategy for the Colorado River Cutthroat Trout, herein referred to as CAS 1999).



**Figure 1**, Colorado River cutthroat trout.

## **II. TAXONOMY**

The first description of the fish by Cope (1871), who designated it *Salmo pleuriticus*, was based on specimens collected from the Green River at Fort Bridger, Wyoming, the Yellowstone River, and the South Platte River. Thus, Cope's original description included three presently accepted subspecies of the cutthroat trout. In his description, Cope listed the Rio Grande system and the Bonneville Basin as part of the range for the species, thus combining the range of a total of five separate currently recognized subspecies of cutthroat trout. The reason given by Cope for his assignment of full specific status for the fish was the existence of a "keel" found along the midline of the skull in one of the specimens (Gr. *pleurites*, "connected to a rib"). The "keel", however, was an artifact made by improper specimen preservation--the skull had partially dried, causing the frontal bones of the skull to push together and form a ridge. Because no other name had been proposed for the indigenous trout of the Colorado Basin, *pleuriticus* became the valid subspecific name when applied by Jordan in 1891 to these particular, fort Bridger (Green River) fish. A full description of *O. c. pleuriticus* was first published by Behnke and Zarn (1976), over a century after the first collection. A close relationship between *O. c. pleuriticus* and both *O. c. virginalis* and *O. c. stomias* has been postulated, measured, and recounted by a number of observers (Behnke, 1979, 1992; Shiozawa and Williams 1985; Trotter, 1987;) and it is thought that *stomias* and *virginalis* are derived from *pleuriticus* via over-the-divide transfers from the Colorado to the Arkansas, South Platte, and Rio Grande stream systems (Behnke 1992). In the hierarchy of relatedness, the Rio Grande, greenback, and Colorado River cutthroats are a closely related group whose nearest relatives are the Bonneville and Yellowstone cutthroat (*O. c. utah* and *O. C. bouvieri* , respectively -- see Shiazoa and Williams, 1992). This relationship bolsters the theory that *pleuriticus* and *bouvieri* arose from a common ancestor which migrated over the Snake River divide and into the very ancient Colorado River basin, approximately 50,000 to 70,000 years ago (Shiozawa and Williams 1985)..

## **III. DISTRIBUTION**

### **Historic Distribution**

The original pre-Columbian distribution of *pleuriticus* included all cool water habitats of the upper Colorado Basin above the present-day Glen Canyon Dam near Lee's Ferry (Figure 2). This area includes at least 16 large and distinct watersheds, including the Green River in Utah

and Wyoming, Blacks Fork in Utah and Wyoming, Yampa River in Colorado and Wyoming, Little Snake River in Colorado and Wyoming, Duchesne River in Utah, Blue River in Colorado, White River in Colorado, Colorado River in Colorado, Gunnison River in Colorado, Dolores-San Miguel Rivers in Colorado, San Juan River in Colorado and New Mexico, Price River in Utah,

**Figure 2**, Historic and known present distribution of Colorado River cutthroat trout as of 1996. Present range does not include some populations documented in CAS (1999) and Young et al. (1998). Historic range does not include lakes, streams in Arizona and New Mexico and very large streams and rivers (those represented as polygons on USGS Digital Line Graph 1:100K maps).

San Rafael River in Utah, Dirty Devil-Fremont River in Utah, Escalante River in Utah, miscellaneous streams of the Chaco Canyon and Canyon de Chelley systems in the Chuska Mountains of Arizona and New Mexico, and Nine Mile Canyon and miscellaneous other east-central Utah waters (Behnke, 1979, Duffield, 1990, Young et al. 1996). Various small streams from the Roan, East, and West Tavaputs plateaus could possibly account for several more isolated populations of the subspecies, but their historical existence in these two areas is unknown at this time. No native trout are known from Kanab Creek, the Paria River, the limestone streams entering the Colorado River within the Grand Canyon, or from the Virgin River, the only other major upper Colorado tributary, while the Gila River, the only major downstream tributary of the Colorado, contains a separate fish fauna, including two non-cutthroat trout. In total, based on GIS data compiled by Young et al. (1996) there were approximately 23,000 miles of perennial stream within the historic range of the Colorado River cutthroat trout.

Presently, all populations of Colorado River cutthroat trout are restricted to habitats over 7,000 feet elevation (Binns 1977). All populations in Wyoming, for example, are found above 8,000 feet, excluding, Rock Creek, a tributary of LaBarge Creek, which lies at 7500 feet. Historically, however, the Colorado River cutthroat trout's range included portions of large rivers, such as the Green, Yampa, White, Colorado and San Juan (CAS 1999, Simon 1935, Trotter 1987). Additionally, lower reaches of these large rivers are believed to have been suitable for migration during winter when water temperatures are lower, perhaps explaining the Colorado River cutthroat's somewhat disjunct distribution (CAS 1999).

Though the lower, desert portions of the Colorado basin were entirely lacking lacustrine, or lake environments, large, natural, high-elevation lakes did occur in the system, some with several thousand acres of surface area and offering superb natural trout habitat for large populations of Colorado River cutthroat trout. Larger lakes included Upper and Lower Green River, New Fork, Willow, Fremont, Half Moon, Burnt, and Boulder lakes in the Green River system of Wyoming. In Utah, abundant stocks of Colorado River cutthroat in 2600-acre Fish Lake at the head of the Fremont River were an important source of food for the Ute Indians of the region, while Moon and Mirror Lakes in the Uinta Mountains had ample populations. In Colorado, Colorado River cutthroat were abundant in Grand Lake, source of the Colorado River. They were seined from the lake in large numbers, providing food for area settlers, and, according to accounts in the 1870s, specimens of up to 20 pounds were taken (Trotter, 1987); they were also found in abundance in Trappers Lake near the source of the White River, which has been called "the Yellowstone Lake of Colorado" because of its value as a cutthroat trout fishery and its longstanding use as a source of spawn for stocking of other waters across the state (Drummond

1966). These cutthroats still retain some markings and meristic traits of Colorado River cutthroat, but the genetic purity of the entire stock has now been brought into question by a succession of both authorized and unauthorized plantings of rainbow trout and nonnative strains of cutthroat trout (Young *et al.*, 1996). Earlier stockings into the five Williamson Lakes, California in 1933 preserved an earlier, purer form of the original Trappers Lake population (Trotter 1987).

## **IV. NATURAL HISTORY AND HABITAT REQUIREMENTS**

### **Habitat Requirements**

Habitat requirements for the Colorado River cutthroat appear to be identical with other cutthroat subspecies, and similar to the habitat requirements of other native North American trout (Joseph and Sinning 1977). Typical of all cutthroat, Colorado River cutthroat live in clean, cool mountain streams, preferably of moderate (6 % or less) gradient. Cutthroat streams in Wyoming, for example, generally have gradients ranging from two to above 11 percent, with most over four percent. Most are cold, fed by springs of 42 degrees to 52 degrees F (Binns 1977). Because these figures are based on the present range of the species, however, they probably only represent a portion of the range of stream gradients and temperatures necessary to sustain the native.

Colorado River cutthroat typically require water with a high dissolved oxygen content, low water temperatures in the summer, and clean gravel for spawning. In addition, they require riffle areas for food production and habitat for young, and pools for overwintering, and summer rest. The number of pools and riffles should be roughly equal for maximum population and biomass, balancing numbers of young and old fish. In headwater streams, overwintering can occasionally be problematic for the trout, due to lack of pools of sufficient size and the formation of anchor ice. Vegetation in the riparian zone needs to be abundant enough to provide shade and cover (Propst and McInnis 1975, Wesche *et al.* 1987).

Colorado river cutthroat trout require a minimum stream-flow to survive. Since most of the flow of regional streams comes as a springtime "pulse" from snowmelt, some streams provide good early-season but very poor late-season habitat. A base flow in late summer/fall/winter that is above 50% of the average annual flow is considered excellent, 25-50 % fair and below 25% poor (Binns and Eiserman 1979). The pH levels of cutthroat habitats should be 5 to 9, with a slightly basic optimal range of 6.5 to 8.0 (Hickman and Raleigh, 1982).

Though cutthroats require cold water, in some cases stream temperatures can be too low for a successful life cycle. For instance, in the high mountains of Colorado, Wyoming, and Utah, where many surviving stocks of Colorado River cutthroat occur, cold snowmelt and low ambient temperatures can keep early summer water temperatures extremely low, harming fish populations. In particular, eggs laid in the spring will incubate for longer periods, waiting until water temperatures are sufficiently high for fry to emerge. If the water remains too cold too long, the fish emerge too late in the year to have sufficient growth to enable them to survive the winter months (Hubert *et al.* 1994; Harig and Fausch 1998). This has been the cause of failure for many attempted introductions of cutthroat trout into extremely high-elevation habitats.

For successful reproduction and survival, Colorado River cutthroat require a gravel substrate with little fine sediment. Fine sediment found on the stream bottom interferes with oxygen absorption by fertilized eggs, severely reducing overall survival. Sedimentation can also cause or occur with widening of stream channels, and changes in prey composition, reducing habitat quality for young and adults. Siltation of cutthroat streams frequently occurs with upstream removal of vegetation by livestock, logging, or other anthropogenic causes. Loss of vegetation results in increases in water temperature, due to exposure of the stream and its tributaries to more sunlight. Warmer water carries less oxygen, compounding problems for the cutthroat.

## **Diet**

Colorado River cutthroat, like other cutthroats, are known to be insectivorous. Young et al. (1997) found that aquatic invertebrates comprised a majority of the Colorado River cutthroat trout's diet and that aquatic *Diptera*, *Ephemeroptera* and *Trichoptera* were selected in greater proportion than their availability in aquatic drift. Though terrestrial invertebrates comprised a smaller proportion of the cutthroat's diet than aquatic invertebrates diet, terrestrial *Hymenoptera*, *Coleoptera*, and *Lepidoptera* were all selected in greater proportion than their availability in aquatic drift (Young et al. 1997). Bozek et al. (1994) found that *Dipterans* were the most abundant order in the stomachs of young of the year (YOY), juveniles and adult Colorado River cutthroat trout. *Ephemeropterans* was second most common for YOY and juveniles, whereas *Trichopterans* was second most common for adults. These findings are similar to studies of other cutthroat species. The Rio Grande cutthroat, for example, were found to feed on midge (*Diptera*) larvae, caddisflies (*Trichoptera*), and mayflies (*Ephemeroptera*), during the month of June, according to a New Mexico Game and Fish D. J. project performed in the 1960s (F-22-R-788, February, 1968). Another cutthroat subspecies, *O. c. henshawi*, were found to eat *Daphnia pulex*, a minute freshwater crustacean, when under 6 centimeters, while larger individuals focus on the typical benthic invertebrates (Luecke 1986). Terrestrial insects are also consumed during summer months, while other freshwater crustaceans provide supplemental food. (vid. Sublette et al. 1990). While piscivorousness has been found in other trout, including cutthroat (McCaffe 1966 and Baxter and Simon 1970), Bozek et al. (1994) found no evidence for its existence, at least in one creek. Finally, because many aquatic invertebrates feed on leaf litter and leaves that fall into streams or in turn feed on other invertebrates that do, the food chain which supports Colorado River cutthroat is dependant on riparian vegetation. Riparian vegetation is also at least partly determinant of the numbers of terrestrial invertebrates falling into streams. Thus, riparian vegetation plays a vital role in providing food for the fish, making populations of the fish extremely susceptible to riparian degradation caused by livestock grazing and other factors.

## **Reproduction**

Also typical of other stream cutthroats, Colorado River cutthroat trout spawn in the spring during snowmelt (from April to July, depending upon latitude and elevation) over clean gravel. The redd sites are scooped out from the bottom, the eggs laid and fertilized, then covered and shaped to form a hydrofoil, allowing current to sweep rapidly over the redd, providing oxygen and food to the fertilized eggs and embryos (Hunter 1991). Spawning is triggered in spring when water temperatures reach 44-46 degrees F. Following spawning, fry are metabolically "timed" to emerge when water temperatures are a few degrees above spawning conditions. After the brief period between emergence from the redd and depletion of the embryonic food supply contained

in the yolk sac, the fry must then gather plankton and other micro-organisms from the stream (Quinlan 1980). This food must be immediately available when needed by the fry. Thus, there is a balance between the colder, better-oxygenated water available earlier in the spring, against the more plentiful food supply later in the season, after the water has warmed. Oxygen requirements of the eggs and fry of the cutthroat trout are particularly high.

Some populations or individual females of related cutthroat trout spawn every other year. This pattern may put the cutthroat at a disadvantage to two of its main competitors, the brook and brown trout. These species also spawn in the fall when water flows are stable, putting them at further advantage (Hubbard 1976). For Colorado River cutthroat, this and other disadvantages against the brook trout are particularly telling, for the brook trout has an apparently unwavering tendency to force the decline and eventual disappearance of Colorado River cutthroat, whenever the two species share the same habitat (*vid.* Young 1995)

Stream cutthroats may live to nine years, more often six, maturing sexually at three or four years. In contrast, exotic trout species consistently reach sexual maturity at three years, giving them an additional advantage over the cutthroat (McClane 1965, Hubbard 1976). Egg production by females depends on their size and varies from 200 to 4000. Snyder and Tanner (1960) found the average fecundity of 16 Trappers Lake females (average length 290 mm.) to be 667 eggs. Thus, the potential for population growth under optimal conditions is extremely high for *pleuriticus*, as it is for all native salmonids.

### **Co-occurring species**

Colorado River cutthroat trout evolved with the speckled dace (*Rhinichthys osculus yarrowi*) within the entire upper Colorado Basin. The subspecies evolved in the uppermost, northern watersheds of the basin with the mottled sculpin (*Cottus bairdi*); it evolved with the mountain whitefish (*Prosopium williamsoni*) and mountain sucker (*Catostomus platyrhinchus*) within in the Green River system, and with the Paiute sculpin (*Cottus beldingi*) in the uppermost Colorado and Roaring Fork rivers. These fish can be considered as competitors to some degree with Colorado River cutthroat for food and space. This competition is thought to be minor, however, and the species seem to be able to thrive simultaneously in secure, good-condition habitats. Loss of cutthroat stocks often blamed on the mountain whitefish generally can be better attributed to degraded stream habitat rather than inter specific competition (Binns 1977). Smaller forms compete with the young of the subspecies, larger forms with the mature. It can be presumed that the large specimens from such waters as Grand Lake included sculpins and perhaps other fish in their diet. Natural predators of Colorado River cutthroat and other cutthroat forms include garter snakes, great blue and other herons, river otters, and raccoons, but natural predation likely has had little effect on the species.

## **V. Population Status**

### **Summaries of the Colorado River cutthroat's status**

There are two reliable and current sources of information on the distribution and status of the Colorado River cutthroat trout--Young et al. (1996 and 1998) and a "Tri-State Summary" found in an appendix to CAS (1999). In an effort to compile all known information on the Colorado

River cutthroat trout, Young et al. (1996) used state databases, comprehensive surveys of state and federal land managers and biologists, and a review of all existing literature to produce a comprehensive status review of the species, titled "*Conservation Status of Colorado River Cutthroat Trout.*" The authors have continued to update a spreadsheet of populations since publication of the status review, which we have obtained a copy of and used for this petition (Young et al. 1998). We also obtained a copy of a Geographic Information Systems (GIS) database created for the status review, which we have used to make several calculations, including an estimate of miles of perennial stream within the Colorado River cutthroat trout's historic range. CAS (1999) similarly compiled all known information from the three state's databases, incorporating many, but not all populations, listed by Young et al. (1996 and 1998). We have used both of these datasets to compile our own database of populations, which is included as an appendix to this petition (Appendix 9). Where there was disagreement between Young et al. (1996) and CAS (1999) on the purity of populations we counted the populations by the more optimistic assessment to be conservative. For example, if CAS (1999) listed a population as unknown and Young et al. listed it as pure, we counted it as pure. Similarly, if Young et al. listed a population as hybrid, but CAS (1999) listed it as an A population we counted it as A. Similarly, we counted all A- populations as pure, even though current evidence indicates they are slightly hybridized. Thus if anything, we have likely overestimated numbers of pure populations. We also received information on populations from the Forest Service and older state conservation plans for the species (Appendix 6). Neither of these sources alone can be considered reliable, however, because we have no information on the genetic purity or viability of populations listed by the Forest Service, not also listed in one of the two summaries noted above, and because information in the older state plans is superceded by CAS (1999). Both databases referenced in this document indicate the Colorado River cutthroat trout now occupies a small fraction of its historic range.

