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Conservation Status of Colorado River Cutthroat Trout

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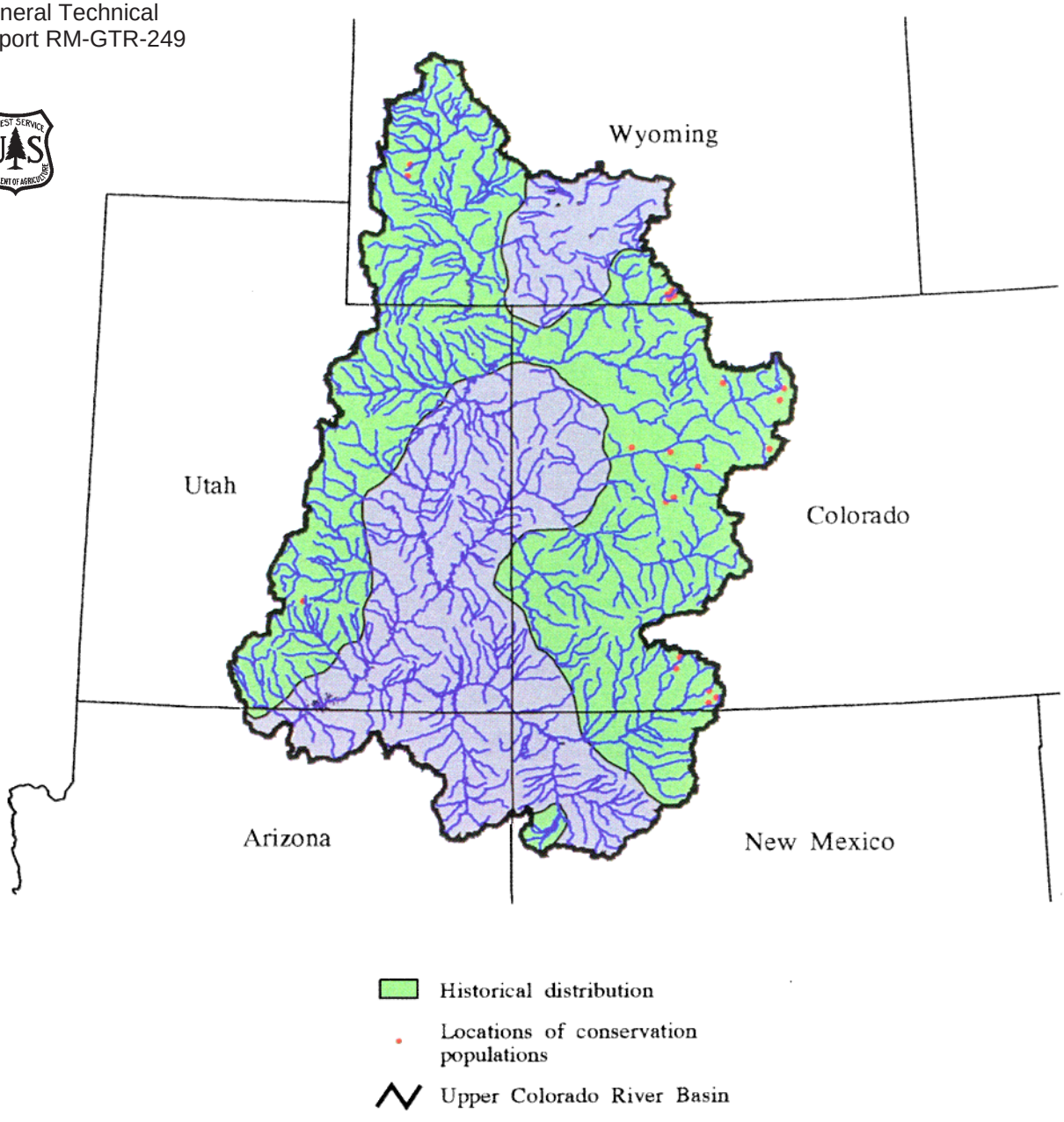

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Abstract

Though biologists recognize that populations of Colorado River cutthroat trout have declined, the magnitude of the loss remains unquantified. We obtained information from state and federal biologists and from state databases to determine the current distribution and status of populations of Colorado River cutthroat trout. Recent population extinctions have been documented throughout this range. Hybridization with rainbow trout, nonindigenous cutthroat trout (those established or supplemented by stocking of genetically pure fish), and introgressed hatchery stocks has degraded many populations of Colorado River cutthroat trout. Only 26% of the remaining populations are believed to be genetically pure. Almost 45% of the remaining populations are at least partly sympatric with non-native trout species or hybridized hatchery stocks. Brook trout are the most common sympatric non-native species. Barriers (permanent, physical obstructions) to upstream migration are known to protect 27% of the indigenous populations from non-native stocks. Land management problems were inconsistently mentioned, but grazing and dewatering were the most frequently cited. As a consequence of these threats, the continued existence of Colorado River cutthroat trout is in doubt. Of the 318 waters, only 20 contain Colorado River cutthroat trout that are believed to be indigenous, genetically pure, allopatric above a barrier, and in a drainage not recently stocked.

Keywords: Colorado River cutthroat trout, *Oncorhynchus clarki pleuriticus*, extinction, conservation biology

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Cover: Historic range of Colorado River cutthroat trout and location of remaining conservation populations.

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Conservation Status of Colorado River Cutthroat Trout

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INTRODUCTION

Many populations of Colorado River cutthroat trout have been exterminated since the late 1800s. The now-familiar causes, which include introductions of non-native fishes, habitat degradation, loss and fragmentation, and overharvest, were widespread throughout the historic range of this subspecies (Young 1995b). Most of these practices continue (Young 1995a) and presumably so does the loss of populations. An increased awareness of this loss has led to attempts to maintain and restore populations of this subspecies (e.g., Pister 1990) and to document their occurrence. Most assessments of the status and distribution of this subspecies have focused on portions of states or national forests (Remmick 1982; Oberholtzer 1987; Martinez 1988; Langlois et al. 1994), but a comprehensive overview of the security of the subspecies is lacking. The intent of this review was to: (1) examine historical information on the distribution of Colorado River cutthroat trout; (2) determine the current distribution of the subspecies in its former range of Wyoming, Colorado, and Utah (neglecting potential populations in Arizona and New Mexico); and (3) identify characteristics that could influence the persistence of these populations.

HISTORICAL DISTRIBUTION AND CURRENT MANAGEMENT

Comprehensive descriptions of the historical range of Colorado River cutthroat trout are unavailable. Behnke (1992) considered the range to include all accessible cool waters of the upper Colorado River drainage, including the Green, Yampa, Gunnison, Dolores, San Juan, Duchesne, and Dirty Devil rivers. By the 1970s, this distribution had been drastically reduced (Behnke and Benson 1980). The decline triggered responses from several management agencies. Colorado River cutthroat trout were classified as a Category 2 species (considered for formal listing under the Endangered Species Act until this category was abolished) by the U.S. Fish and Wildlife Service, a sensitive species by Regions 2 and 4 of the U.S. Forest Service, and designated with special status by Colorado, Utah, and Wyoming (Johnson 1987). Separate management plans for this subspecies have been prepared for northwestern Colorado, southwestern Colorado, south-central Wyoming, southwestern Wyoming, and Utah.

Conservation strategies have centered on surveys, angling restrictions, and channel modifications. Initially, population inventories were limited. Behnke and Zarn (1976) knew of only two genetically pure populations, both in Wyoming. However, they reported but did not identify a number of hybridized populations. Later surveys were more thorough and additional populations were located. Binns (1977) identified 42 waters in the Little Snake River, Blacks Fork, and upper Green River drainage in Wyoming that supported populations of this subspecies. Oberholtzer (1987) collected Colorado River cutthroat trout from 36 streams in the Little Snake River drainage. In the most extensive survey, Martinez (1988) evaluated 160 streams and lakes in northwestern Colorado within the historical range of this subspecies and found 96 populations of Colorado River cutthroat trout; 21 of which were considered genetically pure. Other intensive surveys of the distribution of this subspecies were completed in southcentral Wyoming (Oberholtzer 1990), southwestern Wyoming (Remmick 1982), and northwestern Colorado (T. Fratt, Routt National Forest, pers. comm.; D. Vos, White River National Forest, pers. comm.).

Strategies for restricting anglers have varied. Many Wyoming populations are protected by fishing closures or catch-and-release regulations.

Similarly, Colorado has prohibited harvest and mandates the use of artificial flies and lures in some waters containing this subspecies. Utah chose not to apply special regulations to certain streams containing this subspecies to avoid attracting public attention (Schmidt et al. 1995).

Most conservation and management plans (e.g., Speas et al. 1994) for the Colorado River cutthroat trout emphasize barrier (permanent, physical obstructions; e.g., installing rock weirs) construction to protect existing populations, or barrier construction and chemical treatment (fish removal) to prepare the waters for reintroduction (e.g., West Beaver Creek, Colorado and Clear Creek, Wyoming). An alternative to chemical treatment is depletion-removal electrofishing. The advantage of this method is that nontarget fish, such as Colorado River cutthroat trout, are not killed; nonetheless, complete elimination of undesirable species may be impossible (Thompson 1995). Agencies have also installed channel structures to increase habitat quantity and quality, and are modifying land management to improve stream habitat.

METHODS

We used three techniques to obtain information on the status and distribution of Colorado River cutthroat trout within their historical range. First, we sent two questionnaires to state and federal biologists responsible for managing waters known or suspected to contain Colorado River cutthroat trout in Utah, Wyoming, and Colorado. Second, we obtained data from publications, reports, and personal contacts. Third, we searched the computerized databases maintained by the Colorado Division of Wildlife and the Wyoming Game and Fish Department for references to Colorado River cutthroat trout and for records of stocking in waters believed to contain this subspecies.

Information obtained from the first questionnaire included the name and location of waters known to contain Colorado River cutthroat trout, the non-native trout present, the genetic purity of Colorado River cutthroat trout and mode of determination, and the land management activities affecting the water. After assembling this information, we prepared a follow-up questionnaire that was submitted to the same biologists. The second questionnaire included questions on population origin and the presence of a barrier to upstream migration.

Because not all biologists responded to our pleas for information, the list of populations and their characteristics is inaccurate. In many cases, waters with marginal populations have not been recently revisited, and some of these populations may now be extinct. Similarly, stocking records were limited. The computerized database for Colorado only contains records since 1973, and earlier stocking was not consistently reported. Also, we were unclear about the identity of certain waters; some were unnamed on maps or had names different than those on U.S. Geological Survey maps. Unauthorized stocking by anglers could not be documented and perhaps not all stocking by state or federal agencies was entered in the database. These same concerns pertain to Wyoming. Few records of any kind could be obtained from Utah.

We used the terms "population" and "water" interchangeably because we could not distinguish between distinct populations that occupied the same body of water (e.g., perhaps in Trappers Lake, Colorado; Thurow et al. 1988) or determine when a single population occupied more than one stream or lake (e.g., perhaps in the North Fork Little Snake River, Wyoming; Fausch and Young 1995). Our convention may be appropriate for most populations of Colorado River cutthroat trout because they are isolated in relatively short stream reaches.

We believe that this list of waters is a critical benchmark in assessing the status of Colorado River cutthroat trout and for gaging the success or failure of future conservation efforts. We hope field biologists will direct future efforts to correcting our errors and oversights.

RESULTS AND DISCUSSION

We estimate that 318 populations of Colorado River cutthroat trout still exist within the historical range of this subspecies in Utah, Wyoming, and Colorado (Table 1; Appendix A; Appendix B). This total is provisional because the inclusion of some waters is controversial, for the following reasons.

Table 1. Summary of characteristics for populations of Colorado River cutthroat trout in Utah, Utah-Wyoming, Wyoming, and Colorado waters. All numbers refer to the number of populations.

Characteristics	UT	UT-WY	WY	CO	Total
Total populations	17	30	119	152	318
Nonindigenous populations[1]	1	8	29	17	55
Genetic purity					
Pure	11	3	25	44	83
Hybridized	2	20	51	59	132
Mixed results	3	3	4	5	15
Not tested	1	4	39	44	88
Genetic technique					
Meristics	5	18	79	108	210
Protein electrophoresis	4	10	9	4	27
mtDNA analysis	16	5	1	0	22
Non-native species					
Waters with sympatric populations	5	14	68	55	142
of brook trout	4	11	62	50	127
of brown trout	2	0	5	3	10
of non-native cutthroat trout	2	1	0	0	3
of rainbow trout	2	7	20	11	40
Waters stocked since 1973	0	7	20	70	97
with brook trout	0	0	0	20	20
with brown trout	0	0	0	3	3
with non-native cutthroat trout	0	4	17	54	75
with rainbow trout	0	2	5	33	40
Recently stocked in headwaters	0	2	0	24	26
Waters with barriers[2]					
Yes	1	3	26	59	89
No	0	1	72	28	101
Breached	0	0	14	6	20
Unknown	16	26	7	59	108
Land management effects					
Dewatering	5	1	13	3	22
Grazing	6	2	6	15	29
Logging	1	1	0	0	2
Mining	0	0	4	2	6
Road erosion	3	2	12	2	19

[1] *Populations established or supplemented by stocking of genetically pure fish.*

[2] *Permanent, physical obstructions to upstream migration; non-native species are present above a breached barrier.*

Reintroduced populations

All three states have re-established or created new populations of genetically pure Colorado River cutthroat trout; 17% of all waters have received such nonindigenous fish (those established or supplemented by stocking of genetically pure fish). The population in Durfey Creek, Utah, was translocated from nearby East Fork Boulder Creek. A hatchery stock from trout in Rock Creek 2, Wyoming, supplemented or founded populations in Wyoming and Utah-Wyoming waters.

Similarly, a stock from trout in Williamson Lakes, California, which originated from Trappers Lake, Colorado in 1931 (Pister 1990), was used in Colorado waters. Some of these waters, especially lakes (e.g., Big Sheep Mountain Lake, Wyoming and Bench Lake, Colorado), were probably historically barren. They were included, but whether they should be considered "restored" populations is debatable.