In total, Young et al. (1998) list information for 381 populations. Of these, 217 are also listed in CAS (1999), including 125 populations considered pure by one of the two summaries, 58 hybrid populations, of which 19 are considered severely hybridized ( $\leq B^-$ ), and 34 populations of unknown purity (Table 1, Appendix 1). Most of 164 populations not listed in CAS (1999) were of unknown genetic purity (95). Many of these may have since been found to be hybridized or extirpated and that is why they were not counted in CAS (1999). Of the others not listed in CAS (1999), 13 are pure and 56 are hybrid, of which 19 were also listed in one of the state plans and determined to be severely hybridized ( $\leq B^-$ ). Thus, of the 381 populations identified by Young et al. (1996), 138 (36%) are considered pure (A or A-), 114 (30%) are considered hybrids and 129 (34%) are unknown.

CAS (1999) identified 340 populations, of which 122 are not listed in Young et al. (1996) (Table 1). Of these, ten are pure, six are hybrid (all  $> B$ ) and 106 are unknown. Thus, in total between the two reviews, there are 503 populations of which 148 (29%) are pure, 120 (24%) are hybrid and 235 (47%) are unknown populations. One hundred and forty of the 233 unknown populations are from Utah, where to date little progress has been made to identify the purity of populations.

We encountered some difficulty in correlating populations between Young et al. (1998) and CAS (1999) and likely some populations were counted twice or two separate populations were counted as one. This is because CAS (1999) did not identify the specific drainage that streams



were found in. In addition, as time passes new populations will be found or identified as pure and others will likely be found to have disappeared. Thus, the figures above represent a best estimate of current populations based on available information. Though future estimates may obtain slightly different numbers because of new information or difference in interpretation, this will not alter the fact that the Colorado River cutthroat trout occupies a small portion of its range in a relatively small number of isolated, headwater streams.

**Table 1**, number and purity of Colorado River cutthroat trout populations, according to two summaries.

Source	Pure	Hybrid	Hybrid ≤B-	Total hybrid	Unknown
Young et al.	13	37	19	56	95
Young et al./CAS	125	39	19	58	34
CAS	10	6	0	6	106
<b>Total</b>	<b>148</b>	<b>82</b>	<b>38</b>	<b>120</b>	<b>235</b>

### Conservation Populations

That there are only approximately 503 populations of Colorado River cutthroat is itself cause for concern, particularly considering that most occur in small, isolated headwater streams (see below). Because this figure includes hybridized, unknown and stocked populations, however, it exaggerates the status of the Colorado River cutthroat trout. Additionally, many of these populations have sympatric ranges with exotic trout or are threatened by continuing habitat degradation. Of the 318 populations originally identified by Young et al. (1996), they identified only 20 that could be considered “conservation populations,” defined as indigenous, pure, allopatric above a barrier and not in a recently stocked watershed. We updated this list considering all 503 populations identified by Young et al. (1998) and CAS (1999), using the same definition and taking into consideration additional information. This analysis indicates there are currently 38 populations in 119 miles of stream (based on stream miles listed in CAS (1999) that can be considered conservation populations (Table 2). Thus, very few populations retain the original genetic make-up of the subspecies in the streams where they evolved and are secure from nonnative trout.

**Table 2**, streams with conservation populations of Colorado River cutthroat trout.

Stream	Source	State	Stream miles	# of adults
Abrams Creek	TSS, Young et al.	Colorado	1	100
Augustora Creek	TSS, Young et al.	Colorado	0.5	30
Beaver Creek	TSS	Colorado	5.5	2700
East Meadow Creek	TSS, Young et al.	Colorado	2	105
French Gulch	TSS, Young et al.	Colorado	2	300
Hahn Creek	TSS, Young et al.	Colorado	2	400
Hermosa Creek, SF	TSS, Young et al.	Colorado	2.3	715
Little Green Creek	TSS, Young et al.	Colorado	2	500
N.F. Little Green Cr.	TSS, Young et al.	Colorado	1	790
Lost Trail Creek	TSS, Young et al.	Colorado	1	100
Mitchell Creek	TSS, Young et al.	Colorado	2	500
W.F. Navajo R.	TSS, Young et al.	Colorado	3.6	385
Oliver Creek	TSS, Young et al.	Colorado	3	600

Pagoda Creek	TSS, Young et al.	Colorado	4	800
Piedra River, EF	TSS, Young et al.	Colorado	9	6830
Rocky Fork Creek	TSS, Young et al.	Colorado	4	1000
Spruce Creek (#1)	TSS	Colorado	0.5	55
Little Taylor Cr.	TSS	Colorado	2.5	660
Carr Creek	TSS, Young et al.	Colorado	9	200
Columbine Creek	TSS, Young et al.	Colorado	1	250
Roan Creek	TSS, Young et al.	Colorado	5	250
Little Vasquez Cr.	TSS, Young et al.	Colorado	2	100
S.F. Little Vasquez Cr.	TSS, Young et al.	Colorado	1	50
Alisha Creek	TSS, Young et al.	Wyoming	0.6	50
Bachelor Creek	TSS, Young et al.	Wyoming	1	50
N.F. Beaver Cr.	TSS, Young et al.	Wyoming	3.4	200
Dale Creek	TSS, Young et al.	Wyoming	2	50
Green Creek	TSS, Young et al.	Wyoming	0.8	100
Haggarty Creek	TSS, Young et al.	Wyoming	3.6	
Irish Canyon Cr.	TSS, Young et al.	Wyoming	11	1000
N.F., W.B. Little Snake River,	TSS, Young et al.	Wyoming	7.2	500
Roaring Fork, Little Snake River	TSS, Young et al.	Wyoming	2	500
Standard Creek	TSS, Young et al.	Wyoming	1.7	100
Ted Creek	TSS, Young et al.	Wyoming	2	20
Rock Creek	TSS, Young et al.	Wyoming	2.5	100
Belvidere Ditch	TSS, Young et al.	Wyoming	12.8	500
Happy Creek	TSS	Wyoming	0.7	50
Rhodine Creek	TSS	Wyoming	2	50
Total			119.2	20690

In contrast to Young et al. (1996), CAS (1999) uses a much broader definition of “conservation population.” Based on a proposed USFWS policy that extends Fish and Wildlife responsibility for conserving species to hybridized populations that retain most characteristics of pure natives (50 CFR Part 424, 61 FR26), CAS (1999) defines all populations rated as B or better as a “conservation population,” including stocked and transplant populations and ones that are sympatric with exotic trout. We concur that Fish and Wildlife and the states should work to conserve slightly hybridized populations, particularly until pure populations are more secure. When determining conservation priorities and the status of the Colorado River cutthroat trout, however, there is a fundamental difference between native, pure populations and stocked, transplanted or hybridized populations. This is not simply a question of semantic accuracy over the meaning of a “conservation population,” but has direct bearing on the conservation of genetic diversity in the population as a whole. Pure, indigenous populations represent the original genetic strain from a particular stream or watershed, which once lost can not be reproduced. In contrast, stocked populations are hatchery raised fish often carrying the genetic diversity of only a relatively small number of individuals, which did not evolve in the stream where they have been placed. Using brood stock from hatcheries can lead to a number of problems, including loss of genetic diversity both within populations and among populations, inbreeding depression and domestication (Allendorf and Phelps 1980, Busack and Currens 1995). Behnke (1992) states:

“A concern for this and other hatchery brood stocks developed from wild stocks is loss of genetic variability. Allendorf and Phelps (1980), for example, found that a Montana stock of westslope cutthroat trout suffered a 57% reduction in the proportion of polymorphic gene loci after only 14 years of hatchery cultivation.”

Thus, it is likely that many populations introduced from brood stock suffer from reduced genetic variability. Similarly, transplant populations, though they may represent a rare strain, do not likely preserve genetic diversity to the same degree as indigenous populations because of founder effects, particularly if a small number of fish are used to start the new population. Additionally, local adaptations that allowed fish to survive in one stream may not apply in another, resulting in lowered population fitness (see Epifanio and Nickum 1996). Hybrid populations may carry some of the original genetic diversity of populations that evolved within the stream or watershed, but have lost a portion of this diversity to genes from a separate species or subspecies. Additionally, hybridized populations are likely less viable in the long-term because hybridization can lead to outbreeding depression and other problems (Leary et al. 1995). Finally, because populations that are sympatric with exotic trout are unlikely to persist in the long-term (e.g. Peterson and Fausch 1998), it exaggerates the species status to count them as conservation populations. Thus, while it is important to protect these populations, giving them the same status as allopatric, pure and indigenous populations provides an inaccurate assessment of the species status, particularly regarding conservation of genetic diversity.

Based on their broad definition, CAS (1999) states:

“The numbers of, and stream mileage or lake acreage occupied by, conservation populations of CRCT with genetic purity ratings of B, B+, A- or A totaled 161 in a minimum of 524 stream miles and 12 in 601 lake acres.”

Inexplicably, the tri-state summary in CAS (1999) which presumably is what they based their figures on, includes only 156 populations listed as having a genetic purity of B or better. Based on information in both CAS (1999) and Young et al. (1998), we have determined that of these 156 stream populations only 78 (50%) are indigenous and pure (A or A-), only 66 (42%) are allopatric and above a barrier (secure), and as noted above only 38 (25%) are indigenous, pure and secure. Of the 12 lake populations, only two (Fryingpan and Trappers) are indigenous and only one (Fryingpan) is pure. Ten of the twelve lakes are allopatric, but only six are also protected by a barrier. Thus, a careful examination of what CAS (1999) calls “conservation populations” indicates only a portion of these fully conserve genetic diversity and are secure.

Still more of the populations listed in either CAS (1999) or Young et al. (1998) as being conservation populations or otherwise are also threatened by one or more causes of habitat degradation (Appendices 2, 3, and 4). Of the 38 populations meeting the definition of a conservation population by Young et al. (1996), only two are not threatened by either nonnatives, livestock grazing, water diversion, logging, roads, mining or habitat limitations. And of the 148 pure populations from both summaries, only 15 are not threatened by one or more factors (Appendix 1). Six of these are lake populations that were or are perpetually stocked and thus cannot be considered self-sustaining populations. Thus, only nine pure populations can be considered truly secure. Similarly, only five of the 120 existing hybrid populations are not threatened by nonnatives, livestock grazing, water diversion, logging, roads mining or habitat limitations, and none of the 235 populations of unknown purity are known to

be secure from these factors, though 54 it is unknown whether there is another threat (Appendix 3). That so few populations are truly secure from threat indicates that the Colorado River cutthroat trout requires immediate and additional protection.

### **The Colorado River cutthroat trout now occupies only a small fraction of its historic range**

The Colorado River cutthroat trout has been extirpated from the southern portion of its range and nearly all large streams within its historic range. It was extirpated from northern New Mexico and Arizona, perhaps as early as the 1950's and its range in southern Utah and Colorado is severely reduced. It was completely eliminated from the Fremont River drainage, southern Utah and only recently has been reintroduced to a couple of streams from the Escalante River Drainage, where populations inhabit approximately only ten small creeks. In the San Juan drainage of southern Colorado, there are only 12 populations according to CAS (1999). The majority of remaining populations occur in the northern portions of the species range in the Little Snake River in Wyoming, tributaries of the Green River in Wyoming and Utah, and the upper Colorado River and Yampa River in Colorado (CAS 1999, Young et al. 1996). This is supported by CAS (1999), which stated that "the bulk of existing populations are found in only five of the 14 geographic management units (GMU)." Even within these strongholds, the species range is severely reduced, primarily to small headwater streams. Additionally, most fluvial and adfluvial populations of Colorado River cutthroat trout are now extinct (Young et al. 1996). Young et al. (1996) conclude:

"Fluvial populations (individuals migrating between rivers and streams or between different streams) of Colorado River cutthroat trout have been extirpated from most large streams and rivers throughout their historic range... Similarly, indigenous populations of adfluvial Colorado River cutthroat trout (individuals migrating between lakes and streams) have almost been eliminated from their historic range."

Thus, the species range has contracted from south to north and from high order streams and lakes to primarily first order streams. As a result, the Colorado River cutthroat now occupies a small fraction of its historic range. Binns (1977) concludes:

"Historically, this trout enjoyed a wider distribution and abundance, but hybridization and competition with introduced trout, as well as habitat changes associated with man's activities, combined to reduce *S. c. pleuriticus* populations to the present low level... Present stocks have survived mostly because they were isolated from man's activities."

Using information from the literature and by making several assumptions about likely past habitat, Young et al (1996) estimated the historic range of the Colorado River cutthroat trout, which was incorporated into a GIS database (Figure 2). Using this database, we calculated that the historic range of the Colorado River cutthroat includes approximately 23,000 miles of perennial stream. The current range of the species, however, only includes a small fraction of this original mileage. We calculate that the 318 populations of varying purity, originally identified by Young et al. (1996), occupy roughly 1,200 stream miles, indicating Colorado River cutthroat trout populations inhabit roughly 5% of their historic range (Table 3). Similarly, CAS (1999) included estimates of occupied stream miles for 261 of the 341 populations identified in this summary, totaling 1429 stream miles or 6% of the subspecies former range. A combined analysis of both CAS (1999) and Young et al. (1996) indicates populations of Colorado River

cutthroat trout occupy approximately 1858 miles of stream or 8% of its historic range. We derived this figure by using stream mileage estimates from Young et al. (1996) for those not included in or estimated by CAS (1999). This combined analysis includes estimates for 373 of the 503 populations documented in both summaries.

The above figures, however, include hybridized populations and ones sympatric with exotic trout. If we only include pure and secure populations, the present range of the Colorado River cutthroat trout is greatly reduced. As stated above, conservation populations, as defined by Young et al. (1996), only occupy approximately 119 miles of stream, based on stream mile estimates from CAS (1999), indicating pure, indigenous and secure populations occur in .5% of the subspecies former range (Table 3). If we use the CAS (1999) definition of a conservation population (B or greater purity), the Colorado River cutthroat trout occupies only slightly more than 2% of its historic range. Of these, however, those that are secure only occupy approximately .7% (162 stream miles) of the subspecies historic range. These figures support earlier estimates of range decline. For example, Behnke (1979) estimated the species occupies 1% of its historic range. Thus, no matter how you define populations, the Colorado River cutthroat trout has declined to a small fraction of its historic range.

**Table 3**, Estimates of percent of historic range occupied by the Colorado River cutthroat trout.

<b>All populations CAS (1999) and Young et al. (1996).</b>	<b>CAS (1999) conservation populations (≥B purity)</b>	<b>≥B purity and secure</b>	<b>pure (A or A-), indigenous and secure</b>
8%	2%	.7%	.5%

Significantly, declines continue to the present. For example, during the period from 1954 to 1993, the total stream miles supporting Colorado River cutthroat trout within the critical Little Snake River watershed declined by 35 percent, from 78 miles to 51 miles (Speas *et al.* 1994). Additionally, a pure population in Cottonwood Lake in Southwest Colorado was extirpated since 1994 because of pollution from mine tailings. Similarly, Martinez (1988) documented that of 37 populations in northwestern Colorado sampled from 1978 to 1987, 12 apparently declined in genetic purity, 3 were replaced by populations of brook trout, and 1 population disappeared, possibly because of overharvest. Unfortunately, there is a high likelihood that there will be future losses of populations because most populations of Colorado River cutthroat trout occur in small, isolated, headwater drainages that fail to support viable populations and are highly subject to stochastic disturbance, such as flood, fire, or drought.