Not all attempts to maintain or restore populations of Colorado River cutthroat trout have succeeded. Populations above barriers in some streams (e.g., Irene and Nameless Creeks, Wyoming) are apparently not self-sustaining, but rely on repeated stocking (Thompson 1995). Perhaps inadequate or insufficient habitat prevented successful re-establishment of these populations. Alternatively, hatchery populations founded by migratory or lacustrine stocks may be maladapted for restoring Colorado River cutthroat trout to small, fragmented streams.

Genetic purity

Only 26% of the remaining populations of Colorado River cutthroat trout were judged to be genetically pure (Table 1). In contrast, 42% were thought to be introgressed with genes from rainbow trout or nonindigenous stocks of cutthroat trout; 28% remain unevaluated. Though genetic analysis is critical, absolute confidence in purity designation is unjustified because of technique or sampling method deficiencies. As evidence, 15 populations have been judged both genetically pure and introgressed. Many of these mixed conclusions resulted from meristic analyses, which are based on counts or the presence of certain anatomical characters, conducted by different individuals at different times (e.g., Northwater and Cunningham Creeks, Colorado). Though the populations may have become hybridized in the interval between samples, it is also likely that different meristic analyses conflicted because the method is highly subjective (Hubert and Alexander 1995). The accuracy of meristic analysis is also suspect because of the lack of experimental studies comparing meristic counts of pure fish, their first-generation hybrids and backcrosses (a first-generation hybrid mated with a parent), and the absence of assessments of the statistical reliability of these counts. One of the characteristics thought to be an indicator of hybridization with rainbow trout, the absence of basibranchial teeth, has been demonstrated to be unreliable (Leary et al. 1996). Meristic analysis may also be less sensitive than other techniques (Campton 1987) because meristic variation may have environmental and genetic components (Leary et al. 1985). Meristic analysis of purity should be considered an interim assessment until other techniques are applied.

Partly due to the high costs of these methods, only 49 populations have been genetically evaluated by using protein electrophoresis (Leary et al. 1993) or by examining mitochondrial DNA (Shiozawa and Evans 1995a). These techniques are less subjective, but still suffer shortcomings for evaluating genetic characteristics (Campton 1987; Utter 1987; R.J. Behnke, Colorado State University, pers. comm.), which produced conflicting designations of purity (e.g., Currant and South Fork Sheep Creeks, Utah). We have the greatest confidence in the genetic evaluations for populations judged free from hybridization by all three methods (e.g., Beaver Creek, Utah, and Rock Creek 2, Wyoming). Unfortunately, for some hybrids, such as greenbacks crossed with Colorado River cutthroat trout, there may be no technique that reliably distinguishes them from the parent stock (Behnke 1992; R. Leary, University of Montana, pers. comm.).

Non-native trout

The introduction and subsequent spread of non-native trout may be the greatest threat to the continued existence of populations of Colorado River cutthroat trout (Behnke 1992). Almost 45% of the remaining populations are at least partly sympatric with non-native species or stocks (Table 1). Brook trout occurred in nearly 90% of these sympatric populations and rainbow trout in 28%. Brook trout have been widely reported to replace Colorado River cutthroat trout (Oberholtzer 1987; Behnke 1992; Thompson 1995), and hybridization with rainbow trout has been repeatedly documented (Leary 1990; Behnke 1992; Bischoff 1995).

Non-native salmonids have been stocked in the historical range of Colorado River cutthroat trout for over 100 years. Such stocking began in 1872 in Colorado (Wiltzius 1985). Brook and rainbow trout were first introduced in 1880 in Wyoming, and brown trout were first stocked 10 years later (Wiley 1993). In the North Fork Little Snake River drainage in Wyoming, rainbow trout were first introduced in 1950 and Yellowstone cutthroat and brook trout in 1936 (Oberholtzer 1987). In the Savery Creek drainage, tributary to the Little Snake River, rainbow, brook, and brown trout were first introduced in 1936 and fine-spotted or Yellowstone cutthroat trout may have been introduced as early as 1933 (Eiserman 1958). Rainbow trout were first stocked in 1915 in the Smiths Fork, a tributary to the Green River in Wyoming (M. Fowden, Wyoming Game and Fish Department, pers. comm.). Rainbow, brook , brown, golden, and lake trout and coho salmon were introduced into the northern and eastern portions of the Green River drainage before 1934 (Simon 1935), which probably explains the complete absence of indigenous populations of Colorado River cutthroat trout in that portion of the watershed.

Stocking of non-native trout continues to threaten Colorado River cutthroat trout. Of the waters considered to support this subspecies, 30% have been recently stocked. Many streams on public land in Utah, Wyoming, and Colorado with road crossings, which allow for stocking by automobiles, or with headwater lakes, which allow for stocking by aircraft, have introduced populations of non-native trout. Because some of these waters (e.g., Porcupine Lake, Lake of the Crags, and Lake Diana, Colorado) have been repeatedly stocked with nonindigenous forms of cutthroat trout, they probably should not be included in the remaining range of this subspecies. However, they have been included in this assessment.

Recent stocking has been extensive. For example, of the 152 waters believed to contain remnant populations of Colorado River cutthroat trout in Colorado, 70 have been directly stocked with non-native trout or have had presumably connected portions of their watersheds stocked. Sixty-three of the 70 waters have been stocked with species or subspecies likely to hybridize with Colorado River cutthroat trout. These stocks include rainbow trout, Pikes Peak cutthroat [1], Snake River fine-spotted cutthroat, Trappers Lake cutthroat [2], and Yellowstone cutthroat trout.

Barriers

The majority of waters containing Colorado River cutthroat trout have not been surveyed for migration barriers. Only 28% of the waters with indigenous trout populations are known to have barriers that protect those populations from invasions by non-native stocks (Table 1). Although what constitutes a natural barrier to migration has not been quantitatively defined, many barriers are human-made structures designed to prevent fish passage. In Wyoming, such structures are at least 1 m high with a downstream apron typically extending over 2 m (Ed Novotny, Wyoming Game and Fish Department, pers. comm.). Human-made barriers are less permanent than geologic barriers; high flows in 1995 severed a 10-month-old weir in West Beaver Creek, Colorado.

Twenty waters possess barriers that have been breached by non-native trout species. Headwater introductions by government agencies may account for some of these instances, and improper design or maintenance may have enabled brook trout to scale some barriers (e.g., Nameless and Deep Creeks, Wyoming). The most insidious threats to populations of Colorado River cutthroat trout above barriers are illegal introductions by anglers. This activity often enables non-native trout to reproduce and spread before they are detected by management agencies. For example, when sampling the North Fork Little Snake River above a barrier in 1995, we discovered at least three age classes of brook trout distributed over 4 km, suggesting that adults were probably introduced in 1993 (M. Young, unpub. data). This illegal introduction may jeopardize the future of the largest population of indigenous Colorado River cutthroat trout in Wyoming.

[1] *Greenback cutthroat trout that have hybridized with Yellowstone cutthroat and Snake River fine- spotted cutthroat trout (D. Krieger, Colorado Division of Wildlife, pers. comm.).*

[2] *Colorado River cutthroat trout that have hybridized with Yellowstone cutthroat trout and rainbow trout (Martinez 1988; Leary 1990).*

Land management

Grazing, stream-dewatering, and roads were the most frequently identified problems for waters containing Colorado River cutthroat trout. But the effects of land management were rarely noted by most biologists responding to the questionnaire and may be more widespread than reported. Land management problems were usually noted for well-studied watersheds. For example, water diversion structures and roads for the Cheyenne Stage II water diversion project in the North Fork Little Snake River watershed accounted for most these effects in Wyoming (Appendix A).

Population status

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. The North Fork Little Snake River may contain the longest contiguous, available habitat of 27.8 km (Oberholtzer 1990). Similarly, indigenous populations of adfluvial Colorado River cutthroat trout (individuals migrating between lakes and streams) have almost been eliminated from their historic range. Of the 318 waters containing this subspecies, only 24 are lakes or reservoirs and only two indigenous populations have escaped extensive introductions of non-native stocks. These populations are in the Fryingpan Lakes in Colorado, which may lack a barrier, and North Piney Lake in Wyoming, which nevertheless contains brook trout. Yet adfluvial stocks have been readily re-established and could be a priority for further restoration.

Most of the occupied range of this subspecies consists of isolated segments of small streams on public land; only Miller and Smith Creeks in Colorado and Van Tassel Creek in Wyoming are largely private. This fragmentation resulted from human-built structures (e.g., culverts and water diversions) that blocked upstream fish movement, and from non-native 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 non-native fish (Rieman and McIntyre 1993). But in several locations, connected networks of streams enable individuals to move freely or connections could be restored by non-native fish removal and downstream barriers (Table 2). Such networks could be the focus of restoration (Moyle and Yoshiyama 1994). Linking populations may reduce their risk of extinction by providing some habitats likely to be unaffected by a single environmental disturbance (Shaffer 1987). For this reason, Wyoming intends to chemically remove all non-native fish from the lower reaches of the West Branch and the mainstem of the North Fork Little Snake River downstream to a geologic barrier (M. Fowden, Wyoming Game and Fish Department, pers. comm.). This would reconnect two of the largest populations of Colorado River cutthroat trout in the Little Snake River watershed.

Table 2. Potential sites for restoration of connectivity between populations.

Utah-Wyoming
Upper Henrys Fork
Upper Blacks Fork
Wyoming
North Fork Little Snake River
West Branch North Fork Little Snake River
LaBarge Creek
Hams Fork
Cottonwood Creek
Piney Creek
Colorado
Upper Piedra River
South Fork Little Snake River
East Fork Parachute Creek
Thompson Creek
South Fork Ranch Creek
Little Muddy Creek
Little Green Creek

Immediate needs

As a consequence of the introduction of non-native species, historical overharvest (Behnke 1992), improper land management, and a lack of knowledge about this subspecies, the continued existence of Colorado River cutthroat trout is in doubt. Of the 318 waters believed to contain this subspecies, only 20 may support populations that are indigenous, genetically pure, allopatric above a

barrier, and in a drainage not recently stocked. We consider these "conservation populations" because of their importance as regionally adapted stocks, which might be used to restore populations to nearby waters, and because they may be temporarily secure. Despite this standing, such populations may be too small to remain viable. The overall status of this subspecies may be much worse or only marginally better than we have depicted because of what we do not know. For example, many populations have not been genetically tested, only 12 of those considered genetically pure have been evaluated with more than one technique, and we cannot confirm the presence of a barrier for 25 waters containing purportedly genetically pure populations. Many waters that we included have not been examined for over 20 years and may no longer contain Colorado River cutthroat trout. Finally, historically barren waters and those that have been intensively stocked make a dubious contribution to the total number of populations. Because lakes and accessible streams have experienced intensive fish management, retention of unrecognized, indigenous populations of this subspecies is unlikely. But small streams that are rarely visited by anglers, biologists, or fish culturists may contain remnant populations of Colorado River cutthroat trout. Clusters of such streams may persist in the Gunnison and Dolores river basins in Colorado or the upper Blacks Fork and Strawberry river basins in Utah. Because small streams seem the most likely to contain barriers to upstream migration, these populations may represent the best remaining genetic examples of the subspecies.

Biologists have several tactics for increasing the knowledge of the status and distribution of Colorado river cutthroat trout. We recommend that biologists examine the state databases to identify waters that have not been recently stocked or sampled, or to find waters that other biologists have not noticed. Electrofishing, or visual or hook-and-line surveys in remote waters are effective in identifying populations of Colorado River cutthroat trout and may provide information on the characteristics, location, and permanence of natural barriers. Populations protected by a natural barrier or an old human-made barrier, such as a water diversion, or those with good phenotypic characteristics are likely candidates for genetic testing. Finally, noting the location of existing populations may lead to the discovery of nearby populations and will enable biologists to recognize streams of importance to the conservation of Colorado River cutthroat trout.

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Appendix A.

Characteristics of populations of Colorado River cutthroat trout in Utah, Utah-Wyoming, Wyoming, and Colorado waters. Waters are listed from downstream to upstream within each state.