**The Colorado River cutthroat trout is primarily limited to small, isolated and unstable streams that are incapable of supporting viable populations**

The present range of the Colorado River cutthroat is primarily limited to small isolated headwater streams least accessible to stocking of exotic trout, livestock grazing and other resource extraction (Binns 1977). Small, isolated populations are highly vulnerable to extirpation in the short-term, placing the entire species at severe risk of extinction (Hilderbrand 1998, Rieman and McIntyre 1993, Shepard et al. 1997). Such populations are at greater risk of extirpation for three primary reasons: 1.) populations with few individuals are vulnerable to extirpation from genetic factors, such as inbreeding depression and genetic drift, demographic or environmental stochasticity and deterministic factors, such as habitat degradation; 2.) population

isolation precludes genetic interchange and recolonization of habitat following extirpation; and 3.) small populations in headwater streams are highly subject to extirpation from stochastic disturbances, such as fire, flood or drought.

The majority of Colorado River cutthroat trout are found in exceedingly small streams. For example, 68% of all populations, for which there was an estimate of occupied stream miles in CAS (1999), were in stream reaches equal to or less than five miles. Conversely, only 12% were in reaches equal to or greater than 10 miles, with none over 21 miles. Additionally, most streams occupied by the species average about 30 cubic feet per second (cfs) with many below 5 cfs (Annear *et al.* 1996a, Binns 1977, Young *et al.* 1996). The small size of streams occupied by the subspecies severely limits the number of individual trout occupying a stream and ultimately the total numbers of individuals in the population as a whole. Hilderbrand (1998) estimated that a stream reach must be at least 2.4 miles long to maintain a population of 500 cutthroat trout at 40% survivorship with high fish densities and 12 miles long for low fish densities. To support a population with 1,000 individuals at 40% survivorship, stream reaches must be 6.6 miles long for low fish densities and over 32.4 miles for low densities. Hilderbrand (1998) concludes:

“We regard the high fish density model estimates as absolute minimums because they were based on a stream-resident population inhabiting a well connected stream network containing ample food, habitat, and fish densities an order of magnitude higher than many extant populations. Our results suggest that many populations of cutthroat trout probably cannot persist over the long term because of limited physical space.”

Given the results of Hilderbrand (1998) and the stream mile estimates listed above for Colorado River cutthroat trout populations, it is not surprising that of the populations listed in CAS (1999), for which there was an estimate of numbers of adult fish, 90% had less than 1,000 individuals, 72% had less than 500 individuals and a full 37% had less than 100 individuals. The small size of most populations relates directly to the size and productivity of streams occupied by the Colorado River cutthroat trout. One mile of large rivers, such as the upper San Juan, Green, or Colorado Rivers, which no longer support Colorado River cutthroat, would have likely supported far more individuals than the tiny headwater tributaries where the subspecies still survives. Even streams of intermediate size, such as the Strawberry or Duchesne Rivers, have the potential to produce thousands of trout per mile of stream. For the most part, these larger waters are unavailable to the Colorado River cutthroat trout because of nonnative trout and habitat degradation (Behnke and Zarn 1976).

As stated above, small populations are far more likely to go extinct because of genetic factors, such as inbreeding depression and genetic drift, demographic or environmental stochasticity and deterministic factors, such as habitat degradation (Rieman and McIntyre 1993 and McIntyre and Rieman 1995). Using data on population size and variability from 12 westlope cutthroat trout streams, McIntyre and Rieman (1995) estimated that just considering random effects, such as demographic stochasticity, a population must have at least 2,000 individuals to have a reasonable probability of persistence for 100 years. They conclude:

“If the estimated variances are representative, the results indicate that stochastic risks will increase quickly for many populations that drop to fewer than 2,000 individuals.”

Indeed, the Biology Committee that helped develop CAS (1999) determined that populations must have “several thousand individuals” to be considered at low risk of extinction (CDOW December 23, 1997, see below).

Risk of extinction for small populations is increased further when they are isolated. McIntyre and Rieman (1995) conclude:

“Extinction risk related to variation of populations appear to be an important cause for concern. Extinction for many isolated populations may simply be a matter of time. Although our estimates are the result of crude approximations, they are consistent with a growing body of evidence for similar risks for many species.”

Today, based on maps in Young et al. (1996), there are only two populations with five or more interconnected populations. These are the North Fork of the Little Snake River with 14 populations (nine pure-A, four hybrid-B and one hybrid-C) and Labarge Creek with 15 populations (four pure-A, three hybrid-B and eight unknown). Even in these two drainages, however, many of the populations are still isolated behind barriers because of the presence of hybrids or nonnative trout. The majority of other cutthroat populations are found in isolated stream segments with a lesser number of streams connected to one to three others. Besides precluding natural recolonization of lost habitat, population isolation prevents genetic interchange among populations, potentially leading to loss of genetic diversity and reduced population fitness (Epifanio and Nickum 1997, Soule 1980). Ultimately, successive loss of individual populations because of either stochastic or deterministic processes with little to no chance of recolonization because of isolation will lead to extinction of the subspecies. Hilderbrand (1998) states:

“Metapopulations may be important for maintaining salmonid populations with moderate rates of dispersal (Rieman and McIntyre 1993), and theoretically make some species resistant to disturbance (Stacey and Taper 1992; Hanski and Kuussaari 1995) by enabling migrants from one population to recolonize or maintain another. Island biogeography theory (MacArthur and Wilson 1967) predicts inverse relationships for the distance between patches or populations and the immigration rate between them, and for patch size and extinction rate. Therefore, those populations inhabiting small areas and/or located far away from other populations are at greater risk of permanent extinction (as opposed to being recolonized).”

Much of the current isolation of populations is maintained by natural and constructed barriers. Furthermore, state agencies plan to construct more barriers to protect the native cutthroat from continued presence and stocking of nonnative trout (CAS 1999). Because of the problems associated with population isolation discussed above, barriers are a mixed blessing that keep nonnatives out, but isolate populations. Hilderbrand (1998) concludes:

“barrier construction for cutthroat trout conservation may be a necessary short-term solution, but a long-term impediment... Recent management of cutthroat trout populations has been guided by a restrictive paradigm that may actually endanger long-term population and subspecies persistence. The common management prescription for cutthroat trout in the presence of exotic species calls for population isolation above ‘impassable’ barriers from potential threats below.”

In addition to isolation and small population size, Colorado River cutthroat trout populations are at risk of extirpation from stochastic disturbances, such as flood, drought, anchor ice, or fire. McIntyre and Rieman (1995) state:

“Our estimates do not include the potential for catastrophic loss and might therefore be overly optimistic (see Mangel and Tier 1994). If chance events represent an important risk for many populations, further loss of cutthroat trout populations will likely continue even with no further loss of habitat.”

Colorado River cutthroat populations found in small streams could be wiped out at anytime by a severe winter, a particularly bad drought or a fire leading to sediment flows into the streams. A fire in 1986, for example, decimated trout populations in Leeds Creek in the Dixie National Forest (Duffield 1990). Historically, when such events occurred it did not result in extirpation of a population because either the fish took refuge in larger waters downstream, which were not affected by the drought or fire; or if the population was lost there were always fish from an interconnected stream to recolonize the habitat.

Acknowledging the fact that small, isolated populations are at greater risk of extinction, the Biology Committee that helped develop CAS (1999) defined a scale of extinction risk:

“Decisions of Biological Working Group: a) defined extinction risk criteria for metapopulations as low =5 or more subpopulations of several thousand individuals each and good habitat complexity; moderate risk =less than 5 subpopulations; extreme risk =only a single population or several at low density or isolated subpopulations and poor habitat conditions.” (CDOW December 23, 1997, Colorado River cutthroat trout conservation progress report).

As noted above, only the North Fork of the Little Snake and Labarge Creek have more than five subpopulations. The majority of subpopulations in these systems, however, are made up of less than 500 hundred individuals and none harbor “several thousand individuals.” Thus, by this definition virtually every population of Colorado River cutthroat trout would be considered at extreme risk of extinction. Perhaps realizing this fact, CAS (1999) decided not to adopt the Biology Working Group’s definition of population viability, stating:

“The Coordination Committee adopted a definition of population viability based on criteria from Rieman and McIntyre (1993). However, further by the Biology Committee determined that these criteria were not helpful to the CRCT conservation program at this time. Some small isolated populations of CRCT have been stable for many years and it is clear that there are significant uncertainties surrounding ecological requirements for persistence of this species.” (CAS 1999).

That “some” populations survived for “many years” does not provide strong evidence that the Biology Committee’s definition was inaccurate. Typically, populations are considered viable if they have a high probability of persistence for a minimum of 50 years not just “several years” (e.g. Soule 1987). However, because viability is described in terms of probabilities, we would expect that “some” populations might persist for 50 years even if it was determined that all populations were not viable. Thus, that an unspecified number of populations have survived for



perhaps 20 years in no way indicates that Colorado River cutthroat trout populations are viable or at low risk of extinction. It is far more likely that the Coordination Committee found the definition “not helpful” because it was indicative of the true status of the species and of the failure on the part of the states to create any populations to date that can truly be considered viable. Thus, based on the literature (e.g. Rieman and McIntyre 1993, Allendorf and Ryman 1987) and on the original opinion of the Biology Committee, likely all populations of Colorado River cutthroat are at high risk of extinction. Young *et al.* (1996) conclude:

“Most of the occupied range of this subspecies consists of isolated segments of small streams on public land... This fragmentation resulted from human-built structures (e.g., culverts and water diversions) that blocked upstream fish movement, and from nonnative salmonids in lower reaches that seemingly prevented recolonization by Colorado River cutthroat trout. Populations of Colorado River cutthroat trout in these segments are probably at risk of short-term extinction particularly from events such as fire, flood, toxic spills, or one-time stocking of nonnative fish.”

## **VI. Present or Threatened Destruction, Modification, or Curtailment of the Colorado River Cutthroat Trout’s Habitat or Range.**

### **A. LIVESTOCK GRAZING**

Habitat loss continues to be a serious threat to remaining populations of Colorado River cutthroat trout, particularly from livestock grazing. Countless studies demonstrate reduced trout populations related to habitat loss and degradation caused by livestock grazing (e.g. NMDGF 1974, Behnke and Zarn 1976, and Behnke 1992). For example, Rinne and Lafayette (1991) found that ungrazed streams on the Tonto and Santa Fe National Forests had twice as many trout and twice the trout biomass as did grazed streams; and Clarkson and Wilson (1991) determined that Apache trout were up to ten times more abundant on ungrazed streams within the Fort Apache Indian Reservation and Apache-Sitgreaves National Forest than on grazed streams. Platts (1991) reviewed 21 studies from across the western United States and found that all but one, concluded that cattle degrade trout habitat and suppress trout populations. Numerous studies show increases in trout with removal of cattle. Armour (1977), Marcuson (1977), Crispin (1981), Kennedy (1977), and Duff (1979), for example, all found increases in both trout populations and individual trout size when cattle were fenced out of riparian areas. Chaney *et al.* (1990) report that populations of cutthroat trout in Huff Creek, Wyoming increased from 36 per mile to 444 per mile when cattle were excluded from the stream area, as a result of better in-stream cover, lower water temperature, and decreased sedimentation. In a status review of Colorado River cutthroat trout in southwest Wyoming, Binns (1977) states:

“Cattle grazing is often an important use of lands drained by *S.c. plueriticus* streams. Since most water in these areas is restricted to the water courses, cattle tend to spend much time in the stream bottoms. Consequently, the impact on riparian vegetation from trampling and grazing is considerable and stream banks, as well as trout cover, suffer. As riparian vegetation is removed and the banks trampled, bank erosion potential is increased, which results in a wide and shallow channel, with few undercut banks and vegetation overhangs (Platts 1974). Extensive livestock grazing in the arid west is generally considered detrimental to fluvial trout habitat (Mullan 1975; Leopold 1975; and Behnke 1977).”

Habitat degradation caused by livestock grazing often give nonnative trout a competitive advantage over native cutthroat trout populations (Behnke 1979, Binns 1977, Griffith 1988, Stefferud 1988). Griffith (1988) states that in “optimal habitat native cutthroat may be able to withstand such competition.” Stefferud (1988) concludes that by increasing silt loads and warming streams beyond optimal summer temperatures, logging, road-building, and livestock grazing will favor exotic trout over cutthroat.

Grazing practices have suppressed current Colorado River cutthroat populations rangewide (Colorado Division of Wildlife 1994). In the opinion of many, (Behnke and Zarn 1976; Sublette *et al.* 1990; Behnke 1992) livestock grazing on National Forest and other lands is the first or second greatest threat to the viability of western cutthroat trout habitats (the other threat being nonnative trout). The following sections detail the specific effects of livestock grazing on cutthroat trout, followed by a section on the current extent of grazing along known cutthroat streams.

### **Livestock impacts on riparian vegetation**

Throughout the range of the Colorado River cutthroat, livestock grazing has limited or removed riparian vegetation to the severe detriment of stream habitat and native trout. Rampant cattle grazing has resulted in total loss or severe degradation of riparian vegetation on thousands of river-miles across the west (GOA 1988). Cattle eliminate riparian habitat directly by feeding on and trampling vegetation and, indirectly, by compacting soils, degrading streambanks, and altering watershed hydrology and channel morphology (Klebenow and Oakleaf 1984, Ohmart 1994, Reichenbacher 1984, Taylor and Littlefield 1986).

Loss of riparian vegetation has led to increased bank erosion and siltation, elevated stream temperatures, widened and braided stream channels, and loss of overhanging banks- all to the detriment of native trout (Armour 1977, Behnke 1979ab, Claire and Storch 1977, Gardner 1950, Glinski 1977, Kaufman *et al.* 1983).

### **Livestock impacts on stream hydrology**

By removing forb and grass cover, and by compacting soils, livestock grazing slows the rate of water percolation and infiltration, leading to unnaturally high and frequent runoff events (Dasmann 1972, Holocek *et al.* 1989). Dasmann (1972) reports that an overgrazed watershed on Utah's Wasatch Front experienced severe flooding, while ungrazed watersheds suffered little or no flooding.

Livestock grazing also results in the replacement of native grasses and forbs by juniper, rabbit brush, Russian thistle, and other shallow-rooted vegetation less well-adapted for soil stabilization, thereby increasing sheet erosion. This erosion and the accompanying heavy and frequent flood events destroy trout habitat by filling pools with silt, uprooting great numbers of trees and other riparian vegetation, widening and aggrading stream channels, and lowering water tables (Bock *et al.* 1992).

The direct connection between the health of upland vegetation and the health of riparian vegetation and aquatic habitats is well illustrated by Chaney et al (1993):

"Improper grazing of upland vegetation increases the amount, and concentrates and increases the speed of overland runoff to streams. Accelerated runoff from uplands can trigger downcutting by streams with soft bottoms. Downcutting lowers the streambed and water table, dries out the riparian area, desaturates stream banks, and increases erosion and further accelerates runoff."

Continued disturbance to soils, vegetation, hydrologic regimes and stream channel morphology often leads to the complete desiccation of trout streams.

"The greatest damage from erosion on range lands occurs where the areas have been overgrazed and the ground cover destroyed or seriously impaired. Before the ranges had been overstocked and the ground cover impaired, erratic runoff and erosion were practically unknown. After the breaking up of the vegetative cover in the early [eighteen] nineties, however, many streams originally of steady year round flow became treacherous channels with intermittent flow, through which the water from rainstorms was plunged, or rose and fell according to the size and frequency of the storms that carried so much sediment that fish and similar life could not exist." (Weyl 1918).

### **Livestock impacts on water quality**

By denuding both upland and streamside vegetation, cattle grazing increases runoff and erosion, leading to sedimentation of trout habitat and widening of streambeds and loss of pools and undercut banks, while removing streamside shade and exposing streams to direct sunlight. All of these changes raise water temperatures to dangerous or unsuitable levels for cutthroat trout (Propst and McInnis 1975).

Livestock grazing also dramatically increases stream sediment loads. Cutthroat trout require less than 10 percent fine sediment in their spawning beds. Accordingly, relatively moderate siltation can leave any given population incapable of reproduction. According to Binns (1977),

"Silt is a conspicuous feature of Colorado River cutthroat trout habitat in the Westside and Black's Fork enclaves, where watersheds are often in poor condition due to past forest fires, extensive livestock grazing and clear-cut logging practices. The destructive impact of silt on trout populations is well documented."

### **Current livestock grazing impacts on Colorado River cutthroat populations**

Several sources indicate livestock grazing is currently harming habitat and populations of Colorado River cutthroat trout. Both Young et al. (1998) and CAS (1999) identified streams where livestock grazing is resulting in habitat degradation. In addition, we requested from the various National Forests and Bureau of Land Management Resource Areas within the range of the Colorado River cutthroat trout copies of all management documents for livestock grazing allotments with populations of Colorado River cutthroat trout, including Allotment Management Plans (AMP), Annual Operating Plans (AOP), Environmental Assessments, and Biological Evaluations (BE). This request was made under the Freedom of Information Act. We received a

complete response from all National Forests and Resource Areas, except the Ashley National Forest, which claimed they did not know which streams harbored Colorado River cutthroat trout within their boundaries, indicating that they were categorically not managing for the species. We used information from all of these sources to determine whether livestock grazing occurred adjacent to streams harboring Colorado River cutthroat trout and if so was it reported to be negatively impacting habitat. We determined the latter based on either a determination by Young et al. (1996) or CAS (1999) of livestock impacts or by statements in one of the management documents indicating recent stream degradation. This is not to say that livestock grazing is not impacting habitat at the other streams, only that we have no information to make such a conclusion. Additionally, if livestock impacts were noted by either Young et al. (1996) or CAS (1999) and we did not also have information on current grazing regime from the Forest Service, we assumed that livestock grazing was still occurring. In most cases, this is probably accurate, but for a limited number of streams the impacts may relate to past grazing. There was only one stream, for example, where information from the Forest Service indicated the allotment was being rested (for four years) and Young et al. (1996) or CAS (1999) determined that livestock grazing was impacting habitat.

Based on the above sources, 66% of the pure populations, 56% of the hybrid populations and 42% of the populations of unknown purity occur in areas with active livestock grazing. Livestock grazing is known to be negatively affecting the habitat of 33% of pure populations, 26% of hybrid populations and 23% of populations of unknown purity (Table 4). This analysis clearly demonstrates that livestock grazing is occurring within the habitat of most populations of the Colorado River cutthroat trout and is known to be negatively impacting the habitat of one third of pure populations. Though these figures indicate a serious problem for existing Colorado River cutthroat trout populations, it is important to recognize that the subspecies occurs in some of the least accessible and least desirable locations for livestock grazing. It is likely that grazing is having significantly more impact on lower elevation streams, which are better suited for livestock and are essential for recovery of the Colorado River cutthroat to a larger, more interconnected and productive portion of its historic range.

**Table 4,** numbers of populations exposed to livestock grazing, related to genetic purity.

Purity	Livestock grazing	Unknown livestock grazing	No livestock grazing	Livestock reported to negatively impact habitat	Total populations
Pure	97 (66%)	29 (20%)	22 (15%)	50 (34%)	148
Hybrid	67 (56%)	30 (25%)	23 (19%)	31 (26%)	120
Unknown	98 (42%)	127 (54%)	10 (4%)	54 (23%)	235
total	262 (52%)	186 (37%)	55 (11%)	134 (27%)	503

## B. WATER DIVERSIONS

Diversion of water for agriculture or consumption has harmed and continues to harm Colorado River cutthroat trout populations rangewide. Numerous cutthroat populations are isolated from other populations because downstream reaches are totally dewatered (Young et al. 1996). This limits both population expansion and genetic exchange. Numerous other populations are harmed by degraded habitat, resulting from water diversion. Diversions can only be expected to increase, as demands for both agricultural and municipal water soar in Utah, Colorado and Wyoming. For

example, the Army Corps of Engineers is planning to build a dam on Savery Creek, Wyoming, which is within the present and historic range of the Colorado River cutthroat trout, to increase water storage.

### **The effects of water diversion on cutthroat trout**

In the only quantitative study of the impacts of water diversion on Colorado River cutthroat trout, Jespersion (1981) determined that the city of Cheyenne's Stage I water diversion from the North Fork Little Snake River was having serious effects on the Colorado River cutthroat trout. Specifically, the study found that the quantity of spawning habitat is limiting to the Colorado River cutthroat trout, occupying on average only 2% of the surface area within study areas and that by lowering total flow in the summer, diversion reduced or degraded existing spawning habitat. This increased egg and fry mortality by exposing redds and causing habitat loss. The study predicted that if flows were restored to their natural condition, excluding the springtime, trout populations in Green Timber Creek would increase by 48% in lower reaches and 76% in upper reaches and in the North Fork of the Little Snake would increase by 42% three miles below the diversion and 142% one mile below the diversion. Jespersion (1981) also found that trout in studied reaches were in poor condition and speculated that this related to overcrowding and stress caused by low water. This was further indicated by heavy infestations of an external parasite, *Gyrodactylus sp.*, that is only common when fish are stressed. Thus, water diversions are documented to negatively affect populations of Colorado River cutthroat trout.

### **The effect of water diversion on current populations and the historic range of the Colorado River cutthroat trout.**

Though no rangewide assessment to determine the number and extent of water diversions in the historic range of the Colorado River cutthroat trout has been conducted, it is likely that there are thousands of individual diversions affecting historic and potential cutthroat streams. Significant irrigation occurs in every basin except the upper Green and Yampa. For example, the upper Colorado barely retains permanent flow below the Colorado-Big Thompson water project at Lake Granby, which removes 173,000 acre-feet per year, or nearly one percent of the yearly discharge of the entire Colorado basin. Similarly, the Central Utah Project impacts cutthroat on a number of west-side tributaries of the Green River, particularly the Strawberry River. According to Utah Department of Wildlife Resources (1988):

"A significant portion of the Strawberry River dries up each summer from diversion of flows into Heber Valley for irrigation. Returning water to the Strawberry River is critical to restoring trout spawning habitat in the valley. This river and its tributaries are expected to contribute more wild young-of-the-year trout to Strawberry Reservoir than all other tributaries of the reservoir combined."

In terms of water diversions that affect known Colorado River cutthroat populations, none are more egregious than the water diversion for Cheyenne, Wyoming, which has seriously depleted flows in a number of vital remaining Colorado River cutthroat trout streams in the Little Snake River watershed. The Cheyenne Stage I water project was completed in 1964 and brought into

operation in 1967. Ten diversion structures were installed in three cutthroat streams, where water was collected by gravity flow and transported by tunnel under the Continental Divide into Hog Park Reservoir. As a result, Ted Creek and the upper North Fork of Little Snake River became separated from the rest of the Little Snake system (Binns 1977) and flows in Green Timber and Ted Creeks were reduced by approximately 27 to 60 percent, respectively (Jespersion 1981). All of the aforementioned streams harbor Colorado River cutthroat trout populations. Cheyenne's Stage II water diversion was begun in 1982, and eventually resulted in far greater impact. Diversion structures for the project have isolated a number of Colorado River cutthroat populations in the headwaters of the Little Snake and a number of other Colorado River cutthroat populations have declined noticeably on many former prime stream reaches because of severe drawdowns. Fearing extinction of populations in the enclave, the Wyoming Game and Fish Department filed for minimum instream flows for portions of 16 streams in the Little Snake drainage (Remmick personal communication). These rights, however, only protected unappropriated flows, thereby doing nothing to reverse the damaging drawdowns of the Stage I and II diversions. Routine operation of the Stage II pipeline has also resulted in several catastrophic sediment spills. According to Speas *et al.* (1994)

"Long-term sediment loading from continued mishaps with the Stage I and II pipelines and chronic inputs of sediment from road stream crossings are predicted to cause ongoing habitat degradation within the drainage."

Plans for Stage III, larger yet, are still being evaluated by the Wyoming state engineer's office, though they are currently on hold.

In total, we identified 59 Colorado River cutthroat trout streams where water diversion is negatively affecting habitat, including 21% of known pure populations (Table 5). Most of these were identified by either Young *et al.* (1996) or CAS (1999). We also received information on several damaging diversions on the Manti-La Sal National Forest from conversations with Jill Defour, a former fisheries biologist for the Forest. Finally, 13 streams were identified as having diversions by Rex Johnson of Southwest Trout.

**Table 5**, water diversion impacts to populations of Colorado River cutthroat trout.

Population purity	Number of populations with documented impacts from water diversion	Total number of populations
Pure	31 (21%)	148
Unknown	16 (7%)	235
Hybrid	12 (10%)	120

### C. MINING

Current and abandoned mines threaten a number of remaining Colorado River cutthroat trout populations. Chemicals leaching from mines into streams often results in elimination of most or all biological organisms. For example, leaching of cupric wastes from the Ferris-Haggarty Copper Mine into Haggarty Creek made four to five miles of the stream completely sterile. This poisoned reach has completely isolated upper Haggarty, Green, Alisha, and Bachelor Creeks from the rest of the streams of the Little Snake River enclave. Ironically, this isolation is part of the reason these populations remain pure. In 1992, the state issued a judgement against the mine

owner, a consultant was hired, and in the fall of 1993 a treatment plan was submitted to the state mines division. Though clean-up is underway, Haggarty Creek continues to be impacted by the mine. In total, based on CAS (1999), Young et al. (1996) and conversations with land managers, we documented ten populations where mining is impacting habitat, of which six are pure, including four conservation populations, and four are hybrid.

#### **D. DAMS AND RESERVOIRS**

Hundreds, if not thousands, of dams and their reservoirs occur throughout the range of the Colorado River cutthroat trout, resulting in habitat and population fragmentation. Though we have no way of assessing to what extent dams are limiting populations of Colorado River cutthroat trout from expanding into a wider and more interconnected portion of their historic range, it is likely that they are a significant factor. In one case, a planned dam on Savery Creek, Wyoming threatens to further isolate existing populations (Dirtyman Fork and Hell Canyon Creek) in the Little Snake drainage.

While in several cases dams have preserved pure populations of the Colorado River cutthroat, reservoirs historically and currently have been sites for massive stocking of nonnative trout. Indeed, a significant portion of current stocking now occurs in reservoirs. In one case, stocking of exotic trout into a reservoir in Colorado resulted in infection of Colorado River cutthroat with whirling disease (see below). This increases the isolating effect of dams by creating pockets of nonnatives, where Colorado River cutthroat trout will not be able to recover.

#### **E. OIL AND GAS DEVELOPMENT**

Intense oil and gas development occurs throughout the upper Colorado Basin, particularly in the Green, Yampa, and White River sub-basins, part of the oil-gas Overthrust Belt, posing a significant threat to current populations and limiting recovery. A population of Colorado River cutthroat trout that was transferred from LaBarge Creek into neighboring Pinegrove Creek in the 1970s, for example, was extirpated by an oil spill from a drilling operation (Binns 1977). The following is a preliminary list of streams with Colorado River cutthroat where according to maps there are oil and gas wells:

- Drill Holes are found on slopes above several Colorado River cutthroat streams in the Big Piney District, Bridger National Forest, including Maki, Nylander, and Hardin Creeks, all tributaries of North Cottonwood Creek.
- Drill holes are found in North and South Cottonwood Creeks (pure).
- Drill holes are found all along North Beaver Creek, tributary to Dry Piney Creek in the Big Piney District of the Bridger National Forest, Wyoming. This is one of 39 Conservation Populations.
- Drill holes are found on Spring Creek (hybrid), Black Canyon (unknown purity); South Beaver Creek (hybrid); Beaver Creek (unknown purity); Trail Ridge Creek (hybrid); Fogarty Creek (unknown purity); and Dry Piney Creek (unknown purity, possibly pure-strain), all in the Big

Piney district of the Bridger National Forest and adjacent BLM land. Fully developed oil and gas wells are also found on Black Canyon and Dry Piney Canyon.

- Drill holes are found near Pinegrove Creek, a tributary of South Piney Creek with a pure-strain population. Oil spills destroyed a population here in the 1970s, which was subsequently replaced with a non-indigenous stock.
- Drill holes and drill sites are found along LaBarge Creek (pure), Wyoming, an important recovery stream.
- Drill holes are found in Little Indian Creek (hybrid), a tributary of Hams Fork in the big Piney District
- Oil wells are found on the Henry's Fork, Uinta mountains Wasatch National Forest, Utah, near a population of Colorado River cutthroat (hybrid) and along a tributary of Dahlgreen Creek (hybrids).
- Numerous oil and gas wells can be found along lower Red Creek, which drains into the Flaming Gorge of the Green River in Utah and harbors a pure population.

## **F. ROAD-BUILDING AND LOGGING**

Road-building and logging, by altering the hydrology of watersheds, is well documented to be deleterious to fish and other aquatic life forms (Burns 1971, Eagin and Hubert 1993). Roads and logging increase surface runoff, sedimentation and debris avalanches, and destroy riparian vegetation. Additionally, roads require in-stream structures, such as culverts and bridges, that remove aquatic habitat and/or are barriers to fish (Barrett et al. 1992, Bryant 1981). Of all these effects, stream sedimentation from erosion and debris avalanches is the most harmful to native trout.

Numerous studies have shown that increased surface runoff and decreased slope stability caused by road building and logging increases sediment production and the likelihood of major landslides (e.g. Amaranthus et al. 1985 and Megahan and Kidd 1972). Increased sediments in the stream environment reduces dissolved oxygen, raises stream temperature, and can bury or cement trout spawning beds making reproduction impossible (Cooper 1965). Degradation of habitat from logging, roads or other factors likely also gives nonnative trout a competitive advantage over native trout (Behnke 1979, Griffith 1988). Behnke (1979), for example, observed that a stream, which had previously contained an abundant population of westslope cutthroat trout, only harbored brook trout, following habitat degradation from clearcut logging.

Because of the severe effects of roads and logging, healthy cutthroat populations are frequently limited to roadless or wilderness areas. In a study comparing Colorado River cutthroat trout populations in wilderness and non-wilderness areas, for example, populations in the wilderness area had more and larger adult fish (Kershner et al. 1997). This was directly related to better habitat in wilderness compared to non-wilderness in terms of percent pool habitat, percent undercut bank, mean particle size, and mean stream depth, which were all higher in wilderness streams (Kershner et al. 1997).



Kershner et al. (1997) also noted that Colorado River cutthroat in wilderness streams were less hybridized with rainbow than fish in non-wilderness streams likely because of the lack of access for stocking, either legal or illegal. The benefit to the species from lack of access should not be underestimated. Roads not only provide access for stocking, but also for anglers. This issue is acute because the cutthroat trout is very easily caught by anglers and if not properly regulated recreational fishing can impact populations (see below).