Water[1]	Drainage	Genetic purity[2]	Tech-nique[3]	Non-native species Present[4]	Non-native species Stocked[5]	Barr.[6]	Activity[7]	In Appendix B Figure[8]	In Appendix B Water#[9]
UTAH									
Escalante R.									
E. Fk. Boulder Cr.†	Boulder Cr.	p	m,d	bk,rb	?	y	—	1	1
W. Fk. Boulder Cr.	Boulder Cr.	p	d	—	?	u	—	1	2
Durfey Cr.*	W. Fk. Boulder Cr.	p	d	—	?	u	—	1	3
Duchesne R.									
Whiterocks R.	Uinta R.	u	—	bk	?	u	g,r,l	2	4
Reader Cr.	Whiterocks R.	p	d	?	?	u	—	2	5
Yellowstone R.	Lake Fork R.	p	d	bk,bn,ct	?	u	d,g	2	6
Avintaquin Cr.	Strawberry R.	m	m,d	—	?	u	d,g	3	7
Currant Cr.	Red Cr.	m	e,d	?	?	u	—	3	8
Racetrack Cr.	Currant Cr. Res.	p	d	?	?	u	—	3	9
Timber Canyon	Strawberry R.	p	d	—	?	u	d,g,r	3	10
Willow Cr.	Strawberry R.	h	d	bn,ct,rb	?	u	d,g,r	3	11
W. Fk. Duchesne R.	Duchesne R.	p	d	?	?	u	—	3	12
Green R.									
Dry Fk. Ashley Cr.	Ashley Cr.	p	d	bk	?	u	d,g	2	13
Dolores R.									
Geyser Cr.	Roc Cr.	h	d	?	?	u	—	4	14
La Sal Cr.	*Dolores R.*	*m*	*m,e,d*	?	?	u	—	4	15
Beaver Cr.	La Sal Cr.	p	m,e,d	?	?	u	—	4	16
Mid. Fk. Beaver Cr.	Beaver Cr.	p	m,e,d	?	?	u	—	4	17
UTAH-WYOMING									
Green R.									
Red Cr.*	Green R.	p	m	bk	—	u	—	5	18
Carter Cr.	Flaming Gorge Rs.	u	—	bk,ct,rb	?	u	d,g,l,r	2	19
N. Fk. Sheep Cr.	Sheep Cr.	p	e,d	?	?	u	—	2	20
S. Fk. Sheep Cr.	*Sheep Cr.*	*m*	*e,d*	*bk*	?*	u	—	2	21
Henrys Fk.	Green R.	h	m,e	rb	src	u	—	2	22
Birch Cr.*	Henrys Fk.	h	m	—	src,rb	u	—	2	23
Burnt Fk.	Henrys Fk.	p	d	—	—	u	—	2	24
W. Beaver Cr.*	Henrys Fk.	h	m	—	src	u	—	2	25
Poison Cr.	Henrys Fk.	h	m	rb	—	n	—	2	26
Dahlgreen Cr.	Henrys Fk.	h	e	?	?	u	—	2	27
Currant Cr.*	Green R.	h	m	bk	—	u	—	5	28
Blacks Fk.									
Blacks Fk.	*Green R.*	*h*	*m*	*rb*	—	*u*	—	2	29
E. Muddy Cr.	Muddy Cr.	h	m	—	—	u	—	2	30
W. Muddy Cr.	Muddy Cr.	h	m	—	rb	u	—	2	31
Van Tassel Cr.	W. Muddy Cr.	h	m	—	—	u	—	2	32
Cottonwood Cr.*	Smiths Fk.	u	—	bk	—	u	—	2	33
Sage Cr.	Cottonwood Cr.	h	m	—	src	y	g,r	2	34
Swamp Cr.*	Cottonwood Cr.	u	—	bk	—	u	—	2	35
Willow Cr.	Smiths Fk.	h	m	—	—	u	—	2	36
E. Fk. Smiths Fk.*	Smiths Fk.	u	—	bk,rb	—	u	—	2	37
*Gilbert Cr.**	*E. Fk. Smiths Fk.*	*h*	*m,e*	bk,rb	—	y	—	2	38
Little Gilbert Cr.	Gilbert Cr.	m	m,e	bk	—	u	—	2	39
W. Fk. Smiths Fk.	Smiths Fk.	h	m,e	bk,rb	—	u	—	2	40
Archie Cr.	W. Fk. Smiths Fk.	h	m,e	—	—	u	—	2	41

Appendix A. Cont'd.

Water[1]	Drainage	Genetic purity[2]	Tech-nique[3]	Non-native species Present[4]	Non-native species Stocked[5]	Barr.[6]	Activity[7]	In Appendix B Figure[8]	In Appendix B Water#[9]
UTAH-WYOMING (Cont'd.)									
Green R. (Cont'd.)									
Little W. Fk. Blacks Fk.	Meeks Cabin Res.	m	m	—	—	y	—	2	43
E. Fk. Blacks Fk.	Blacks Fk.	h	e	?	?	u	—	2	44
Little E. Fk. Blacks Fk.	E. Fk. Blacks Fk.	h	e	bk	?*	u	—	2	45
W. Fk. Blacks Fk.	Blacks Fk.	h	d	—	—	u	—	2	46
Middle Fk. Blacks Fk.	W. Fk. Blacks Fk.	h	d	—	—	u	—	2	47
Horse Cr.	Blacks Fk.	h	m	?	—	u	—	2	42
WYOMING									
Little Snake R.									
Deep Cr.	Big Sandstone Cr.	h	m	bk	—	y	—	6	48
E. Branch Deep Cr.	Deep Cr.	m	m,e	bk	—	y	—	6	49
W. Branch Deep Cr.	Deep Cr.	u	—	bk	rb	y	—	6	50
Mill Cr.	Big Sandstone Cr.	h	m	bk	—	b	—	6	51
S. Fk. Mill Cr.	Mill Cr.	u	—	bk	—	y	—	6	52
Elk Cr.	Mill Cr.	h	m	—	—	y	—	6	53
Right Branch Mill Cr.	Mill Cr.	u	—	bk	—	y	—	6	54
Skull Cr.	Big Sandstone Cr.	h	m	bk	—	n	—	6	55
Big Sandstone Cr. AC	Big Sandstone Cr.	p	m	bk	—	u	—	6	56
N. Fk.	Big Sandstone Cr.	p	m	bk	—	u	—	6	57
Hell Canyon	Savery Cr.	h	m	—	—	y	—	6	58
Dirtyman Fk. Savery Cr.	Savery Cr.	h	m	—	ct,rb	y	—	6	59
Hatch Cr.	E. Fk. Savery Cr.	h	m	—	—	y	—	6	60
Carrico Reservoir*	Hatch Cr.	h	m	—	—	y	—	6	61
Beaver Cr.	Joe Cr.	p	m	—	—	u	—	6	62
Haggarty Cr.	W. Fk. Battle Cr.	u	—	—	ct	n	m	6	63
Green Cr.	Haggarty Cr.	p	m	—	—	n	m	6	64
Alisha Cr.	Haggarty Cr.	p	m	—	—	n	m	6	65
Bachelor Cr.	Haggarty Cr.	p	m	—	—	n	m	6	66
Lost Cr.	W. Fk. Battle Cr.	u	—	bk	ct	n	—	6	67
Roaring Fk.†	Little Snake R.	p	m,e	bk	ct	y	—	6	68
N. Fk. Little Snake R.	Little Snake R.	m	m,e	bk	rb,yc	b	d,r	6	69
W. Branch	N. Fk. Ltl. Snake R.	h	m	bk	ct	y	d,r	6	70
Deadline Cr.	W. Branch	u	—	bk	—	y	d,r	6	71
Rabbit Cr.	W. Branch	h	m	bk	—	y	d,r	6	72
Standard Cr.	W. Branch	h	m	—	—	y	d,r	6	73
Solomon Cr.	N. Fk. Little Snake	p	m,e	—	—	b	d,r	6	74
Rose Cr.	N. Fk. Little Snake	h	m	—	—	b	d,r	6	75
Harrison Cr.	N. Fk. Little Snake	h	m	—	—	b	d,r	6	76
Green Timber Cr.	N. Fk. Little Snake	h	m	—	—	b	d,r	6	77
Deadman Cr.	N. Fk. Little Snake	h	m	—	—	b	d,r	6	78
Third Cr.	N. Fk. Little Snake	h	m	—	—	y	d,r	6	79
Ted Cr.†	N. Fk. Little Snake	p	m,e	—	—	y	d,r	6	80
Dale Cr.†	N. Fk. Little Snake	p	m	—	—	y	—	6	81
Upper N. Fk.†	N. Fk. Little Snake	p	e	—	—	y	—	6	82
Green R.									
Trout Cr.*	Sage Cr.	h	m	—	src	y	d,g	5	83
Little Indian Cr.	Hams Fk.	h	m	rb	—	n	—	7	84
Devils Hole Cr.	Hams Fk.	p	m	bk,rb	—	n	—	7	85
Game Trail Cr.	Devils Hole Cr.	u	—	rb	—	y	—	7	86
Faucet Cr.	Devils Hole Cr.	u	—	—	—	u	—	7	87
Sculpin Cr.	Big Sandy R.	u	—	bn,rb	—	n	—	8	88

Appendix A. Cont'd.

Water[1]	Drainage	Genetic purity[2]	Tech-nique[3]	Non-native species Present[4]	Non-native species Stocked[5]	Barr.[6]	Activity[7]	In Appendix B Figure[8]	In Appendix B Water#[9]
WYOMING (Cont'd.)									
Green R. (Cont'd.)									
S. Fk. Fontenelle Cr.	Fontenelle Cr.	u	—	bk	—	n	—	7	89
LaBarge Cr.*	Green R.	u	—	bk,bn,rb	—	n	—	7	90
Rock Cr. 2†	LaBarge Cr.	p	m,e,d	—	—	y	—	7	91
Little Fall Cr.	LaBarge Cr.	u	—	bk	—	n	—	7	92
Little Hornet Cr.	LaBarge Cr.	h	m	bk,rb	—	n	—	7	93
Big Fall Cr.	LaBarge Cr.	u	—	rb	—	n	—	7	94
Turkey Cr.	*LaBarge Cr.*	*u*	—	*bk,rb*	—	*n*	—	7	95
Bald Hornet Cr.	LaBarge Cr.	u	—	bk	—	n	—	7	96
Shafer Cr.	LaBarge Cr.	u	—	?	—	n	—	7	97
Packsaddle Cr.	LaBarge Cr.	u	—	?	—	n	—	7	98
S. LaBarge Cr.	LaBarge Cr.	m	m	bk,rb	—	u	—	7	99
Mack Cr.	S. LaBarge Cr.	u	—	bk	—	n	—	7	100
Nameless Cr.*	LaBarge Cr.	h	m	bk,rb	—	b	—	7	101
Road Cr.	LaBarge Cr.	u	—	bk	—	n	—	7	102
Spring Cr. 2	LaBarge Cr.	p	m,e	bk	—	n	—	7	103
Clear Cr.*	LaBarge Cr.	p	m	bk	—	b	—	7	104
Trail Cr.	LaBarge Cr.	h	m	bk	—	n	—	7	105
Dry Piney Cr.	Green R.	u	—	bk	—	n	—	7	106
Fogarty Cr.*	Dry Piney Cr.	u	—	bk	—	n	—	7	107
Pine Grove Cr.*	Fogarty Cr.	p	m	—	—	n	—	7	108
Black Canyon Cr.	Dry Piney Cr.	u	—	bk	—	n	—	7	109
Beaver Cr.	S. Piney Cr.	u	—	—	—	n	—	7	110
Spring Cr.	Beaver Cr.	h	m	rb	—	n	—	7	111
Trail Ridge Cr.	Beaver Cr.	h	m	—	—	n	—	7	112
N. Beaver Cr.†	Beaver Cr.	p	m	—	—	y	—	7	113
Mid. Beaver Cr.	Beaver Cr.	h	m	—	—	n	—	7	114
S. Beaver Cr. 1	Beaver Cr.	h	m	rb	—	n	g	7	115
Fish Cr.*	S. Piney Cr.	u	—	bk,rb	src	n	—	7	116
N. Fk. Fish Cr.*	Fish Cr.	u	—	—	—	n	—	7	117
Porcupine Cr.	*S. Piney Cr.*	*u*	—	*bk*	—	*n*	—	7	118
Apperson Cr.	N. Piney Cr.	u	—	bk	src	n	—	9	119
Lake Cr.	N. Piney Cr.	h	m	bk	—	n	—	9	120
N. Piney L.	N. Piney Cr.	h	m	bk	—	n	—	9	121
N. Piney Cr.*	Green R.	h	m	bk	src	n	—	9	122
Muddy Cr.	Green R.	u	—	—	—	n	—	9	123
S. Muddy Cr.	Muddy Cr.	u	—	—	src	n	—	9	124
N. Muddy Cr.	Muddy Cr.	h	m	—	—	n	—	9	125
L. August*	N. Fk. Boulder Cr.	p	m	—	—	n	—	10	126
*Sunrise L.**	*S. Fk. Boulder Cr.*	*p*	*m*	—	—	y	—	10	127
Little Cottonwood Cr.	S. Cottonwood Cr.	h	m	—	—	n	—	9	128
Beecher Cr.	Little Cottonwood	u	—	—	—	n	—	9	129
Camp Cr.*	Beecher Cr.	h	m	—	—	n	—	9	130
Red Castle Cr.	Little Cottonwood	h	m	—	—	n	—	9	131
S. Cottonwood Cr.*	Cottonwood Cr.	h	m	bk,rb	src	n	g	9	132
Bare Cr.*	S. Cottonwood Cr.	h	m	bk	—	b	g	9	133
N. Cottonwood Cr.*	Cottonwood Cr.	h	m	bk,rb	src	n	—	9	134
Maki Cr.	N. Cottonwood Cr.	h	m	—	—	n	—	9	135
Irene Cr.*	N. Cottonwood Cr.	h	m	bk	—	b	—	9	136
Hardin Cr.*	N. Cottonwood Cr.	p	m	bk	—	b	—	9	137
Nylander Cr.*	N. Cottonwood Cr.	p	m	bk	—	b	—	9	138
Ole Cr.	N. Cottonwood Cr.	u	—	bk	—	n	—	9	139

Appendix A. Cont'd.