In order to determine the impacts of logging on the Colorado River cutthroat trout, we requested all management documents, including Environmental Assessments and Biological Evaluations, for all timber sales planned within the last five years and within the same watershed as populations of Colorado River cutthroat trout from all National Forests and Bureau of Land Management Resource Areas within the range of the subspecies. Based on these documents, we determined logging is occurring within the watersheds of approximately 19% of all pure, 18% of all hybrid and 9% of all unknown populations of Colorado River cutthroat and that it is impacting the habitat of roughly 7%, 8% and 5% of these populations, respectively (Table 6). Considering the small number of existing populations, these numbers indicate a serious problem, particularly considering that they are very likely underestimates. This is because response from the various National Forests was inconsistent with some providing no data and others providing data that was difficult to interpret. In addition, we only considered a timber sale to impact a population if the particular stream in question was mentioned in the EA or BE. In some cases, the stream might not be mentioned in these documents even if it was being affected. Finally, this analysis only included the last five years. Many of the streams have likely been impacted by decades of logging.

Based on Young et. al. (1996), roads are currently impacting seven percent of all pure and hybrid populations and 1% of all unknown populations. This number is based on a survey of Forest Service biologists and managers, which Young et al. (1996) stated only reported the most severe management conflicts with Colorado River cutthroat. Thus, it is almost certainly an underestimate. Because there are so few pure populations of Colorado River cutthroat trout, an impact on seven percent of populations, however, is still cause for concern.

**Table 6**, known logging and road impacts on existing populations of Colorado River cutthroat trout.

<b>Population purity</b>	<b>Logging has occurred</b>	<b>Logging impacted habitat</b>	<b>Roads impacting habitat</b>	<b>Total populations</b>
Pure	28 (19%)	11 (7%)	10 (7%)	148
Unknown	22 (9%)	12 (5%)	3 (1%)	235
Hybrid	21 (18%)	10 (8%)	8 (7%)	120

## **VII. OTHER NATURAL OR MANMADE FACTORS AFFECTING THE CONTINUED EXISTENCE OF THE COLORADO RIVER CUTTHROAT TROUT**

### **A. INTRODUCTION AND STOCKING OF NONNATIVE TROUT**

The introduction, stocking and subsequent spread of nonnative trout, including rainbow, brook, brown and non-indigenous cutthroat is considered one of the most serious threats to the continued existence of the Colorado River cutthroat trout (Behnke 1992, Epifanio and Nickum 1997, Young et al. 1996). Nonnative trout compete with, prey on and in the case of rainbow and other subspecies of cutthroat, hybridize with native Colorado River cutthroat trout, all often resulting in the complete extirpation of populations from rivers and streams (Benke 1979, CAS 1999, Trotter 1987, Young et al. 1996). Behnke and Zarn (1976) state:

“Brown trout and rainbow trout have completely replaced S.c. pleuriticus in larger rivers, and brook trout have frequently displaced it in smaller tributaries, but the major factor pushing pure populations of the Colorado River cutthroat towards extinction has been hybridization with rainbow trout and nonnative cutthroat trout used in stocking programs in Colorado, Utah, and Wyoming.”

Additionally, stocking of exotic trout can and has resulted in the introduction of new diseases, which threaten native trout (see below). Stocking of exotic trout, which began in the late 1800s (Bowen 1970), is still widespread throughout the historic range of the Colorado River cutthroat trout in all three states and as recently as 1997 in Colorado was occurring over existing populations of Colorado River cutthroat trout (Epifanio and Nickum 1997). We provide a brief discussion of the impacts of introduction and stocking of exotic trout, followed by an analysis of the degree of threat to existing populations and current stocking programs.

## **Competition**

Price (1975) noted that two organisms occupying the same niche cannot coexist and eventually one will either be displaced or extirpated, primarily because of competition for food, cover and other resources. In the case of the introduction of brook, brown and rainbow trout, this is often exactly what happens: total displacement of Colorado River cutthroat trout from the reach where nonnative trout were introduced (Oberholtzer 1990, Fausch 1989, Behnke and Zarn 1976, Eiserman 1958). Like all the subspecies of cutthroat trout, the Colorado River cutthroat does not compete well with other, non-cutthroat trout species. Particularly in lower elevation, warmer habitats, or low gradient streams, nonnative trout, especially brook, out-compete and displace native cutthroats (Behnke and Zarn 1976, Griffith 1988, De Staso and Rahel 1994, Eiserman 1958, Fausch 1989, Oberholtzer 1990, Peterson and Fausch 1998). De Staso and Rahel, for example, found that as water temperatures warm brook more consistently outcompete Colorado River cutthroat trout. They conclude:

“The species were nearly equal competitors at 10°C, but brook trout showed a clear competitive dominance over cutthroat trout at 20°C. At the warmer temperature, brook trout were more aggressive consumed more food, and occupied the lead position in a dominance hierarchy more often than cutthroat trout.”

This finding has important implications in that habitat degradation from logging, livestock grazing and other factors leads to warmer water temperatures. Where Colorado River cutthroat trout are able to persist in sympatry with nonnative trout, their overall numbers and biomass are greatly reduced. This is very likely a major factor, along with habitat degradation, in the restriction of the Colorado River cutthroat to isolated, high elevation, headwater streams.

## Hybridization

Hybridization with rainbow trout, other sub-species of cutthroats, and even other Colorado River cutthroat that are transferred between basins is a severe threat to the continued existence of the Colorado River cutthroat. Indigenous cutthroat trout readily hybridize with hatchery forms of rainbow and other cutthroat trout (Fleener 1951; Behnke and Zarn 1976; Trotter, 1987). This results in fertile hybridized offspring, which harbor only a portion of the genetic diversity contained in the original pure population and if the hybrids eventually replace all the natives, functional loss of the native population (Epifanio and Nickum 1997, Young et al. 1996). Epifanio and Nickum (1997) state:

“the “cut-bow,” a first generation hybrid between cutthroat and rainbow trout, offers an example of interspecific hybridization between native and introduced species. Cut-bows are partially fertile hybrids capable of backcrossing with native cutthroats. This kind of gene flow can have two major effects on gene pool “integrity” of the cutthroat trout: one, the many manifestations that mixing of divergent and incompatible gene pools can have [see below]; and two, a form of genomic extinction of native gene pools. In the latter case, the native species’ genes may still occur to some extent in the introgressed mixture, however, the combination of genes or genotypes that typified the native species is extinct.”

This not only occurs with introduction of rainbow, but also other subspecies of cutthroat, such as Yellowstone, Snake River or Pikes Peak (actually a hybrid), which were all stocked in portions of the Colorado River cutthroat’s range. Similar to hybridization with rainbow, introgression with other cutthroat subspecies results in loss of a genetically intact population of Colorado River cutthroat trout (Epifanio and Nickum 1997). Hybridized populations in most cases have reduced fitness because they are less well adapted to the local environment and can have reduced reproductive capacity (see Epifanio and Nickum 1997).

Similarly, introduction of Colorado River cutthroat from brood stocks that originated in a divergent basin can have negative effects on local populations (Epifanio and Nickum 1997). Colorado River cutthroat trout populations occurring in a specific basin have in some cases been isolated from other basins for considerable lengths of time and presumably have developed traits that are beneficial to the local environment they occur in. This is called “local adaptation.” Introducing individuals from another basin, such as was done in many streams in Colorado with Trappers Lake, which may actually be a hybrid, and Lake Nanita brood stock, can result in loss of these beneficial traits and ultimately a decrease in population health from outbreeding depression (Waples 1995).

### **The current status of Colorado River cutthroat trout in relation to nonnative trout**

Of the 148 populations of Colorado River cutthroat trout listed as pure by Young et al. (1996) or CAS (1999), 49 (33%) are sympatric with nonnative trout, 27 (18%) there is no data and 72 (49%) are allopatric (Table 7, Appendix 6). Of the 235 populations listed as unknown purity by the two summaries, 124 (53%) are sympatric with nonnative trout, 70 (30%) there is no data and 41 (18%) are allopatric; and of the 120 populations identified as hybridized by the two summaries, 51 (43%) are sympatric with nonnative trout, 8 (7%) there is no data and 61 (51%)

are allopatric (Table 7). Thus, nonnative trout are currently impacting at least a third to half of all remaining populations of Colorado River cutthroat trout.

Of the 72 pure, allopatric populations, 19 (26%) are not protected by a barrier and three of these were stocked with nonnative trout since 1973 (Beaver Creek, CO., Trout Creek, WY., Clinton Reservoir, CO.) (Young et al. 1996), indicating they are likely candidates for future invasion of nonnative trout (Table 7). Additionally, 12 of the 29 pure populations, where it is unknown whether they are sympatric or not, lack protection of a barrier and thus, if they are not already sympatric may become so in the future. In total, only 83 (48%) of the 172 allopatric populations are protected by a barrier.

Even those populations protected by a barrier are not completely safe from invasion by exotic trout because barriers can be breached or nonnatives can be illegally stocked above the barrier by private parties. For example, brook trout were documented above a barrier in 1996 on the North Fork of Little Snake River, which harbors a conservation population. In this case, it is suspected that they were placed above the barrier by an angler, but barriers also often fail. Thompson and Rahel (1998) found that 26 of 80 brook trout marked below a constructed rock-filled gabion barrier were later found above the barrier. Further, Harig and Fausch (1999) noted that “most anthropogenic barriers on greenback streams have been breached either from nonnative salmonids surmounting low structures or swimming through channels eroded around or beneath the barrier.” Based on information provided by Young et al. (1996) and CAS (1999) a total of 22 barriers protecting Colorado River cutthroat trout have been breached within the last five-ten years. Thus, because barriers isolate populations from one another and because they do not provide absolute security, they are only a temporary fix to a problem that continues to be perpetuated by the three state wildlife agencies, who are stocking millions of nonnative trout into the historic range of the subspecies.

**Table 7**, status of populations of Colorado River cutthroat in regards to nonnative species by purity.

<b>Population Purity</b>	<b>Sympatric</b>	<b>Allopatric</b>	<b>no data</b>	<b>Allopatric with a barrier</b>	<b>All populations with a barrier</b>	<b>Nonnatives stocked since 1973</b>
Pure	49	72	27	53	91	29
Unknown	124	41	70	10	40	34
Hybrid	51	61	8	20	32	42

### **Current nonnative stocking programs**

Stocking programs are ongoing in all three states presently occupied by the species. Currently, more than 10 million exotic trout are stocked yearly in Utah, more than 15 million in Colorado and more than six million in Wyoming (CDOW 1999, Utah Division of Wildlife Resources 1988, Remmick, personal communication). Though none of the states currently stock over native cutthroat populations, stocking does occur within the same watersheds as Colorado River cutthroat trout, which still entails some risk for the native because of the propensity of trout to migrate (Gowan et al. 1994). Additionally, it is only very recently that all the states stopped stocking over native populations. Until as late as 1997 the Colorado Division of Wildlife continued to stock over Colorado River cutthroat trout populations in several streams, including

Freeman Reservoir, Big Beaver, Poose, First, Armstrong, Beaver, Dome, Middle Thompson, Egeria and North Fork Elliot Creeks (Epifanio and Nickum 1997). Prior to 1997, stocking was common in Colorado River cutthroat trout streams. Young et al. (1996) using state stocking records, noted nonnatives had been stocked into 116 Colorado River cutthroat trout streams since 1973. These nonnatives persist in many, if not most, of these streams. Even today, given the extent of stocking and lack of monitoring, there is always the possibility that a stream with a yet to be discovered remnant population of Colorado River cutthroat trout will be stocked with nonnatives.

Of particular concern is that Colorado is annually stocking millions of trout infected with whirling disease. Though this practice is in most cases limited to waters distant from known Colorado River cutthroat trout populations, there is still risk involved and in fact at least one population has already been infected. Geysers Creek in Utah was infected from whirling disease infected trout stocked by Colorado in Buckeye Reservoir (Hudson, personal communication). There is also always the risk that presently unknown populations could be stocked with infected fish. Perhaps more importantly, waters that could one day serve as recovery habitat are being infected with the virus, placing a severe limitation on recovery and migration of the species into a portion of its range, particularly some of the larger waters. While Colorado maintains that they are only stocking into waters where the virus already occurs, this is loosely applied to whole watersheds, where the virus may have only been found in one reach (Epifanio and Nickum (1997).

It is not only stocking of whirling disease infested nonnative trout that limits recovery of the species to a larger portion of its range, but stocking of all nonnative trout. For example, Young (1995) concludes:

“Streams in other watersheds often have populations of nonnative salmonids in lower reaches that seemingly prevent recolonization by Colorado River cutthroat trout.”

This is perhaps one of the most severe impacts of stocking—the complete isolation of Colorado River cutthroat trout into small headwater drainages in less than 5% of their historic range. Currently, in order to expand the range Colorado River cutthroat trout even by a few miles, the stream in question has to be poisoned or shocked to remove nonnatives, a time consuming, expensive and often unsuccessful prospect. While the states are actively involved in doing so on a number of streams, their actions are contradicted by stocking of millions of exotics by the very same agencies.

Finally, stocking of nonnative trout allows the agencies to ignore habitat degradation to current and former Colorado River cutthroats habitat; Epifanio and Nickum (1997) state:

“In a more subtle fashion, heavy reliance on stocked fish can mask serious environmental degradation by maintaining supplies of fish for harvest while doing nothing to address the continuing loss of wild trout habitat.”

## **B. CATASTROPHIC DISTURBANCE AND ENVIRONMENTAL STOCHASTICITY**

Since virtually all remaining *pleuriticus* populations exist in isolated streams, the potential for loss of any of these populations to catastrophic disturbance or environmental stochasticity (i.e. drought, flood, cold winter resulting in anchor ice) and for an accumulation of such losses over time is very great. Once lost, there is no natural means by which most populations can recruit new members and return. Such catastrophic losses of populations of other species of trout have occurred repeatedly over the West over the past several decades and continue today.

- A 1989 fire in the Gila National Forest followed by heavy rains resulted in 100 percent mortality of the Gila trout (*O. gilae gilae*) in Main Diamond Creek, which had held over 50 percent of the world's population of the species (Propst *et al.* 1992).
- A 1995 fire in the Gila National Forest destroyed Gila trout populations in Trail Canyon and upper Mogollon Creek. Another destroyed a mixed population of brown trout, rainbow trout, and Gila x rainbow trout hybrids in Aspen Canyon, Black Canyon and the East Fork of the Gila River (Steve Libby, pers. com. 1998).
- Fires in 1951 extirpated a suspected population of Gila trout or Gila trout hybrids in Little Turkey and upper Little creeks in the Gila National Forest (Campbell, 1994; Bruce Anderson, Gila NF, pers. com. 1990; Hanson 1971).
- Flood conditions in the Prescott National Forest in the early 1980s followed by drought in 1989 and 1990 resulted in the disappearance of the introduced population of Gila trout in Gap Creek by 1991 (Propst *et al.* 1992).
- Fire in 1986 decimated trout populations in Leeds Creek in the Dixie National Forest (Duffield 1990).

Drought, fire, flood and anchor ice are naturally occurring processes in forests of the Colorado Basin. When trout populations exist in inter-connected watersheds, such as existed historically throughout most of the range, trout always remain in some portion of the watershed after these events, and are able to re-colonize streams lost to catastrophe. Isolated populations in first or second order streams can never recover by natural means after such stochastic events, however. Thus, over sufficient time, remaining populations can be expected to disappear one by one. Even if human intervention occurs and trout are re-introduced into affected streams, similar genetic strains are not always readily available, and in such cases loss of genetic diversity remains even as new populations are re-introduced into affected waters.