Water[1]	Drainage	Genetic purity[2]	Tech-nique[3]	Non-native species Present[4]	Non-native species Stocked[5]	Barr.[6]	Activity[7]	In Appendix B Figure[8]	In Appendix B Water#[9]
WYOMING (Cont'd.)									
Green R. (Cont'd.)									
Sjhoberg Cr.	N. Cottonwood Cr.	m	m,e	bk	—	n	—	9	140
S. Horse Cr.	Horse Cr.	h	m	bk	—	n	—	9	141
Cole Cr.	S. Horse Cr.	u	—	—	—	n	—	9	142
Dead Cow Cr.	S. Horse Cr.	h	m	—	—	n	—	9	143
Camp Cr.*	S. Horse Cr.	h	m	—	—	n	—	9	144
N. Horse Cr.*	Horse Cr.	h	m	bk,rb	src	n	g	9	145
Lead Cr.	N. Horse Cr.	p	m	bk	—	n	g	9	146
N. Fk. N. Horse Cr.	N. Horse Cr.	h	m	bk	—	n	—	9	147
S. Fk. N. Horse Cr.	N. Horse Cr.	h	m	bk	—	n	—	9	148
S. Beaver Cr. 2	Green R.	h	m	bk,rb	—	n	—	9	149
Chall Cr.	S. Beaver Cr. 2	h	m	?	—	n	—	9	150
S. Fk. Chall Cr.	Chall Cr.	h	m	bk	src	n	—	9	151
Buck Cr.	S. Beaver Cr. 2	u	—	—	src	n	—	9	152
N. Fk. Mid. Beaver Cr.	N. Beaver Cr.	h	m	bk	—	n	—	9	153
Miner Cr.*	N. Beaver Cr.	u	—	bk	—	n	—	11	154
Packer Cr.*	N. Beaver Cr.	h	m	bk	—	n	—	11	155
Big Sheep Mountain L.*	Gypsum Cr.	p	m	—	—	y	—	11	156
Little Twin Cr.	Green R.	u	—	?	—	u	—	11	157
Big Twin Cr.	Green R.	u	—	?	—	u	—	11	158
Rock Cr. 3	Green R.	h	m	bk,bn,rb	rb	n	—	11	159
Trudy Cr.*	Rock Cr. 3	h	m	—	—	n	—	11	160
No Name Cr.*	Green R.	u	—	bk	—	n	—	11	161
Klondike Cr.*	Green R.	p	m	bk,bn,rb	—	y	—	11	162
Tosi Cr.	Green R.	u	—	bk,bn,rb	rb	b	—	11	163
Tepee Cr.*	Tosi Cr.	h	m	bk	src	n	—	11	164
Wagon Cr.	Green R.	u	—	bk	—	n	—	11	165
Beats Me Cr.*	Wagon Cr.	p	m	—	—	n	—	11	166
COLORADO									
San Juan R.									
S. Fk. Hermosa Cr.†	Hermosa Cr.	p	m	—	ppn	y	—	12	167
Deer Cr.†	Hermosa Cr.	p	m	—	rb,tlc	y	—	12	168
Big Bend Cr.	Hermosa Cr.	h	m	?	—	u	—	12	169
E. Fk. Hermosa Cr.*	Hermosa Cr.	p	m	—	—	y	—	12	170
E. Fk. Piedra R.†	Piedra R.	p	m	—	—	y	—	13	171
W. Fk. Navajo R.†	Navajo R.	p	m	—	—	y	r	13	172
Augustora Cr.†	W. Fk. Navajo R.	p	m	—	—	y	—	13	173
Himes Cr.	W. Fk. San Juan R.	u	—	—	—	y	—	13	174
White R.									
Lake Cr.	Cathedral Cr.	h	m	—	rb	u	—	14	175
Soldier Cr.	Cathedral Cr.	h	m	rb	—	u	—	14	176
Big Beaver Cr.	N. Fk. White R.	h	m	rb	rb	u	—	15	177
Fawn Cr.	N. Fk. White R.	u	—	bk	—	u	—	15	178
Lost Cr.	N. Fk. White R.	h	m	—	—	u	g	15	179
Hahn Cr.	Lost Cr.	p	m	—	—	u	g	15	180
Snell Cr.	N. Fk. White R.	p	m	bk	bk,tlc*	n	—	15	181
Little Skinny Fish L.*	Skinny Fish Cr.	h	m	—	rb,tlc	u	—	15	182
Trappers L.	N. Fk. White R.	m	m,e	bk,rb	rb,yc	u	—	15	183
Little Snake R.									
Willow Cr.	Little Snake R.	p	m	bk	—	n	—	16	184

Appendix A. Cont'd.

Water[1]	Drainage	Genetic purity[2]	Tech-nique[3]	Non-native species Present[4]	Non-native species Stocked[5]	Barr.[6]	Activity[7]	In Appendix B Figure[8]	In Appendix B Water#[9]
COLORADO (Cont'd.)									
Little Snake R. (Cont'd.)									
Roaring Fk. Slater Cr.	Slater Cr.	u	—	bk	bk,ct,tlc	n	—	16	185
S. Fk. Slater Cr.	Slater Cr.	u	—	—	tlc	u	—	16	186
W. Prong S. Fk.	S. Fk. Slater Cr.	u	—	—	bk	u	—	16	187
S. Fk. Little Snake R.	Little Snake R.	u	—	bk	—	u	—	16	188
Johnson Cr.	S. Fk. Ltl. Snake R.	h	m	?	—	u	—	16	189
Oliver Cr.	S. Fk. Ltl. Snake R.	h	m	—	—	u	—	16	190
Lopez Cr.	S. Fk. Ltl. Snake R.	u	—	bk	—	n	—	16	191
Summit Cr.	Independence Cr.	u	—	—	rb	u	—	16	192
Yampa R.									
Beaver Cr. 1	S. Fk. Williams Fk.	u	—	—	bk,rb,tlc	u	—	15	193
Indian Run	Beaver Cr. 1	u	—	bk	bk	u	—	15	194
Poose Cr.	E. Fk. Williams Fk.	h	m	rb	rb*	n	—	15	195
Cyclone Cr.	Poose Cr.	u	—	—	—	u	—	15	196
Rough Cr.	Poose Cr.	u	—	—	rb	u	—	15	197
Baldy Cr.	E. Fk. Williams Fk.	u	—	bk	bk	u	—	15	198
Black Mountain Cr.	E. Fk. Williams Fk.	u	—	—	—	u	—	15	199
Little Cottonwood Cr.	Fortification Cr.	u	—	rb	ct,ppn,rb,tlc*	n	—	16	200
Freeman Res.	Little Cttwd. Cr.	u	—	rb	ct,ppn,rb,tlc	b	—	16	201
S. Fk. Fortification Cr.	Fortification Cr.	u	—	bk	—	u	—	16	202
First Cr.	Elkhead Cr.	h	m	bk,rb	bk,rb	n	—	16	203
Armstrong Cr.	Elkhead Cr.	u	—	bk	bk	u	—	16	204
Porcupine L.	S. Fk. Mad Cr.	h	m	—	ct,ppn,tlc	u	—	16	205
Luna L.	N. Fk. Mad Cr.	h	m	—	ct,ppn,tlc*	u	—	16	206
L. of the Crags	N. Fk. Mad Cr.	h	m	—	ct,ppn,tlc	u	—	16	207
Smith Cr.	Deep Cr.	u	—	—	—	u	—	16	208
Miller Cr.	Deep Cr.	h	m	—	—	n	—	16	209
Sand Cr. 1	Elk R.	u	—	—	—	u	—	16	210
Beaver Cr. 2	Willow Cr.	u	—	bk	bk,ppn	u	—	16	211
Lost Dog Cr.	N. Fk. Elk R.	h	m	bk	—	u	—	16	212
L. Diana	N. Fk. Elk R.	h	m	—	ct,ppn,tlc	u	—	16	213
W. Coal Cr.	Coal Cr.	u	—	—	rb	u	—	15	214
Dome Cr.	Bear R.	u	—	—	bk	u	—	15	215
Mandall Cr.	Bear R.	h	m	bk,bn,rb	bk,ct,ppn, rb,tlc*	b	—	15	216
Gunnison R.									
Jones Cr.	Cr. Fk. E. Muddy Cr.	u	—	—	—	y	—	17	217
Rock Cr.	Cr. Fk. E. Muddy Cr.	u	—	bk	—	n	—	17	218
N. Anthracite Cr.	Anthracite Cr.	u	—	—	ppn	u	—	17	219
Second Cr.	Smith Fk.	p	m	bk	—	u	g	18	220
Upper Lake Fk.*	Gunnison R.	u	—	bk	bk,bn,ct,ppn, rb,src,tlc*	b	—	12	221
W. Beaver Cr.*	Beaver Cr.	p	m	—	—	n	g	18	222
Colorado R.									
Roan Cr.	Colorado R.	p	m	?	—	u	—	14	223
E. Fk. Parachute Cr.	Parachute Cr.	h	m	bk	—	n	g	19	224
JQS Gulch	E. Fk. Parachute Cr.	h	m	bk	—	n	g	19	225
E. Mid. Fk.	Parachute Cr.	h	m	—	ct,rb	y	—	19	226
Northwater Cr.	E. Mid. Fk.	m	m	—	ct,rb	y	—	19	227
Trapper Cr.	E. Mid. Fk.	h	m	—	ct,rb	y	g	19	228
Battlement Cr.	Colorado R.	p	m	bk	ct,ppn,rb,tlc*	u	—	19	229

Appendix A. Cont'd.

Water[1]	Drainage	Genetic purity[2]	Tech-nique[3]	Non-native species Present[4]	Non-native species Stocked[5]	Barr.[6]	Activity[7]	In Appendix B Figure[8]	In Appendix B Water#[9]
Butler Cr.	Mid. Rifle Cr.	h	m	—	ct,ppn,rb,tlc	y	g	19	230
COLORADO (Cont'd.)									
Colorado R. (Cont'd.)									
Corral Cr.	*Main Elk Cr.*	h	m	bk	bk,bn,ct, rb,tlc	n	—	19	231
Mitchell Cr.†	Colorado R.	p	m	—	—	y	—	19	232
Cattle Cr.	Roaring Fk. R.	h	m	—	—	y	g	21	233
N. Thompson Cr.	Thompson Cr.	h	m	bk,bn,rb	bk,ct,rb,tlc	n	g,m,r	17	234
Park Cr.	N. Thompson Cr.	u	—	bk	—	n	g	17	235
Mid. Thompson Cr.	*Thompson Cr.*	h	m	—	ct,ppn,rb,tlc	u	m	17	236
Avalanche L.	Avalanche Cr.	h	m	bk,rb	ct,ppn,rb,tlc	n	—	17	237
Yule Cr.	Crystal R.	h	m	bk,rb	ct,ppn,tlc*	b	—	17	238
Lost Trail Cr.†	Crystal R.	p	m	—	—	y	—	17	239
Rocky Fk. Cr.†	Fryingpan R.	p	m	—	—	y	d,g	20	240
Cunningham Cr.	N. Fk. Fryingpan R.	m	m	bk,bn	—	y	—	20	241
Carter L.	Carter Cr.	h	m	—	—	u	—	20	242
S. Fk. Fryingpan R.	Fryingpan R.	u	—	—	—	u	—	20	243
Fryingpan Ls. 2 & 3	Fryingpan R.	p	m	—	—	u	—	20	244
Nickelson Cr.	Capitol Cr.	p	m	—	—	n	—	17	245
Hunter Cr.	Roaring Fk. R.	h	m	—	—	u	—	20	246
Difficult Cr.	Roaring Fk. R.	h	m	—	—	y	—	20	247
Abrams Cr.†	Brush Cr.	p	m	—	—	y	d,g	21	248
Hat Cr.†	Brush Cr.	p	m	—	—	y	—	21	249
Squaw Cr.	Eagle R.	u	—	bk	—	n	—	21	250
E. Lake Cr.	Lake Cr.	h	m	bk	ct,ppn,tlc*	y	—	21	251
Berry Cr.	Eagle R.	h	m	—	—	y	—	21	252
McCoy Cr.	Eagle R.	h	m	—	—	y	—	21	253
Booth Cr.	Gore Cr.	u	—	—	ct,ppn,tlc*	y	—	22	254
Pitkin Cr.	Gore Cr.	h	m	bk	ct,ppn,tlc*	y	—	22	255
Miller Cr.	Black Gore Cr.	h	m	bk	—	y	—	22	256
Polk Cr.	Black Gore Cr.	h	m	—	—	y	—	22	257
Cross Cr.	Eagle R.	m	m	bk	bk,ct,ppn, rb,tlc*	y	—	21	258
W. Cross Cr.	Cross Cr.	p	m	—	ct,ppn,rb,tlc*	y	—	21	259
Wearyman Cr.	Turkey Cr.	u	—	—	ct,tlc	n	—	22	260
Sopris Cr.	Homestake Cr.	h	m	—	ct,ppn,tlc*	u	—	20	261
Hack L.*	Hack Cr.	p	m	—	ct,ppn,tlc	y	—	15	262
Red Dirt Cr.	Colorado R.	h	m	—	—	y	—	15	263
E. Fk. Red Dirt Cr.	Colorado R.	h	m	—	—	y	—	15	264
W. Fk. Red Dirt Cr.	Colorado R.	h	m	—	—	y	—	15	265
Egeria Cr.	Harper Res.	u	—	bk	bk	u	—	15	266
E. Meadow Cr.	Meadow Cr.	p	m	—	—	u	—	22	267
Big Park Cr.	Blacktail Cr.	h	m	bk	—	n	d,g	23	268
Antelope Cr.	Muddy Cr.	u	—	?	—	u	—	23	269
Lindsey Cr.	Muddy Cr.	u	—	?	—	u	—	23	270
Frantz Cr.	Muddy Cr.	u	—	—	bk	u	—	23	271
Little Green Cr.	Muddy Cr.	h	m	—	—	y	—	23	272
N. Little Green Cr.†	Muddy Cr.	p	m	—	—	y	—	23	273
Blue R.									
N. Fk. Elliott Cr.	Elliott Cr.	h	m	?	bk,rb*	u	—	22	274
Cataract Cr.*	Blue R.	h	m	?	ct,ppn,rb,tlc*	u	—	22	275
L. 10794	Cataract Cr.	h	m	?	ct,rb,tlc	u	—	22	276

Appendix A. Cont'd.

Water[1]	Drainage	Genetic purity[2]	Tech-nique[3]	Non-native species Present[4]	Non-native species Stocked[5]	Barr.[6]	Activity[7]	In Appendix B Figure[8]	In Appendix B Water#[9]
Meadow Cr.	Dillon Res.	h	m	bk	—	y	—	22	277
Corral Cr.	W. Tenmile Cr.	p	m	bk	—	y	—	22	278
COLORADO (Cont'd.)									
Colorado R.									
Clinton Res.	Clinton Cr.	p	m	?	ppn,src	u	—	24	279
N. Fk. Swan R.	Swan R.	p	m	bk	ct	n	—	24	280
French Gulch†	Blue R.	p	m	—	—	y	—	24	281
Spruce Cr.*	Blue R.	h	m	—	bk,ct,gol, ppn,rb, rxc,tlc*	u	—	24	282
Long Draw	Haystack Cr.	u	—	bk	tlc	u	—	23	283
Paradise Cr.	E. Fk. Trblsm. Cr.	p	m	?	—	u	—	23	284
Timber Cr. 1	E. Fk. Trblsm. Cr.	p	m	?	—	u	—	23	285
Rabbit Ears Cr.	Troublesome Cr.	u	—	bk	—	u	—	23	286
Steelman Cr.	Williams Fk.	p	m	bk	—	y	—	25	287
McQueary Cr.	Williams Fk.	u	—	bk	ct,ppn,tlc*	u	—	25	288
Bobtail Cr.	Williams Fk.	p	m	bk	—	n	—	25	289
Little Muddy Cr.	Colorado R.	h	m	bk	ct,ppn	n	g	25	290
Cub Cr.	*Little Muddy Cr.*	*h*	*m*	*bk*	*ct*	*n*	—	25	291
Kelly Cr.	Little Muddy Cr.	h	m	bk	ct	n	—	25	292
Kinney Cr.*	Colorado R.	p	m	bk	—	y	—	26	293
Hamilton Cr.	Hurd Cr.	p	m	bk	—	y	—	25	294
Cabin Cr.	*Ranch Cr.*	*h*	*m*	*bk*	—	y	—	25	295
S. Fk. Ranch Cr.*	Ranch Cr.	h	m	—	—	n	—	25	296
Mid. Fk. Ranch Cr.	S. Fk. Ranch Cr.	u	—	—	—	y	—	25	297
Iron Cr.	St. Louis Cr.	u	—	—	ct,ppn,tlc*	y	—	25	298
Vasquez Cr.	Fraser R.	u	—	—	bk,rb	y	—	25	299
Little Vasquez Cr.†	Vasquez Cr.	p	m	—	—	y	—	25	300
S. Fk. Vasquez Cr.	Vasquez Cr.	p	m	—	—	n	—	25	301
Jim Cr.	Fraser R.	h	m	bk	ct	b	—	25	302
Trail Cr.	Willow Cr.	h	m	—	—	y	—	26	303
Roaring Fk.	L. Granby	h	m	—	ct,ppn,tlc*	y	—	26	304
Watanga Cr.	Roaring Fk.	u	—	—	ct,ppn,tlc*	y	—	26	305
Watanga L.	Watanga Cr.	u	—	—	ct,ppn,tlc	y	—	26	306
Arapaho Cr.	Monarch L.	h	m	bk	bn,ct,ppn, rb,tlc*	b	—	26	307
Buchanan Cr.	Arapaho Cr.	h	m	—	ct,ppn,rb,tlc*	u	—	26	308
Thunderbolt Cr.	Buchanan Cr.	h	m	—	tlc*	n	—	26	309
Columbine Cr.	Colorado R.	m	m	—	—	y	—	26	310
Paradise Cr.*	E. Inlet	p	m	—	—	y	—	26	311
Adams L.*	Paradise Cr.	p	m	—	—	y	—	26	312
*Fifth L.**	E. Inlet	p	m	—	—	y	—	26	313
Ptarmigan Cr.*	N. Inlet	p	m,e	—	—	y	—	26	314
Bench L.*	Ptarmigan Cr.	p	m,e	—	—	y	—	26	315
L. Nanita*	N. Inlet	p	m,e	—	—	y	—	26	316
*Timber Cr. 2**	*Colorado R.*	*p*	*m*	—	—	y	—	26	317
Timber L.*	Timber Cr.	p	m	—	—	y	—	26	318

[1]**Water**

* = *population established or supplemented by stocking of nonindigenous, genetically pure fish*

† = *a conservation population (believed to be indigenous, genetically pure, allopatric above a barrier; and not believed to be in a recently stocked watershed)*

Appendix A. Cont'd.

[2]Genetic purity
- *p* = *genetically pure*
- *h* = *hybridized*
- *m* = *mixed results*
- *u* = *unknown (not tested)*

[3]Technique *Techniques used in genetic analysis*
- *m* = *meristic analysis*
- *e* = *electrophoretic analysis of proteins*
- *d* = *analysis of mtDNA*
- *dash* = *no analysis performed*

[4]Present *Presence of sympatric populations of non-native species*
- *bk* = *brook trout*
- *bn* = *brown trout*
- *ct* = *unknown subspecies of cutthroat trout (probably not indigenous)*
- *gol* = *golden trout*
- *ppn* = *Pikes Peak cutthroat trout (greenback cutthroat trout introgressed with Yellowstone cutthroat trout and possibly Snake River cutthroat trout)*
- *rb* = *rainbow trout*
- *rxc* = *rainbow-cutthroat trout hybrid*
- *src* = *Snake River fine-spotted cutthroat trout*
- *tlc* = *Trappers Lake cutthroat trout (Colorado River cutthroat trout introgressed with Yellowstone cutthroat trout and possibly rainbow trout)*
- *yc* = *Yellowstone cutthroat trout*
- *—* = *non-native species believed absent*
- *?* = *presence of non-native species not determined*

[5]Stocked *Water stocked since 1973; species codes are as above*
- *—* = *water (or nearby, connected waters) was not believed stocked since 1973*
- *?* = *stocking of non-native species could not be determined*
- *** = *some or all of the stocking was in a nearby (usually upstream) and presumably connected water body*
- *?** = *unidentified species were stocked*

[6]Barr. *Presence of permanent, physical barrier to upstream migration*
- *y* = *yes*
- *n* = *no*
- *u* = *unknown*
- *b* = *a barrier breached by non-native species*

[7]Activity *Land management activities that affect water*
- *d* = *water removal*
- *g* = *grazing*
- *l* = *logging*
- *m* = *mining*
- *r* = *roads*
- *—* = *no effects reported*

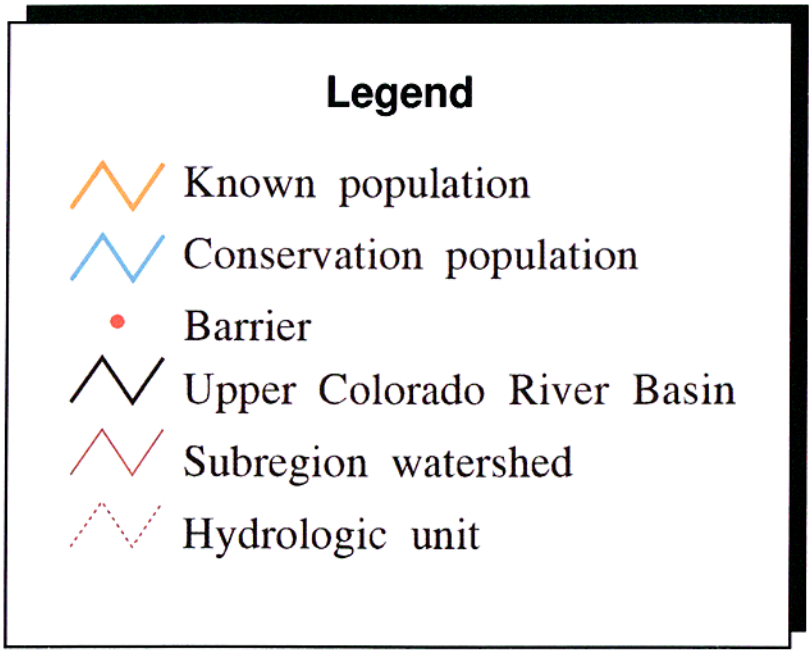
[8]Figure *Figure in Appendix B that contains this stream or lake*

[9]Water# *Number on figure in Appendix B that denotes this stream or lake*

Appendix B

Current distribution of Colorado River cutthroat trout in Utah, Utah-Wyoming, Wyoming, and Colorado waters.

Water and figure numbers shown here correspond with those listed on Appendix A.



Appendix B. Cont'd.

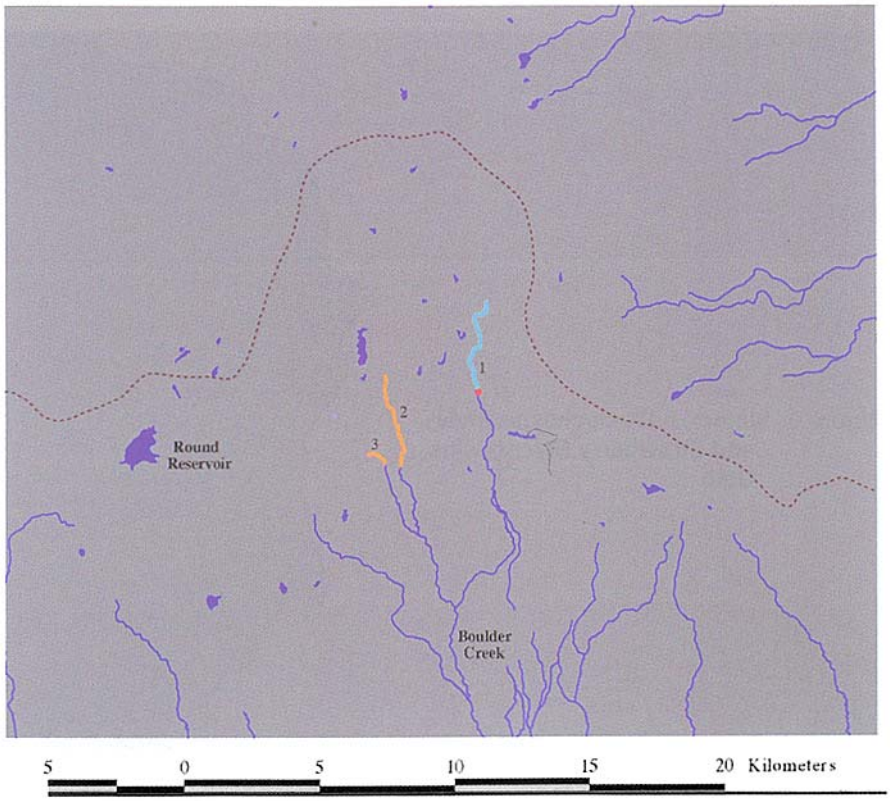


Figure 1. Waters 1-3, Escalante River basin, Utah

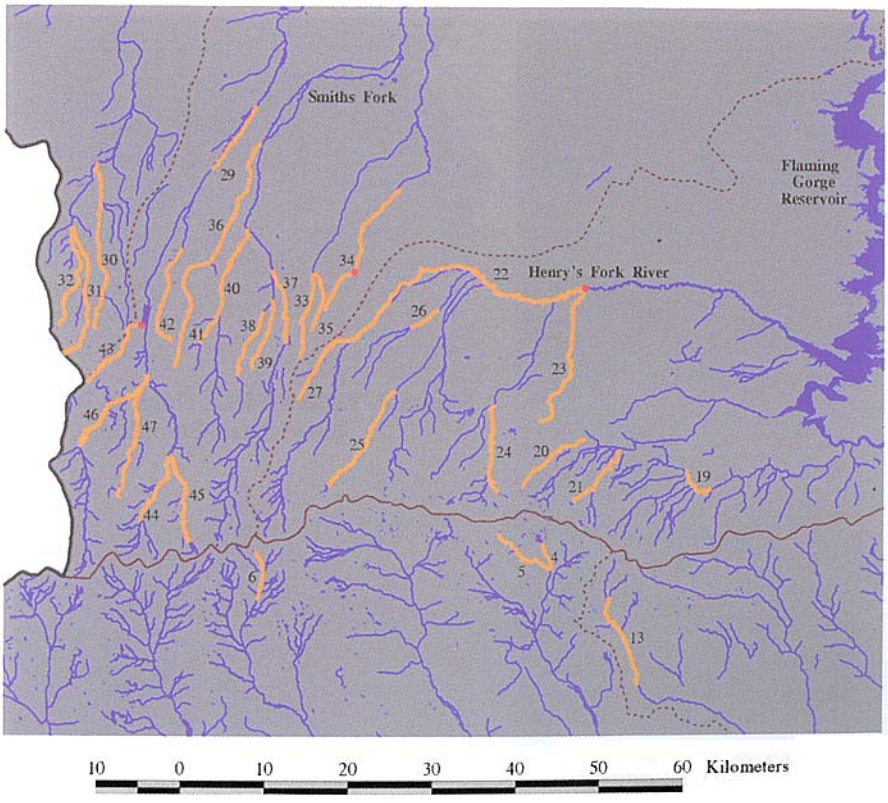


Figure 2. Waters 4-6, 13, 19-27, 29-47, Muddy Creek, Blacks Fork, Ashley Creek, and Flaming Gorge basins, Utah-Wyoming

Appendix B. Cont'd.