### **C. HABITAT LIMITATIONS**

The small headwater streams primarily occupied by the Colorado River cutthroat trout provide poor habitat, limiting population size and stability. CAS (1999) noted habitat limitations resulting from both management action and natural stream conditions. Of the latter, limitations included excessive riffle areas, low stream flow, unstable substrate, few spawning areas, limited stream mileage, excessive siltation, low productivity, poor pools and cover, intermittent flow, inadequate riparian vegetation, steep gradient, high temperature in low reaches, low temperature and others. In total, CAS (1999) identified 95 populations, including 41 pure, 26 hybrid and 39 populations of unknown genetic purity, with habitat limitations that were not immediately

identified as relating to management action. Low stream flow was the most commonly identified limitation, highlighting the small size of streams inhabited by the Colorado River cutthroat trout. For Colorado River cutthroat trout populations to increase and become stable, they must occupy larger streams within their historic range. This will require significant habitat recovery and removal of nonnative trout from large sections of stream, neither of which is planned in the near or distant future.

## **VIII. DISEASE AND PREDATION**

### **WHIRLING DISEASE**

A portion of waters in all three states where the Colorado River cutthroat trout occurs, including waters within its historic range, have been infected with a parasitic infection called whirling disease. First introduced into the United States in the 1950's with brown trout, whirling disease is a microscopic amoebic parasite that produces a spore. The parasite has a two stage life cycle that involves trout and an alternate host, which is a tubifex worm (CDOW 1999). When trout infested with the parasite die, multiple spores are released and ingested by worms. The spores multiply in the worms and then are released into the water to infect more trout by attaching to their body or when fish eat the worms. The spores remain viable for decades and resist freezing and drought. Thus, once a stream is infected it may remain so for a considerable amount of time. Whirling disease usually only kills young fish, attacking soft cartilage and causing bone deformities and a strange tail chasing behavior, hence the name whirling disease. Adult fish carry the disease, but often do not show symptoms. Colorado River cutthroat trout and other subspecies of cutthroat are highly susceptible to the disease, exhibiting high mortality when exposed (Nehring 1998).

The disease was first found in Colorado in the late 1980's and was believed to have been introduced by a private hatchery. It quickly spread to all of the state's hatcheries. In Utah and Wyoming it is not found in state hatcheries, but is found in private hatcheries and many rivers and streams. Colorado continues to spread the disease by stocking infected fish and, as noted above, this practice has resulted in infection of at least one population of Colorado River cutthroat in Geysers Creek in the La Sal Mountains of Utah. Given that Colorado stocks millions of infected nonnatives in numerous waters, it is only a matter of time before more populations are infected. Numerous currently unoccupied streams within the historic range of the Colorado River cutthroat have been infected in all three states, limiting recovery of the subspecies in large portions of its range.

The introduction and spread of this disease highlights the severe risk of continued stocking of nonnative trout. Continuing to stock exotic trout on such massive scales will not only increase the likelihood of spreading whirling disease, but will also increase the risk of introducing other diseases, such as proliferative kidney disease (PKD) or epithelial epizootic disease (EED). Though these diseases are not currently found in the region, Epifanio and Nickum (1997) note that current policy in Colorado requires testing for these and other diseases in imported fish only. Thus, if they enter the state illicitly they could spread without being detected.

## **IX. OVERUTILIZATION FOR RECREATIONAL PURPOSES OF THE COLORADO RIVER CUTTHROAT TROUT**

Cutthroat trout, including the Colorado River cutthroat, are easily caught by anglers, making them particularly sensitive to recreational fishery impacts. An Idaho study, for example, showed that 32 man hours of angling removed 50 percent of the cutthroat trout above 6 inches in one small, previously un-fished stream (McPhee 1966). Quinlan (1980) found that 50 Colorado River cutthroat trout can be caught in 4-6 hours, which would be enough to decimate many of the remaining populations. Similarly, Langlois *et al.* (1994) conclude:

"Fishing has taken a toll on vulnerable Colorado River cutthroat trout populations.... some studies have shown that it would be possible to remove nearly all of the adult fish population in a kilometer of stream in less than 24 angler hours."

Thus, it is clear that fishing can and has had an impact on populations of Colorado River cutthroat trout. Given that many populations of Colorado River cutthroat are remote and isolated, however, recreational fishing is only a significant threat to a portion of remaining populations. In response to this threat, the three states have enacted specific restrictions for Colorado River cutthroat streams, including closing streams to fishing, requiring that all cutthroat be released, or limiting catch to one to two cutthroat per day (Utah Division of Wildlife Resources 1999, Wyoming Game and Fish Commission 1998). Though these regulations are in most cases adequate, recreational fishing still poses a potential threat for a couple of reasons. First, for the regulations to be effective, they must be followed and enforced. Given declining budgets for state game agencies, there is no guarantee that there will be adequate personnel to educate the public about the regulations and to enforce them. Second, complete and systematic surveys for Colorado River cutthroat trout have not occurred in all waters of the three states. This leaves open the possibility that undiscovered waters containing remnant populations, which are not protected by the existing fishing regulations, will be over-fished.

## **X. INADEQUACY OF EXISTING REGULATORY MECHANISMS**

### **A. States**

The Colorado River cutthroat trout is listed as a species of special concern in Colorado and a sensitive species in Utah and Wyoming. Because of this status and because it is a game species, the various state wildlife agencies have been taking action to conserve the species for five to ten years. For the most part, these actions have involved constructing barriers to prohibit exotics from entering Colorado River cutthroat streams, poisoning streams to remove exotics and translocating or stocking Colorado River cutthroat to streams free of exotics. To date, these actions have been ineffective at recovering the species, demonstrated by the fact that the species still occupies less than five percent of its historic range. Their actions are also contradicted by stocking of exotic trout by the same state wildlife agencies throughout the historic range of the species, including up until the last five years streams where the native occurs. Current management of the species by the states is guided by a recently signed conservation agreement between the states and the Fish and Wildlife Service, titled "Conservation Agreement and Strategy for Colorado River cutthroat trout" (Agreement)(CAS 1999). Below we present a detailed analysis of the Agreement, along with an analysis of implementation of past plans, which is indicative of the various state's ability to carry out the agreement.



## **Description of the “Conservation Agreement and Strategy for the Colorado River Cutthroat Trout”**

the Agreement has several overarching goals and objectives, including: establishing two meta-populations each with five sub-populations in all 14 “geographic management units” in the historic range of the subspecies; maintaining abundant populations and increasing non-abundant populations; maintaining genetic diversity; increasing the distribution where “ecologically, sociologically and economically feasible”; maintaining and restoring 383 conservation populations in 1754 stream miles and 18 populations in 652 lake acres; and eliminating or reducing threats to the trout “to the maximum extent possible”. Planned activities in the agreement fall into three categories: protecting existing and restored ecosystems, restoring degraded ecosystems, and planning. Actions to protect existing and restored ecosystems include constructing in-channel barriers, regulating angling, preventing introduction of exotic trout, monitoring populations and habitat, preventing introduction of whirling disease, and implementing education programs. Restoration activities include: improving watershed, lake and stream habitat by developing site plans with appropriate land management agencies, and constructing instream structures; acquiring instream flow rights, securing reintroduction sites, removing nonnative fish, creating hatchery stocks and stocking streams and lakes with Colorado River cutthroat. Planning activities include describing existing populations and their habitat, surveying, developing a list of potential restoration sites, developing management plans, preparing new conservation strategies, and monitoring the results on the current strategy. In an appendix, the agreement presents a laundry list of activities to occur within the next three to five years that fall under these three categories. These goals, objectives and actions fall far short of recovery of the species and, given the state agencies’ past performance, are unlikely to be met, thus necessitating listing of the species under the Endangered Species Act.

### **The Conservation Agreement consists only of planned and future actions**

Under the Endangered Species Act, when determining whether a species meets the requirements of a threatened or endangered species, the Fish and Wildlife Service is not to consider planned and future management actions, but instead only the current management and status of the species. In numerous cases, the Fish and Wildlife has been forced by judicial action to reverse decisions not to list species because they relied on promised management actions, including decisions over the Barton Spring’s salamander, Queen Charlotte goshawk, jaguar, Alexander Archipelago wolf and coho salmon. This is not merely a legalistic technicality. There is a good reason for considering only current management and status. States, Federal agencies and private interests can easily promise to protect and recover species in order to avoid or delay a listing that they consider potentially controversial. Indeed, threat of a petition for listing by the Biodiversity Legal Foundation was a primary reason for developing the Agreement (Need reference). Whether they fulfill the promises of the Agreement and whether this fulfillment will result in recovery of the trout can only be determined with time. Thus, the Conservation Agreement, which was only signed in April, 1999, is ultimately immaterial to determining whether the Colorado River cutthroat trout merits listing under the Endangered Species Act. Given its perilous status and ongoing threats, the Colorado River cutthroat trout requires immediate protection.

**The Conservation Agreement is a voluntary, non-binding agreement without mechanism for enforcement or even a guaranteed source of funding.**

Though signed by the directors of the three state's respective wildlife agencies and the regional director of the Fish and Wildlife Service, the Conservation Agreement is a voluntary, non-binding agreement with no means of enforcement. This is stated clearly in the agreement: "administration of the Agreement will be conducted by a coordination team" and "authority of the Coordination Team shall be limited to making recommendations for the conservation of the CRCT to the Administrators of the signatory agencies" (page 3). Thus, it is at the discretion of the administrators whether they wish to implement the recommendations or not. There is no penalty for any of the three states if they do not follow the Agreement, nor can they be sued by the public or one of the other parties to the Agreement for non-compliance. Thus, the Conservation Agreement is not a regulatory mechanism, but instead a set of ideals that may or not be followed.

This lack of regulatory mechanism means that when the states are faced with tough decisions where conservation of the Colorado River cutthroat trout conflicts with the wishes of special interests, such as the livestock industry, the trout will always lose. Similarly, when the states encounter tough budget decisions where there is a choice between funding action for the Colorado River cutthroat trout or another program, such as stocking exotic trout, there will be no incentive for the state's to choose the former. Indeed, Epifanio and Nickum (1997) found that Colorado spent 2.2 million dollars on and had 88 full-time staff for nonnative stocking programs, whereas it spent only 1.6 million on and had 70 full-time staff for the entire aquatics section.

Problems of budgeting priorities are compounded by the fact the Conservation Agreement does not include a secure source of funding. The Agreement specifically states:

"It is understood that all funds expended in accordance with this Agreement are subject to approval by the appropriate local, state or Federal appropriations. This instrument is neither a fiscal nor a funds obligation document." (page 4).

Thus, there is no guarantee that any of the signatories to the Agreement will provide the necessary funds to carry out conservation efforts towards recovery of the species.

**Even if the goals and objectives of the Conservation Agreement were met the species would still not be recovered**

The Conservation Agreement proposes to restore 383 conservation populations, which are pure or relatively pure and isolated from exotics, to 1,754 miles of stream and 18 populations in 652 lake acres. Though this would at least double the current population, the cutthroat would still only occupy approximately eight percent of its historic range of 23,000 miles of stream. Perhaps more significantly, the Agreement fails to set goals that will result in recovery of the subspecies to a more interconnected and stable portion of its range. While the Agreement does call for establishing one metapopulation per "Geographic Management Unit", Appendix B in the Agreement, which details the actions to be taken in the next three to five years, only contains plans for three metapopulations, two of which already formed metapopulations prior to signing of the agreement (North Fork of the Little Snake River and Labarge Creek). This means that the

Agreement only calls for creating one new metapopulation in the next three to five years. This makes it unlikely that the states will create a total of 14 metapopulations in 10 years. Even if they are successful at creating one new metapopulation and maintaining the two existing ones, these watersheds comprise only three of literally hundreds of watersheds of similar or greater size formally occupied by the Colorado River cutthroat trout.

Besides the one metapopulation, the vast majority of streams targeted for restoration of conservation populations will be similar to those currently occupied by the subspecies—isolated, small headwater drainages. As discussed above, populations in these streams are subject to sudden extirpation by stochastic processes, such as fire, flood, drought or anchor ice; and because of their isolation, once these populations are extirpated, there is little chance for natural recolonization of the stream. Additionally, high elevation streams chosen for reintroduction often provide poor habitat and fail to support viable populations. A recent study on reintroduction of Rio Grande and greenback cutthroat trout in Colorado and New Mexico, for example, concludes:

“Management has consisted mainly of locating remnant populations and establishing new populations through translocations of genetically pure cutthroat into waters that were previously barren of fish or treated with fish toxicants to remove nonnative species. However, empirical evidence suggests that this strategy may not ensure long-term persistence. For example, although Rio Grande cutthroat trout have been transplanted to 24 stream segments in Colorado, only 5 (21%) have produced stable populations whereas 9 are unstable or have died out, presumably due to unknown problems with habitat (10 others were invaded by nonnative species)”. (Harig and Fausch 1998).

### **Most populations and habitat occur on Federal lands, where the states lack the mandate to affect habitat recovery**

State agencies have failed to recover the Colorado River cutthroat trout in part because the majority of populations and habitat for the trout occur on Federal lands, where the states lack administrative control to affect management of habitat. Logging, livestock grazing and water diversion remain the dominant uses of watersheds on Forest Service and Bureau of Land Management lands within the range of the Colorado River cutthroat and are continuing to cause habitat degradation and loss, which the states have no jurisdiction to stop. These activities combined with stocking of exotic trout are the primary reason Colorado River cutthroat trout are limited to small, isolated headwater drainages. Conflicts with extractive industries severely limit the pool of streams for reintroduction of native trout. For example, planned reintroduction of Colorado River cutthroat trout into the headwaters of Muddy Creek in Wyoming have been delayed because the habitat is overly degraded by Forest Service Livestock grazing (Remmick personal communication). Extractive uses of Federal lands not only limit recovery of the species, but are also limiting recovery of existing populations. Of the 148 known pure populations of Colorado River cutthroat trout, for example, 66% occur in areas with active livestock grazing and 33% are documented to have been impacted by livestock grazing.

Significantly, neither the Forest Service nor the BLM are signatories to the Tri-State Agreement, meaning that efforts to restore habitat under the Agreement are much less likely to be successful. Reflecting the fact that states have little control over habitat management, stipulations for habitat restoration in the Agreement are vague, stating:

“Improve watershed conditions: Colorado River cutthroat trout habitat requirements will be considered on watersheds designated for CRCT restoration [a very small percentage of each state’s watersheds are designated as such]. They will be surveyed and site plans developed in concert with responsible land management agencies to mitigate adverse impacts of watershed activities on water quality, instream habitat, channel morphology, riparian areas and population stability.”

The above recommendation belittles the fact that livestock grazing, water diversions and other management actions are already known to be impacting a significant portion of populations. By failing to specifically mention these factors and by suggesting surveys and new plans as the only concrete actions, the Agreement guarantees that little or no action will be taken to reduce or remove ongoing activities harmful to Colorado River cutthroat trout populations and habitat. To be effective and remove threats, the Agreement needed to specifically identify management actions known to be adversely impacting populations along with remedies to reduce or eliminate said threats.

While the Forest Service and BLM have been signatories on the individual state plans and remain so on those that are still in effect, these plans, like the Tri-State Agreement, contain only vague stipulations to remove factors that have led to habitat loss, such as livestock grazing. For example, Utah’s agreement states:

“Enhance and/or restore habitat conditions in designated waters throughout the range of CRCT. Actions may include bank stabilization and runoff control structures, road closure and restoration or road relocation, riparian fencing and sustainable grazing practices.”

The above statement does not name waters where these changes in management should occur, nor are the changes mandatory or non-discretionary. Instead, they only “may occur.” This means that even in streams that are being severely degraded, mitigation measures are entirely optional.

Thus, state agreements are ineffective at assuring habitat protection or enhancement and, given the lack of regulation on Federal lands (see below), it is unlikely that management changes necessary to protect existing populations will be implemented.

### **State recovery efforts are contradicted by the stocking and spread of nonnative trout**

Efforts on the part of the states to increase the Colorado River cutthroat trout’s range are contradicted by the stocking of millions of nonnative trout annually by the same state wildlife agencies charged with enforcing the Agreement for the trout. Currently, in order to increase the native’s range even by a few stream miles, the states have to construct a barrier and remove nonnative with poison or electro-shock. Such efforts are time consuming, costly and not always successful (Harig and Fausch 1999). Despite the difficulties involved in removing exotics to increase the trout’s range, the states are still stocking nonnatives throughout most of the Colorado River cutthroat trout’s range. This practice is in direct conflict with the need to return the Colorado River cutthroat trout to a larger, more interconnected and stable portion of its

range. As long as large-scale stocking continues there is little chance the states or any other entity will recover the Colorado River cutthroat trout.

**The states have inconsistently implemented past state Conservation Agreements and have failed to meet stated goals. Those actions that have been taken have not resulted in substantial recovery**

Wyoming, Colorado and Utah all have conservation plans for the Colorado River cutthroat trout. In general, the recommendations in these plans have been inconsistently followed. Where actions have been taken, they have failed to result in recovery of the subspecies to a substantial portion of its historic range. Instead, instead the main result has been the introduction of Colorado River cutthroat trout to relatively few, small, isolated headwater drainages similar to those already occupied by the species. The following paragraphs provide a discussion of implementation in the various state plans and the degree to which accomplished goals have resulted in recovery. This analysis documents that the various states are not able to follow their own agreements, several of which are still in effect, and that state efforts are inadequate to recover the subspecies. Since CAS (1999) is very similar to these past Agreements and will be implemented by the same state agencies, the following analysis indicates the degree to which we can expect success towards recovery of the species from this newest of Conservation Agreements.

**Wyoming**

The Wyoming Game and Fish department first produced a management plan for the Colorado River cutthroat trout in 1987, which included several objectives to be met by 1990 (WGFD 1987). Specifically the plan called for increasing stream miles occupied by the species by 10%, increasing total population numbers by 100% and maintaining the average length of fish. In terms of habitat protection, the plan had several vague stipulations to develop recommendations for land management actions, to include the species in land management planning and more specifically, to acquire instream flow rights and lands or easements for protection of habitat.

As required by the plan, Remmick and Nelson (1992) and Oberholtzer (1990) produced reports to determine if the objectives of their Wyoming plan had been met. According to both reports and other sources, Wyoming Game and Fish failed to meet several of the objectives of the 1987 plan. For example, though the plan only called for increasing stream miles by 10%, Wyoming Game and Fish was not able to accomplish this goal. Remmick and Nelson (1992) conclude:

“We have not met objective 1 (10% increase in waters containing CRC) within the Green River Enclave. Increase in total mileage of streams containing CRC in the Green River Enclave was 6 miles or 4% (Miner Creek-3 miles and Hardin Creek-3 miles).”

Significantly, Miner Creek was not listed in the Tri State Summary (CAS 1999), indicating that this population eventually failed most likely due to poor habitat or invasion of nonnative trout. Hardin Creek is listed in CAS (1999) as still harboring a population, but according to the summary, brook trout have invaded the stream and low stream flow is a problem. Thus, some of the primary “accomplishments” of five years of work by Wyoming Game and Fish Department are contradicted by lack of habitat and invasion by nonnative trout.

Similarly, Oberholtzer (1990) concluded that the goal of a 10% increase in stream miles was not met for the Little Snake enclave, stating:

“Following criteria outlined in the Plan for the Little Snake River enclave (densities of 200 fish per mile or 25 pounds per mile), it was determined that cutthroat trout occupied 42.1 miles of stream in 1986. In 1990, cutthroat trout occupied 37.3 miles of stream. This is an 11.4% reduction in occupied stream miles and is probably the result of drought and displacement by brook trout.”

Remmick and Nelson (1992) indicated that they had met the goal of increasing numbers of fish in the Green River Enclave by 10% to 18,500 fish. However, this was partially based on numbers of fish in Miner Creek, which is now extirpated, and on stocked fish, many of which eventually did not survive (Nelson et al. 1999). Indeed, a later report documented severe declines in numbers of stocked fish within streams in the Green River Westside Tributaries Enclave, whereas wild fish remained relatively stable (Nelson et. al. 1999). Thus, if stocked fish were removed from the analysis, it is likely this goal also would not have been met. Similarly, Oberholtzer (1990) indicated this goal had been met in the Little Snake River enclave, but we have no way of assessing whether this was partially based on hatchery fish stocked over the native.

Remmick and Nelson (1992) stated that the size of fish has remained stable, meeting one of the objectives of the plan. In contrast, Oberhotzer (1990) noted that fish had declined slightly, but not significantly, in the Little Snake River enclave. Simply maintaining fish size does little to increase population stability, particularly considering that population numbers likely did not increase and that little was accomplished to improve population connectivity.

From 1987 to 1990 only modest gains were made towards improving habitat condition and very few actions were taken to protect habitat. Remmick and Nelson (1992) noted that enhancement structures were built on 10 streams and barriers were constructed on six, including Hardin Creek, where brook trout have since invaded. While these actions help the populations in these particular streams, they are relatively modest gains towards recovery of the species, effecting less than 20 miles of stream. Oberholtzer (1990) observed that habitat conditions remained roughly the same between 1986 and 1990. Neither report mentions any changes in management, such as reducing livestock grazing, to benefit the subspecies on the part of the Forest Service or Bureau of Land Management, even though these are the primary habitat managers for the Colorado River cutthroat and the plan specifically states to: “include Colorado River cutthroat trout habitat protection as an integral part of Federal, state, and local land management plans and specific decisions.” According to a review of hundreds of Federal land management plans, the Forest Service and BLM are still not including mitigation measures for this species into their management plans (see below). The plan also called for acquiring instream flow rights and lands or easements for habitat protection. Though all except two applications were submitted after 1990, Wyoming Game and Fish has applied for instream flow rights for 21 streams. However, these rights are primarily for headwater streams that are currently un-appropriated (Remmick personal communication) and therefore do not represent a gain in habitat for the species. They instead only maintain the status quo. To date, no property has been purchased or easements obtained in Wyoming to provide habitat protection for the Colorado River cutthroat.

After a four year gap, in 1994 Wyoming Game and Fish produced management plans for two of three “enclaves”—the Little Snake River (Speas et al. 1994) and Green River Westside Tributaries (Remmick et al. 1994). The latter plan states that the goal is to have a management plan for all enclaves, but to date this has not occurred. The same is true for other goals and objectives mandated by these plans as well.

**Green River Westside Tributaries Enclave.** A plan was developed and signed for the Green River Westside Tributaries in 1994. The Plan included goals to protect existing populations and their habitat and to increase the range of the cutthroat in the Enclave. Significantly, it also included criteria for determining whether the subspecies required review for listing under the Endangered Species Act. A draft summary of accomplishments details the extent to which the goals and objectives of this plan were met and whether the species requires review for listing (Nelson et al. 1999).

The first goal of the Green River Plan was to “protect existing populations of Colorado River cutthroat trout and their habitat so there is no long-term decline in population densities and habitat quality.” The first and only substantive objective of this goal was to create a “CRC population mean density for all index streams greater than or equal to 200 CRC/mile; and maintain a population structure that represents all age groups, assuring a naturally reproducing population.” Neither the specific objective nor the overall goal were met. According to Nelson et al. (1999), the average density of the 14 index streams identified by the Wyoming Game and Fish Department was only 114 CRC/mile. Furthermore, population estimates for the index streams indicates that the overall goal of no decline in population densities was also not met. If hatchery stocked fish are counted in the population estimates, ten of the 14 populations declined over the four-year period. If hatchery stocked fish are not counted than seven of the 14 populations declined over the four-year period (Nelson et al. 1999). Either way a substantial number of populations declined, with several declining by more than 50%. As an aside, these findings call into question the effectiveness of using hatchery raised fish to create new populations or to supplement existing ones because it shows that hatchery fish have poor survival rates. In Hardin Creek, for example, the entire hatchery plant was lost during the time between the two surveys.

Similarly, the objective of assuring naturally reproducing populations was not met. Reproductive problems were observed in five of the 14 streams with low or limited reproduction observed in Fish Creek, Irene Creek, and Hardin Creek. No reproduction was observed at Nylander Creek and no young of the year were observed at North Horse Creek (Nelson et al. 1999).

Likewise, the goal of preventing declines in habitat quality was not met. Habitat surveys by the Forest Service, Bureau of Land Management and Wyoming Game and Fish all indicate there has been a decline in habitat quality on many of these streams and that many do not meet standards for ecological function, particularly in lower reaches of streams (Nelson et al. 1999). Nelson et al. (1999) conclude:

“Past and current land management impacts continue to manifest themselves through degraded riparian and aquatic conditions.”

According to Forest Service surveys as documented in Nelson et al. (1999), width to depth ratios exceeded expected values on Labarge Creek at the intersection of Nameless Creek, the Ham's Fork River, several reaches of Fontenelle Creek, and Tepee Creek. Bare Creek had excessive eroding banks. Similarly, BLM watershed assessments show that a significant proportion of the stream miles on the South Cottonwood, Labarge, Fontenelle, and Ham's Fork watersheds are functional but at risk (Nelson et al. draft). Results of habitat monitoring for index streams by both the Forest Service and Wyoming Game and Fish were presented in the report and indicate declines on several waters. The Forest Service evaluated Tepee, Hardin, Irene and Bare Creeks with the latter being the only one that improved. Rather than improving, width to depth ratios increased on several reaches of Tepee Creek and every reach of Hardin Creek. Similarly, stable banks decreased on several reaches of Tepee and every measured reach of Hardin. Width to depth ratio also increased on Irene Creek, whereas stable banks did not change appreciably. According to the Wyoming Game and Fish Department's survey, width to Depth Ratio increased on portions of Irene and Lead Creeks and eroding banks increased on North Cottonwood, Bare, North Horse, Lead, Rock, Trailridge, S.F. Beaver, Fish and N.F. Beaver Creeks (Nelson et al. draft). In some cases the increase was substantial. For example, Fish Creek went from 2.7% of banks eroding to 62%. In total, at least one measure of habitat quality declined on 11 of the 14 index streams.

The second goal of the Green River Westside Tributaries Enclave plan was to "increase the range of the Colorado River cutthroat trout." Several objectives were established to meet this goal, including introducing pure populations into four new streams and upgrading the genetic purity of two streams with "C" or less populations. While the Wyoming Game and Fish did identify six streams suitable for introduction of populations and did stock fish into these streams, to date only two of these (Klondike and Clear Creeks) have been monitored to determine if reproduction has occurred and as a result only these two were listed in CAS (1999). Thus, though it has been six years since this plan was signed, Nelson et al. (draft) could not confirm that the objective of introducing populations into four new streams was met. Similarly, the goal of raising the genetic purity of two "C" or less populations was not met. Nelson et al. (1999) note that Wyoming Game and Fish did stock pure cutthroat into several streams, but none of these were "C" or less. In fact, CAS (1999) identified them all as being "A" populations, except Bare Creek, which is a "B" population. As a result, Nelson et al. (1999) did not identify any streams where genetic purity of populations had been improved. This indicates that the goal of increasing the range of pure Colorado River cutthroat trout was not met through stocking over hybrid populations and was only partially met through stocking of populations into two previously unoccupied streams.

**According to the Green River Westside Tributaries Plan, the Colorado River cutthroat trout merits review for listing under the Endangered Species Act.** The Plan included three criteria which if met would indicate the species merited review under the Endangered Species Act. The first of these criteria is that "the 1996-1997 fish population and aquatic habitat sampling on any index stream compared to the 1993-1994 sampling indicates a statistically significant decrease in CRC population density, and at the same time an increase in stream width/depth ratio and increase bank erosion. Nelson et al. (1999) argues that this criterion has not been met because those populations that have decreased have not also seen increases in width to depth ratio and bank erosion. Rather than presenting this data for all streams, a composite analysis that shows decreases in width to depth ratios and no change in bank erosion



for all index streams is presented. The Plan, however, says only one stream has to meet the criteria. Based on a combination of Forest Service and Wyoming Game and Fish data, it appears that Hardin Creek meets the criterion. The population in Hardin Creek declined from 198 to 30 fish in four years or from 21 to 9 fish per mile. Nelson et al. (1999) argued that if hatchery fish were excluded than the population would appear to have increased from zero to 30 fish. The criteria, however, does not require excluding hatchery fish and, considering that all the fish were either hatchery raised or the off-spring of hatchery raised fish it seems inappropriate to do so. According to the Forest Service, bank erosion increased by an average of 7% and width/depth ratio increased by an average of 2.7% on Hardin Creek. Nelson et al. (1999) concludes:

“A decline in stable banks and an increase in width to depth ratio was observed for Hardin Creek between 1990 and 1997. Review of land management activities to determine cause of downward trending aquatic conditions should be initiated and actions taken to reverse this trend.”

In contrast, the two stations monitored by Wyoming Game and Fish on Hardin Creek did not show declining habitat conditions. However, the criteria did not specify that the entire stream show a decline and the fact that the Forest Service found declines on several reaches indicates a problem, even if a couple stations indicated only no decline. Additionally, several other streams had increased bank erosion or width/depth ratio and declining populations, including North Horse, North Cottonwood, Irene, Bare, Fish and S.F. Beaver Creeks. That seven (counting Hardin) of 14 creeks nearly met the criteria by having some indication of habitat loss and population decline indicates serious problems in the Green River Westside Tributaries Enclave and the necessity of review for listing.

The second criterion for determining whether the species should be reviewed for listing is that “the average population density for all index stream stations measured in 1996 and 1997 is less than 170 CRC/mile and the number of immature fish is statistically lower than the number measured during the 1993-1994 sampling season.” Nelson et al. (1999) note that the average population density for the index streams did not meet the criteria of 170 CRC/mile. Despite the finding that population densities were well below goals and also not at levels that can be considered stable, Nelson et al. (1999) determined that Colorado River cutthroat did not need to be reviewed for listing because “there was not a significant decrease in recruitment between years 1993-1997 for all index streams.” They provide no numbers or analysis to support this assertion, however.

The final criterion for determining whether the species requires review for listing, according to the Wyoming Game and Fish, is that “no young of the year or immature CRC are sampled from Rock Creek or North Beaver Creek during the 1993-1994 and 1996-1997 sampling years.” Nelson et al. (1999) noted that “immature CRC were observed in Rock and North Fork Beaver creeks. Although natural recruitment appears low in Rock Creek.” Thus, evaluation of Colorado River cutthroat trout populations under each of these criteria indicates serious problems for the subspecies, including meeting the first criterion, which should have resulted in Wyoming Game and Fish recommending review of the subspecies for listing under the Endangered Species Act. Whether or not the species met the three criteria, however, analysis of the index streams certainly indicates that Wyoming Game and Fish was not able to meet its goal of preventing decline in existing populations or habitat quality. This is indicated by declines in seven to ten of the 14 populations and declines in the habitat quality for 11 of the 14 populations.

Declines in populations and habitat quality relate directly to poor habitat management on the part of Federal agencies, which state action is not able to combat, and the continued presence of nonnative species, which the state of Wyoming has been actively involved in stocking.