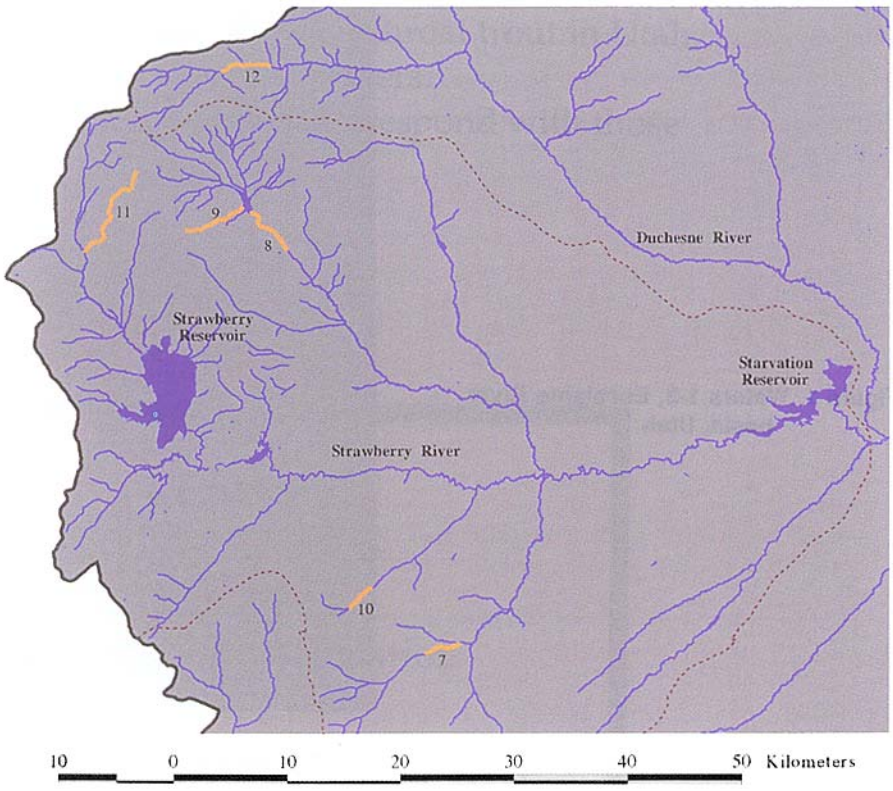


Figure 3. Waters 7-12, Duchesne River and Strawberry River basins, Utah

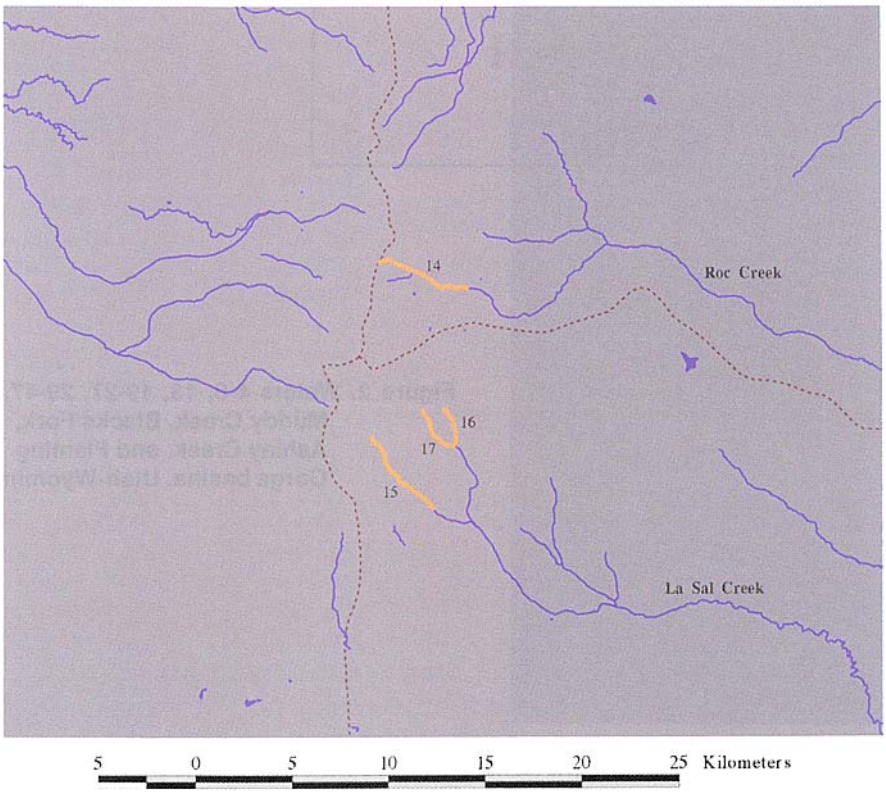


Figure 4. Waters 14-17, Dolores River basin, Utah-Colorado

Appendix B. Cont'd.

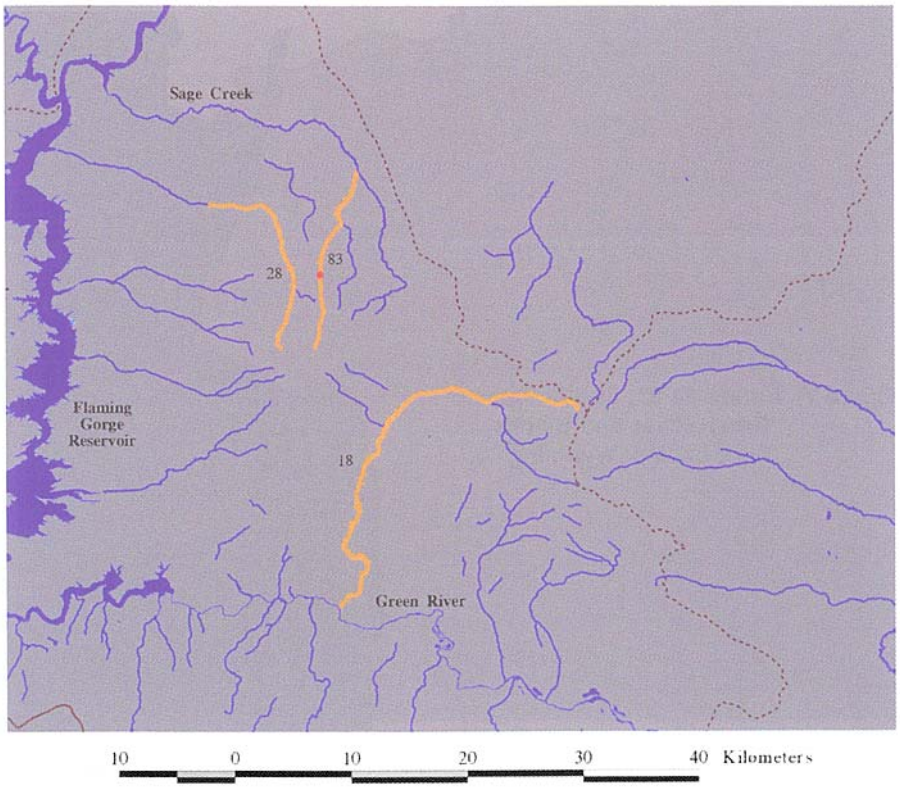


Figure 5. Waters 18, 28, 83, upper Green River and Flaming Gorge basin, Utah-Wyoming

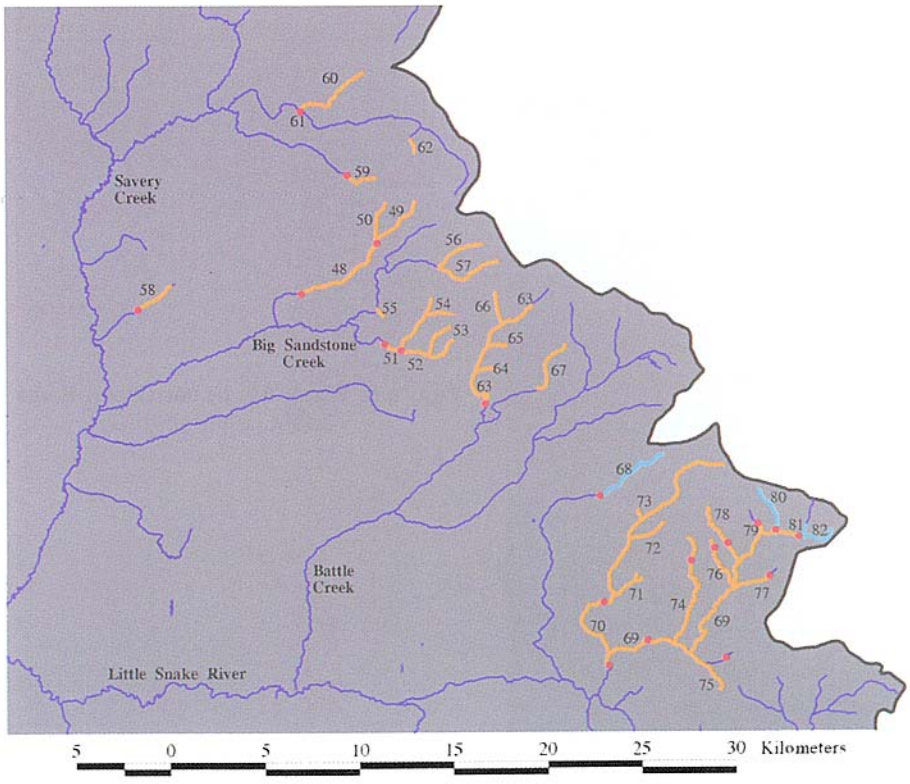


Figure 6. Waters 48-82, Little Snake River basin, Wyoming

Appendix B. Cont'd.

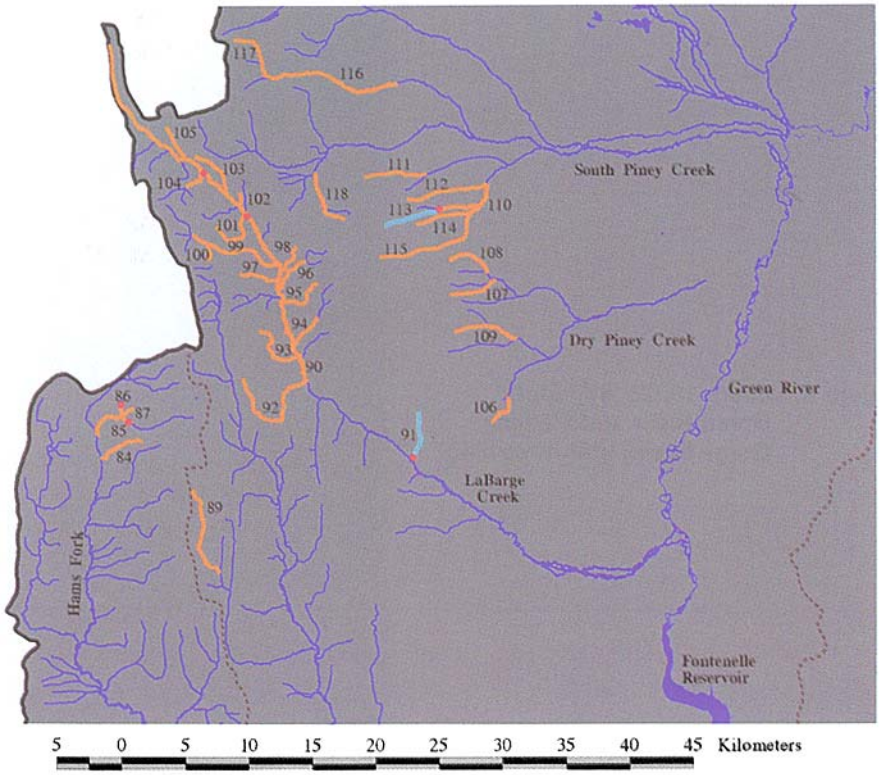


Figure 7. Waters 84-87, 89-118, upper Green River and Blacks Fork basins, Wyoming

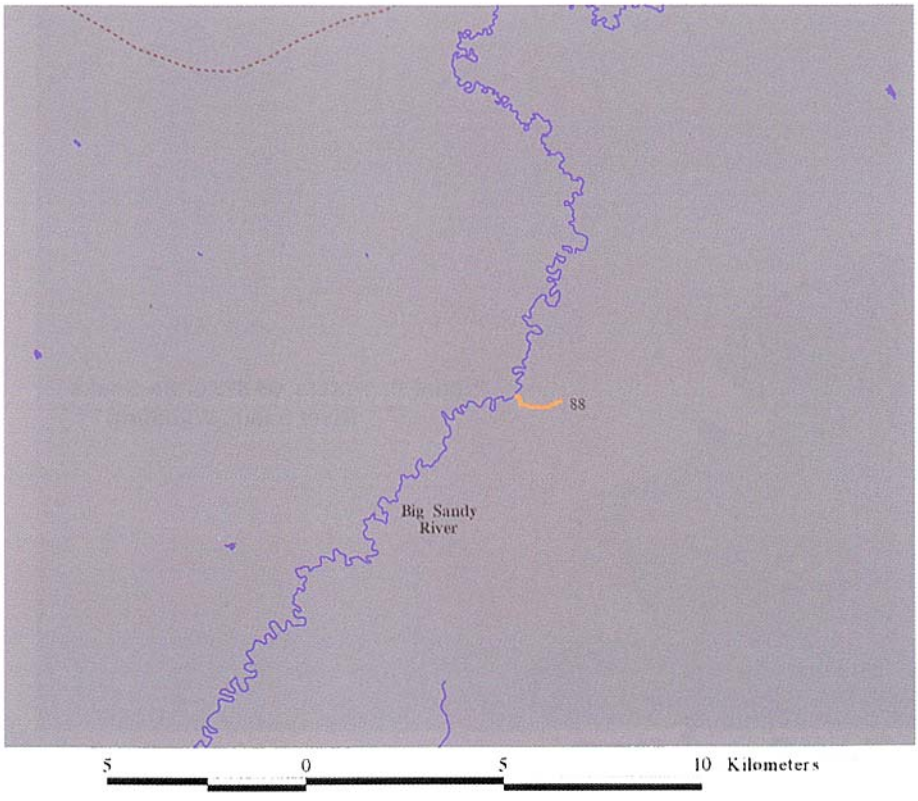


Figure 8. Water 88, upper Green River basin, Wyoming

Appendix B. Cont'd.