**Little Snake River Enclave.** Goals of the Little Snake River enclave plan include increasing stream miles with Colorado River cutthroat trout, stream miles with populations of over 200 fish per mile, and miles with allopatric populations, and to maintain or improve habitat quality. Even based on these loose criteria, the state’s efforts can not be considered successful. For example, Wyoming Game and Fish was not able to increase the number of stream miles with over 200 fish per mile. Both populations that meet this criterion, the North Fork and Roaring Forks of the Little Snake River, were already established when the plan was signed. Additionally, in 1995 the North Fork was invaded by brook trout, meaning that instead of creating new stream miles with large populations, the department had to work to protect two of the four miles that already exist. While they were able to increase stream miles, meeting their goal, it was only by less than 12.4 miles in two streams (Deep Creek and the West Branch of the North Fork of the Little Snake River). Besides not meeting some of the goals of the Little Snake Plan, Wyoming Game and Fish also failed to implement several of the specific objectives of the plan, based on an analysis of their annual reports from 1994 to the present (WGFD 1994, 1995, 1996, 1997, 1998, 1999)(Appendix 7). For example, the plan called for reintroducing populations into Littlefield and Muddy Creeks, which to date has not occurred. Forest Service livestock grazing is an impediment to reintroducing trout in the upper portion of Muddy Creek, exemplifying the degree to which Federal habitat management limits recovery. Thus, only a few of the management objectives in the Conservation Plan for the Little Snake River Enclave were met. Several others were not met with several not obtained as of the end of 1998, the last year of the plan. The objectives that were met have resulted in recovery to or protection for a relatively small number of stream miles and not overall recovery of the species. This is evidenced by the fact that fish were recovered to only 12.4 miles of new stream in the Little Snake River Enclave since inception of the plan.

**Utah**

Utah has only recently produced a conservation plan for the Colorado River cutthroat trout (Conservation Agreement and Strategy for Colorado River cutthroat trout, UDWR 1997). The plan primarily calls for surveying and genetically testing populations, failing to specify substantial management actions to recover the Colorado River cutthroat trout. This reflects the fact that Utah has, to date, accomplished little towards documenting the extent of remaining pure populations in the state and even less towards protecting and enhancing habitat and increasing the range of the Colorado River cutthroat trout. Because Utah’s efforts are focused on documenting populations, most of the work towards increasing the range of the trout, through reintroduction efforts, is scheduled for well after the year 2001. Whether this work will ever be completed, however, is in question. This is evidenced by the fact that most of the actions scheduled for the first three years of the plan were not completed (table 8)(Hepworth 1997, 1998 and 1999, Mullins and Crosby 1996, 1997 and 1998, Berg and Slater 1998 and 1999, UDWR1997, 1998 and 1999).

**Table 8,** actions planned under Utah’s 1997 conservation agreement that were not completed.

Year	Streams scheduled	Proportion	Streams scheduled for	Proportion	Streams scheduled for	Proportion	Streams scheduled for	Proportion
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	for survey or monitoring, where this did not occur		genetic analysis, where samples were not collected		habitat enhancement or nonnative eradication where this did not occur		reintroduction where this did not occur	
1996	Carrot Creek Durphey Cr. Crandall Cr. Nine Mile Cr. Cow Hollow Race Track Cr. Currant H.W. Right Hand Fork Jones Cabin	9 of 16 streams not completed	Beaver Creek Beaver Meadow Res. Carrot Creek Kyune Creek Minnie Maud Cr. Range Creek	6 of 12 streams not completed	Headwaters Whiterocks Reader Creek Beaver Creek	3 of 3 streams not completed	Whiterocks R. Reader Creek Meadow Creek	3 of 4 streams not completed
1997	Skull Creek Eagle Creek Water Hollow Granddaddy L. Tabbyune Cr. Rock Creek Beaver Cr.(SE)	7 of 25 streams not completed	Elk Creek Little Elk Creek Cub Creek Skull Creek Allen Creek Eagle Creek Granddaddy Lake	7 of 9 streams not completed	White River Willow Creek Range Creek Taylor Creek Mill Creek Deer Springs Cr. (1998) Whiterocks River	7 of 11 streams not completed	No reintroductions scheduled	
1998	Diamond Cr. Granite Cr.	2 of 16 not completed 3 unknown	Daggett Cr.	1 of 5 not completed	Grassy Trail Creek Indian Creek	2 of 5 streams not completed	Sears Creek Little Creek	2 of 2 not completed

As with the Tri-State Agreement, even if these actions were completed it would not result in recovery of the Colorado River cutthroat trout to a substantial and more interconnected portion of its range because the Utah plan primarily recommends reintroducing the trout into relatively few isolated, headwater drainages. This is exemplified by past actions on the part of the state of Utah, which have resulted in introduction of a few populations into small, isolated streams, such as the Right Fork of UM Creek, amounting to no more than 20 miles of stream.

## Colorado

The state of Colorado has two conservation strategies for the Colorado River cutthroat trout: “Interim Colorado River cutthroat trout Conservation Strategy for Southwestern Colorado 1994” (Langlois et al. 1994) and “Conservation Plan for Colorado River cutthroat trout in Northwest Colorado 1992” (Sealing et al. 1992). Though both plans called for monitoring of the effectiveness of state actions towards meeting the goals of the plans, Colorado Division of Wildlife has not produced any reports detailing their activities and in general information was difficult to obtain. Mr. Dave Langlois provided some information over the phone, and a scattering of reports to Megan Corrigan from Ancient Forest Rescue, who visited CDOW’s office in Montrose, mostly on actions taken in southwestern Colorado. Dave Langlois stated that the person charged with carrying out the northwest plan had retired, and that as a result the plan

had fallen by the way side (phone conversation 1999). Because of the main person retiring and lack of reporting, we found little information on Colorado's actions in the Northwest part of the state.

The primary goal of Colorado's strategy for conserving Colorado River cutthroat trout in southwestern Colorado was to "Create at least three metapopulations of Colorado River cutthroat trout: one for each of the major river basins that include the Gunnison, the San Juan and Delores drainages." Planned actions to reach this goal include inventorying streams and populations to create a database of potential waters and populations, reestablishing populations, improving and restoring habitat and protecting existing populations by excluding nonnatives, setting fishing regulations and improving land management practices. Both the overarching goals and individual actions under this plan were for the most part not implemented.

The state did survey a number of streams to determine if Colorado River cutthroat trout were present or if they could be reestablished. They, however, did not produce a database or list of candidate streams as promised in their plan and perhaps more importantly, very few populations were established in new waters. To our knowledge, there have been no new populations of Colorado River cutthroat trout established since inception of the plan. Even before inception of the plan, Colorado Division of Wildlife has had little success establishing new populations. In the three basins covered by this plan, CAS (1999) shows only two streams (East fork of Hermosa Creek and West Beaver Creek) for a total of eight miles of streams where pure (A) populations of Colorado River cutthroat trout have been stocked and established. The plan also called for establishing a wild broodstock for each of the three basins, which again to date has not been completed. Because they were unsuccessful at establishing new populations, they also did not meet the goal of establishing three metapopulations and indeed there are none in the state.

Similarly, the Colorado Division of Wildlife accomplished little towards improving habitat of Colorado River cutthroat trout, largely because most habitat and populations are on Federal lands. For example, the plan states that "watersheds with populations of Colorado River cutthroat trout will be identified in Forest Plans, grazing allotments, RMPs and AMPs, activity plans and integrated resource plans." As noted below, populations of Colorado River cutthroat trout, including those covered by this plan, were not identified in these documents. Indeed, the San Juan-Rio Grande National Forest, which harbors many of the populations in the three basins mentioned above, claimed they did not have a list of allotments that had Colorado River cutthroat trout (letter from Pat Prentice, San Juan-Rio Grande National Forests, October 27, 1998). Colorado's plan specifically states "it may be necessary to revise Allotment Management Plans to include protection of stream or riparian habitat." According to our review of AMPs for allotments with Colorado River cutthroat trout, none have been revised to improve riparian habitat for Colorado River cutthroat trout. Thus, there is no indication that there have been any changes in management to improve habitat as a result of the conservation strategy for southwestern Colorado.

In Northwest Colorado, CAS (1999) shows a number of populations where CDOW has stocked Colorado River cutthroat trout and established populations. Many of these, however, were stocked from Trappers Lake brood stock, which was found to be hybridized. Thus, CAS (1999) lists only 12 small streams and three lakes where pure (A) Colorado River cutthroat have been stocked and populations remain. Some of these were likely existing populations that had cutthroat stocked over them and thus were not established by CDOW. Most were stocked from

Lake Nanita stock regardless of which basin they were in. This goes against current policies in CAS (1999) and elsewhere recommending that streams be stocked only from genetic strains from within the same basin. Thus, CDOW has established pure populations in a small number of streams and lakes, but with limited genetic variability. Given this fact and the small size of most of these streams, it is clear their efforts have accomplished little towards actual recovery.

## **B. United States Forest Service**

There currently are no regulations that will protect populations or habitat of Colorado River cutthroat trout on Forest Service lands even though livestock grazing, logging and other actions are negatively affecting a substantial portion of all populations. The subspecies is listed as a sensitive species by both the Intermountain and Rocky Mountain Regions of the Forest Service, but this affords it little protection. While the National Forest Management Act (NFMA) at §219.19 states that “Fish and Wildlife habitat shall be managed to maintain viable populations of existing native and desired nonnative vertebrate species in the planning area,” it does not prohibit the Forest Service from carrying out actions that harm species or their habitat, stating only that “where appropriate, measures to mitigate adverse effects shall be prescribed” (NFMA §219.19(a)(1)). Thus, the Forest Service can conclude in a Biological Evaluation that an individuals or populations will be harmed or destroyed by an action, but still carry out this action. Similarly, the National Environmental Policy Act (NEPA) requires the Forest Service and other Federal Agencies to disclose the effects of their actions on the environment, including sensitive species and to create a range of alternatives for the action in question, but does not require them to select an alternative that will not harm habitat or populations of Colorado River cutthroat trout or other species.

In order, to assess whether the Forest Service was considering the effects of its actions on the Colorado River cutthroat trout and whether they were modifying management actions to mitigate or remove these effects, we requested through the Freedom of Information Act all management documents for livestock grazing allotments with populations of Colorado River cutthroat trout and for all timber sales within the same watershed as Colorado River cutthroat trout. From this request, we received documents, including allotment management plans (AMP), biological evaluations (BE) and environmental assessments (EA) for livestock allotments, harboring 173 populations of Colorado River cutthroat trout, recognized by either CAS (1999) or Young et al. (1998). The various documents indicate that only 37 of these populations were considered in planning documents for the various allotments in which they are found. Even of these populations, however, many were not specifically considered in a management document for the allotment, but instead were considered in a programmatic BE or EA for a district or National Forest, including 16 populations on the White River National Forest and three on the Escalante Ranger District of the Dixie National Forest. In the case of the White River National Forest BE, the individual populations were not identified, nor were assessments made of the impacts of livestock on individual populations. Instead, the BE established a one size fits all prescription, requiring permittees to retain a six inch stubble height along stream reaches known to contain cutthroat trout (White River National Forest 1995). The BE did not provide any justification for why this would benefit the species or any evidence that this requirement was adequate to sustain cutthroat populations. It did, however, determine that grazing “may impact individuals” of Colorado River cutthroat trout, but again lacking relevant detail, did not identify in which streams or to what extent populations would be impacted and whether a threshold of viability

would be crossed. Where populations were individually identified in management documents for allotments, in no case were targets established for populations or habitats, or even measurable goals to determine if changes in management were reducing harm to the species. Thus, though livestock grazing on Forest Service lands is clearly harming Colorado River cutthroat trout populations and habitat, the Forest Service does not routinely document, mitigate or if necessary eliminate the effects of livestock grazing on allotments.

The other 136 populations that we have information for occur in allotments where the effects of livestock grazing has not been considered or mitigated to any extent. For example, the Labarge Allotment in Wyoming contains six streams with Colorado River cutthroat trout, yet no BE has been prepared for the allotment and an AMP has not been completed since 1960. Numerous other Colorado River cutthroat trout populations similarly occur in allotments where managers give no consideration to the subspecies' habitat needs. Indeed, the Wasatch-Cache has not produced BEs for any allotments and the San Juan, Manti-La Sal, Arapaho-Roosevelt, and Grand Mesa-Uncompadre-Gunnison National Forests have not produced any documents for their allotments that considered impacts to the Colorado River cutthroat trout.

Similarly, we received documents for 37 timber sales, potentially affecting 57 populations of Colorado River cutthroat trout on National Forest lands. Effects to the Colorado River cutthroat trout were only considered for seven of these timber sales. Thus, similar to livestock grazing, even though logging is known to impact habitat and populations of Colorado River cutthroat trout, these impacts are not routinely considered or mitigated by the Forest Service. Failure on the part of the Forest Service to document, mitigate or remove impacts from livestock, logging or other actions stems directly from a lack of regulatory mechanism to protect the Colorado River cutthroat trout.

### **C. The Bureau of Land Management**

There are even fewer protections for the Colorado River cutthroat trout on BLM lands. The BLM does not maintain sensitive species lists or prepare biological evaluations for sensitive species. While they are required by NEPA to produce Environmental Assessments for actions, this does not require them to select an alternative that does not result in harm to habitat or populations of Colorado River cutthroat trout. In addition, the BLM has only conducted environmental analyses for a fraction of their allotments, meaning that in most cases they have not assessed effects on the Colorado River cutthroat.

Based on a Freedom of Information Act request similar to one sent to the Forest Service, we received documents for 20 livestock grazing allotments affecting 27 populations. Only two of these allotments (North Labarge and Salt Wells) had management plans that addressed effects on the Colorado River cutthroat trout. The North Labarge AMP, dated from 1972, recommended deferring grazing until after August every other year on pastures with populations. However, since that time no monitoring has occurred to determine if this has improved or maintained suitable habitat conditions. The AMP for the Salt Wells Allotment was the only one that set a target for maintaining a Colorado River cutthroat trout population, including a requirement that 500 fish/mile is maintained. Despite this target, livestock grazing impacts were still reported by CAS (1999). Thus, like the Forest Service, the BLM is not routinely documenting, mitigating or eliminating the effects of livestock grazing on the Colorado River cutthroat trout.

To its credit, the BLM did create the East Douglas Creek Area of Critical Environmental Concern for the Colorado River cutthroat trout, where livestock grazing has been reduced, though not eliminated, to benefit the trout. Unfortunately, the ACEC only harbors six hybrid populations that are believed to be “C” or less and thus CAS (1999) recognized none.

#### **D. The National Park Service**

There are twelve populations of Colorado River cutthroat trout that are partially or totally within the boundaries of Rocky Mountain National Park (Rosenlund et al. 1999), eight of which are known to be genetically pure and are recognized by either CAS (1999) or Young et al. (1998). Five of the latter are stocked lakes. Management of the Park ensures that all of these populations are safe from threat of habitat degradation. In addition, seven of the eight pure populations are allopatric and protected by barriers. The eighth (Timber Creek) it is unknown, whether it is allopatric or has a barrier. Recreation and fishing impacts are the only potential threats to these populations and at this time, these are not considered serious. Thus, populations within Rocky Mountain National Park, though most are not indigenous, are secure. These populations, however, comprise an insignificant portion of remaining or historical populations of Colorado River cutthroat trout.

#### **E. Private landowners**

An indeterminate portion of Colorado River cutthroat trout populations and historic habitat are found on private lands. Though we have no way of assessing the degree to which the actions of private land owners are damaging to Colorado River cutthroat trout populations, there currently are no regulations to protect these populations. Given this lack of regulation, it is likely that actions damaging to Colorado River cutthroat trout, including livestock grazing, stocking of nonnative trout, and other activities, are occurring unchecked and more than likely are the dominant uses of these lands.

### **XI. REQUEST FOR CRITICAL HABITAT DESIGNATION**

Petitioners strongly request the designation of critical for the Colorado River cutthroat trout coincident with its listing. Critical habitat should be designated in all areas where it is currently located and in key unoccupied areas where restoration is necessary for the conservation of the species.

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Center for Biological Diversity  
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David Noah Greenwald signs for the following groups who have agreed to be co-petitioners: Biodiversity Associates (WY), Biodiversity Legal Foundation (CO), Ancient Forest Rescue (CO), Southwest Trout (NM), Wild Utah Forest Campaign (UT), Center for Native Ecosystems (CO), Colorado Wild (CO).

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