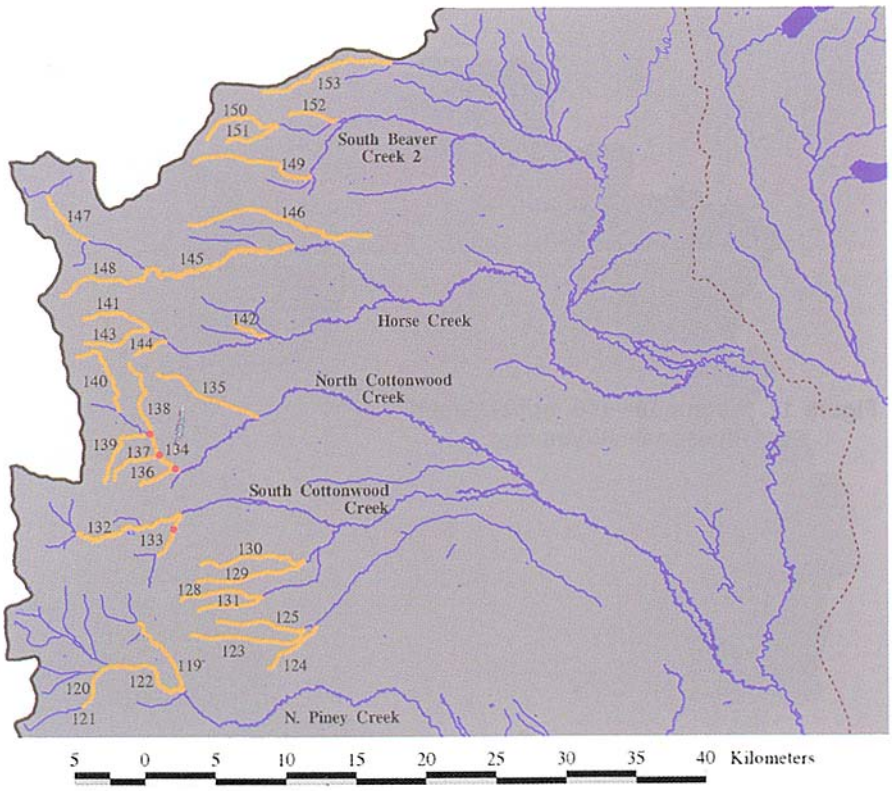


Figure 9. Waters 119-125, 128-153, upper Green River basin, Wyoming

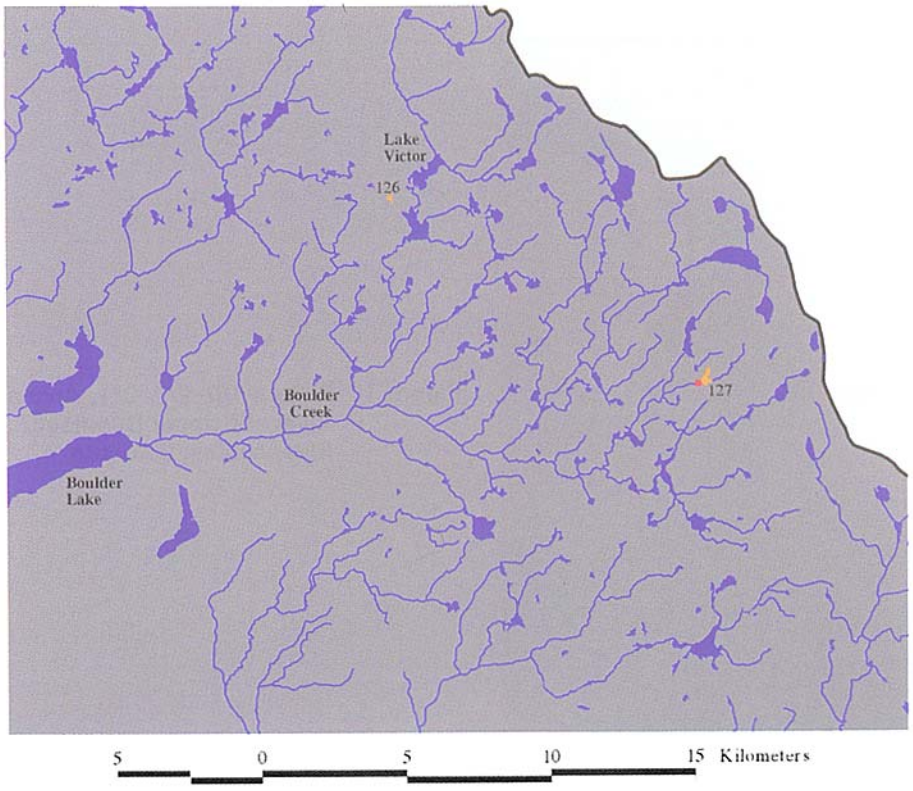


Figure 10. Waters 126-127, upper Green River basin, Wyoming

Appendix B. Cont'd.

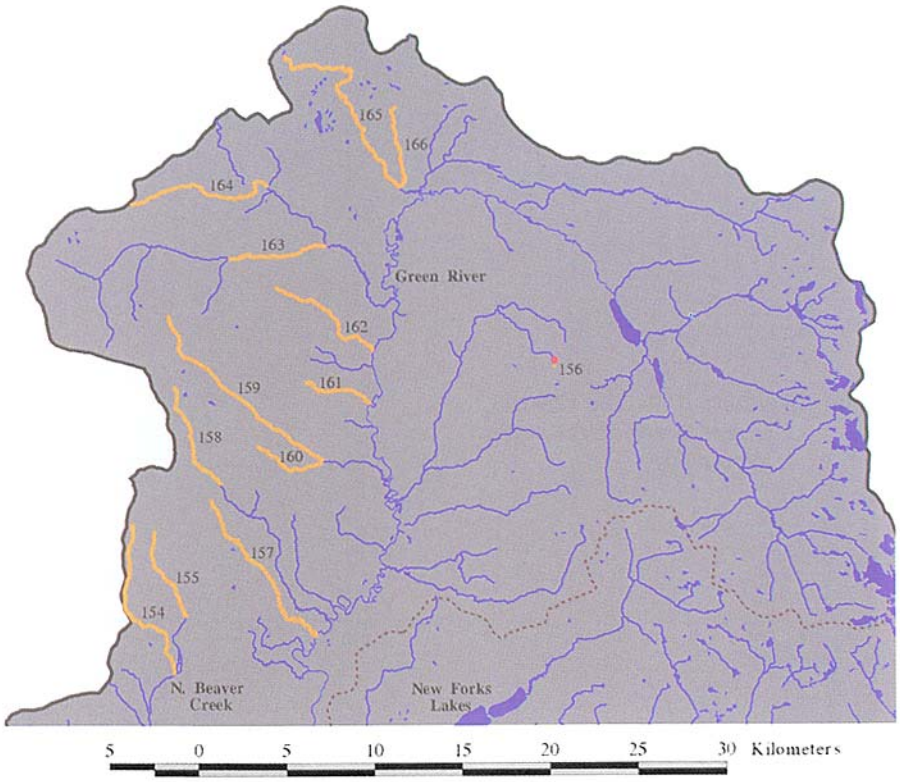


Figure 11. Waters 154-166, upper Green River basin, Wyoming

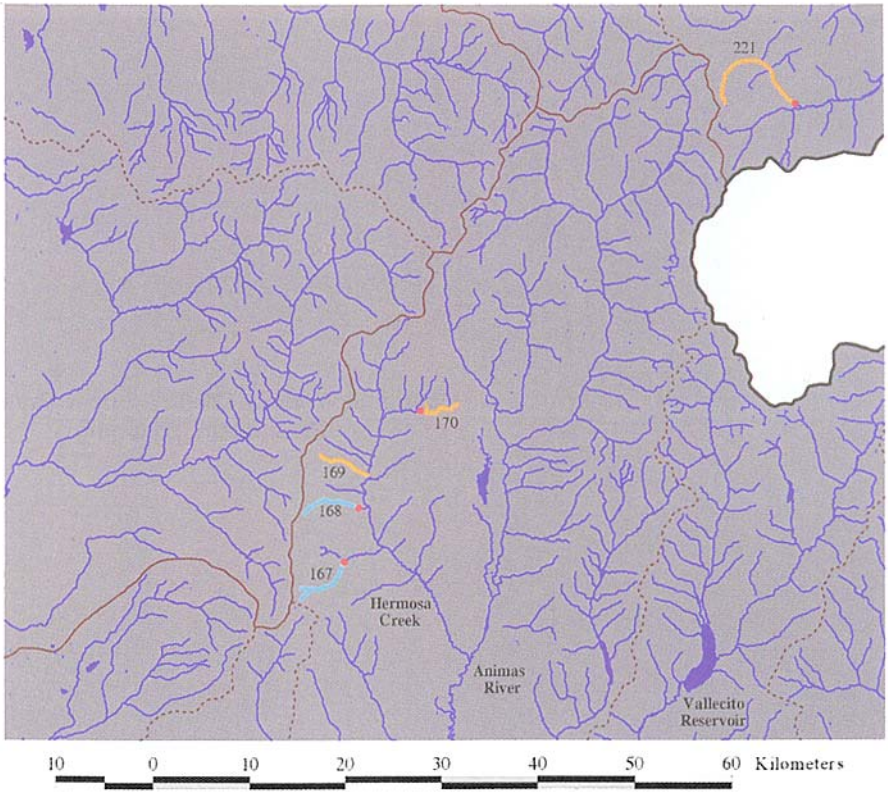


Figure 12. Waters 167-170, 221, Animas River and upper Gunnison River basins, Colorado

Appendix B. Cont'd.

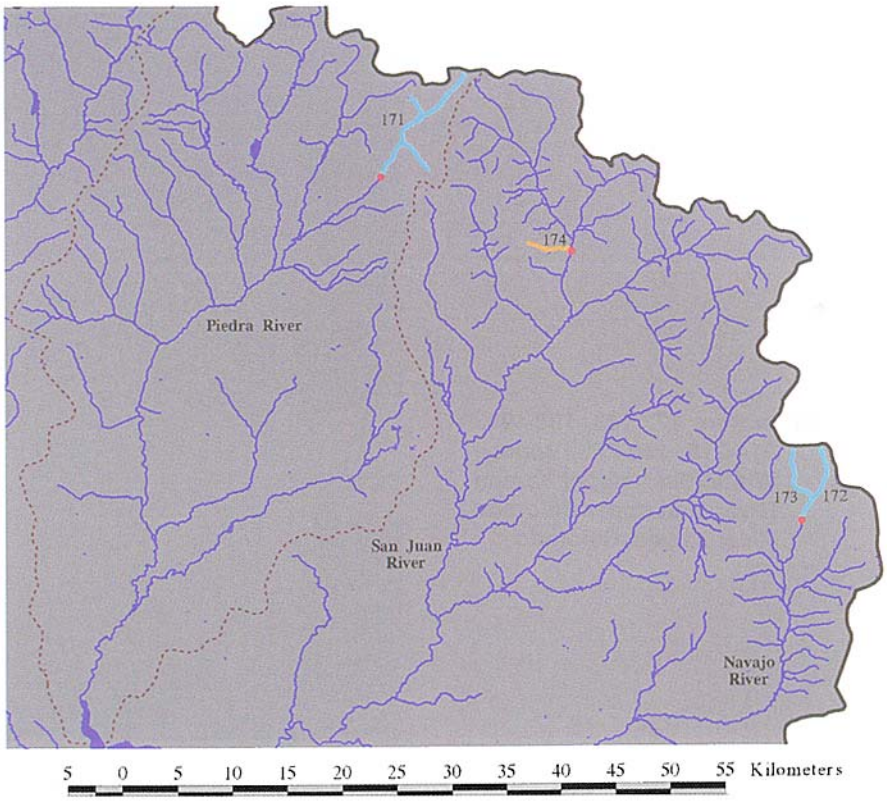


Figure 13. Waters 171-174, upper San Juan River and Piedra River basins, Colorado

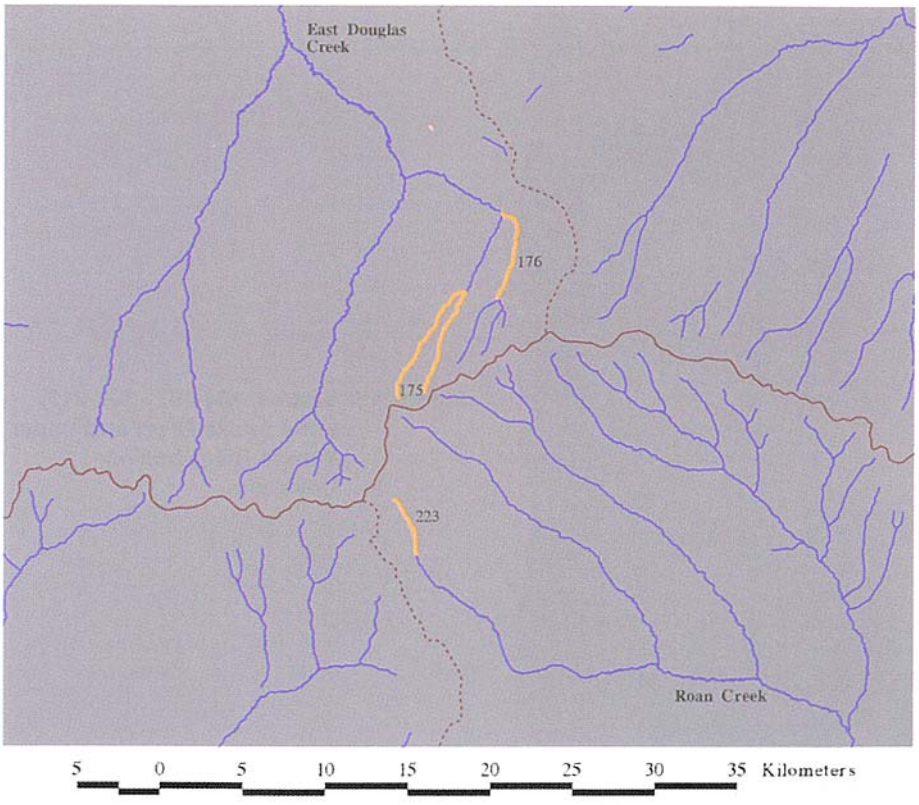


Figure 14. Waters 175, 176, 223, lower White River and Roan Creek basins, Colorado

Appendix B. Cont'd.

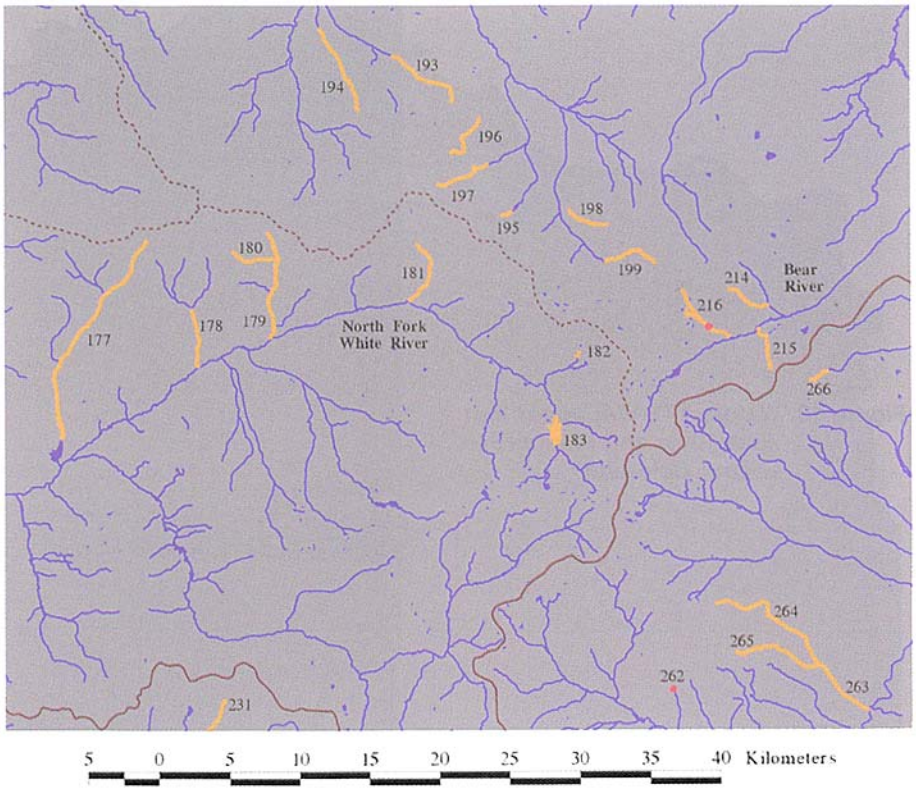


Figure 15. Waters 177-183, 193-199, 214-216, 262-266, upper White River, upper Yampa River, and upper Colorado River basins, Colorado

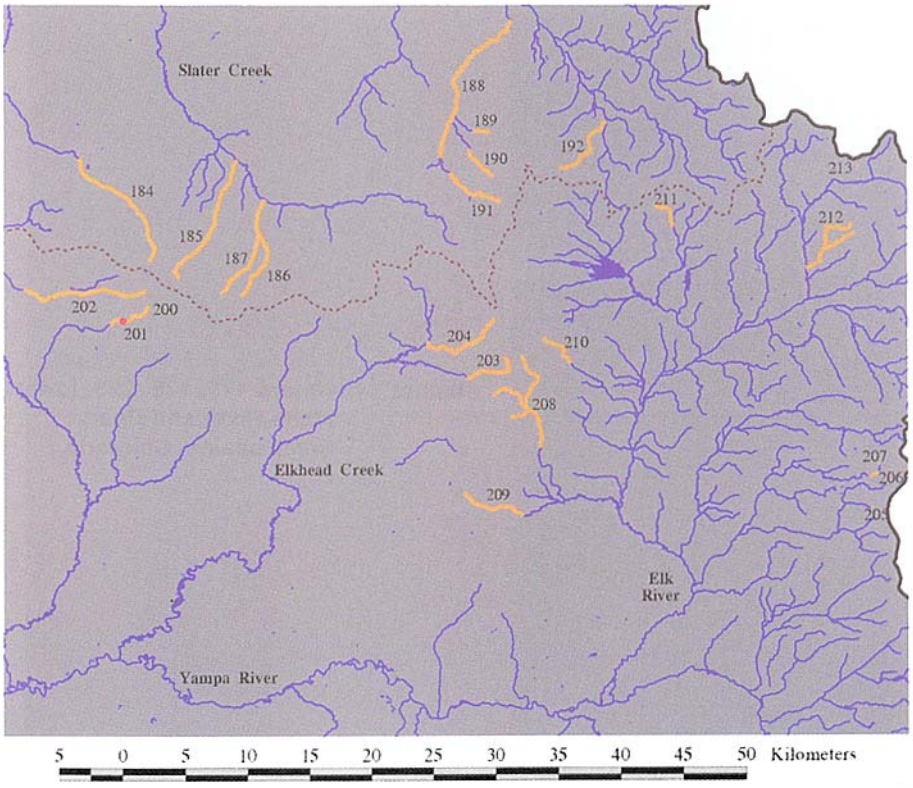


Figure 16. Waters 184-192, 200-213, Little Snake River and upper Yampa River basins, Colorado

Appendix B. Cont'd.

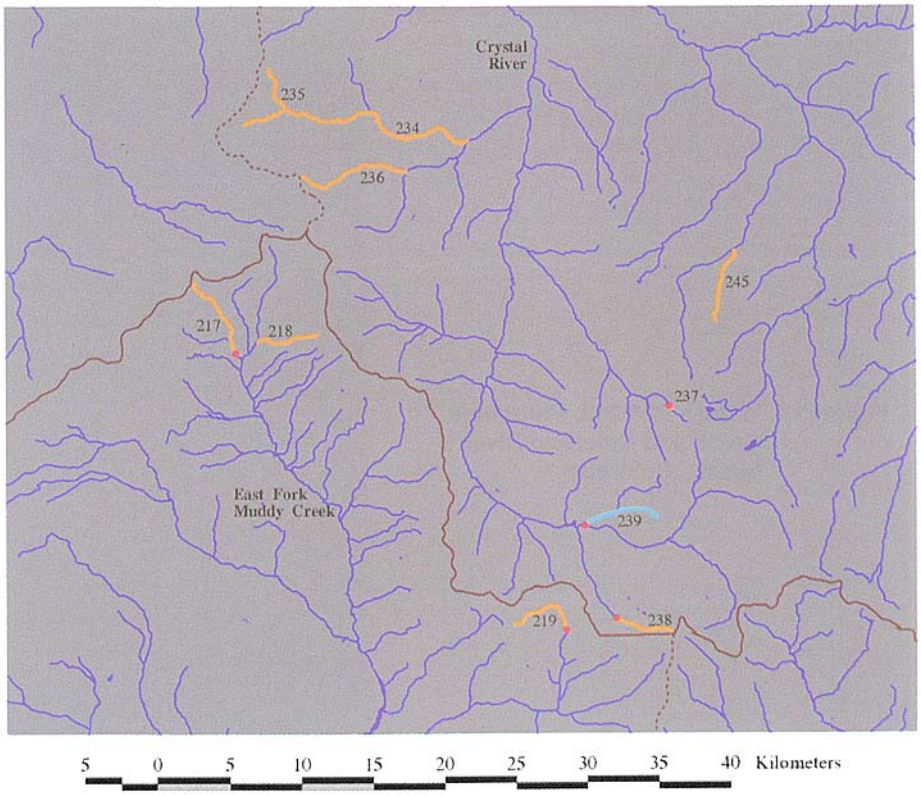


Figure 17. Waters 217-219, 234-239, 245, North Fork Gunnison River and Roaring Fork River basins, Colorado

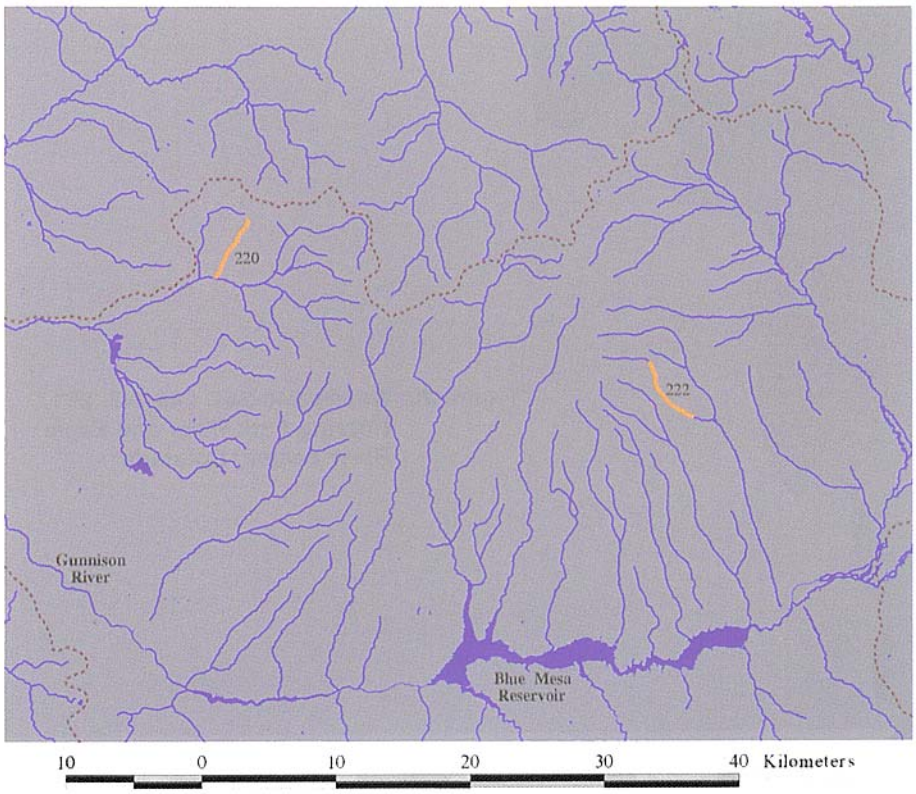


Figure 18. Waters 220, 222, upper Gunnison River basin, Colorado

Appendix B. Cont'd.

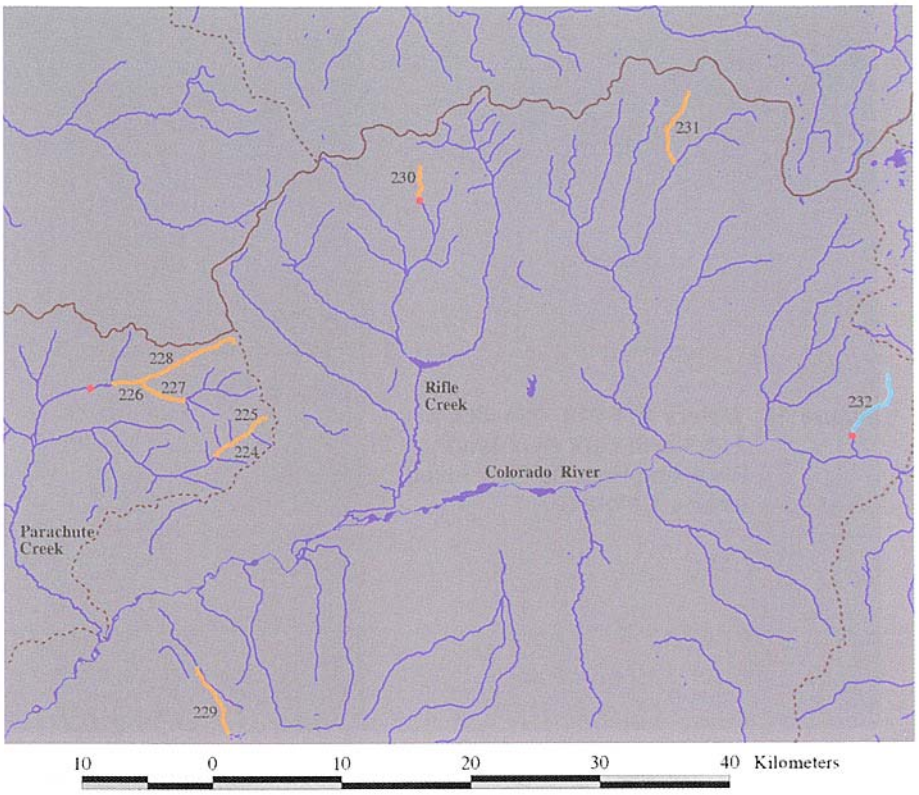


Figure 19. Waters 224-232, Parachute Creek and Colorado River basins, Colorado

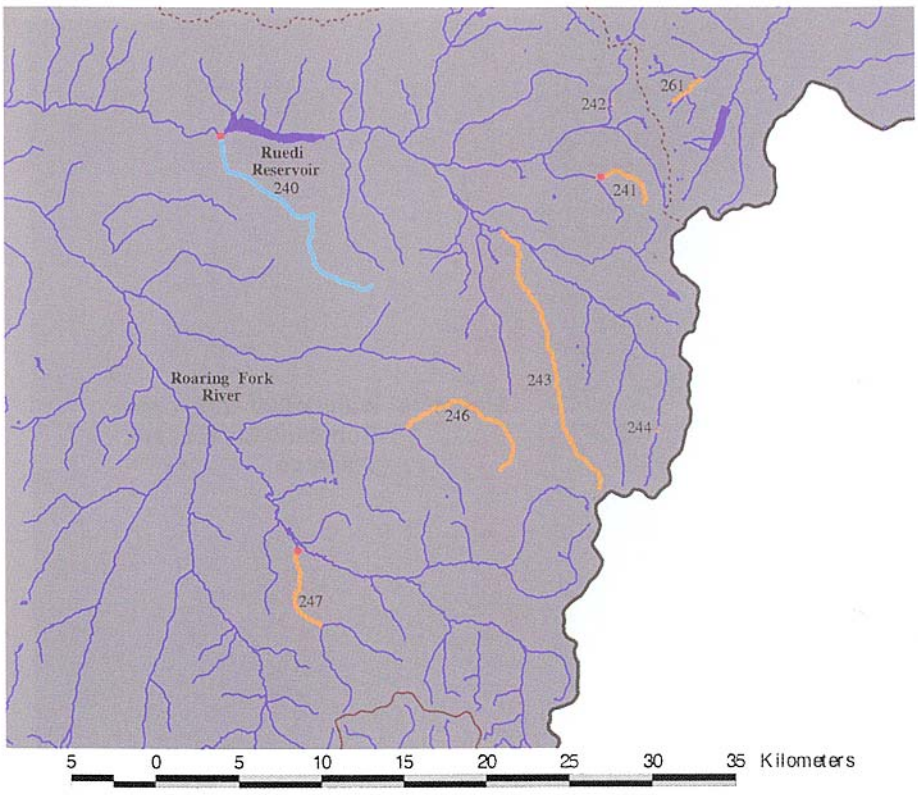


Figure 20. Waters 240-244, 246-247, 261, Roaring Fork River and Eagle River basins, Colorado

Appendix B. Cont'd.

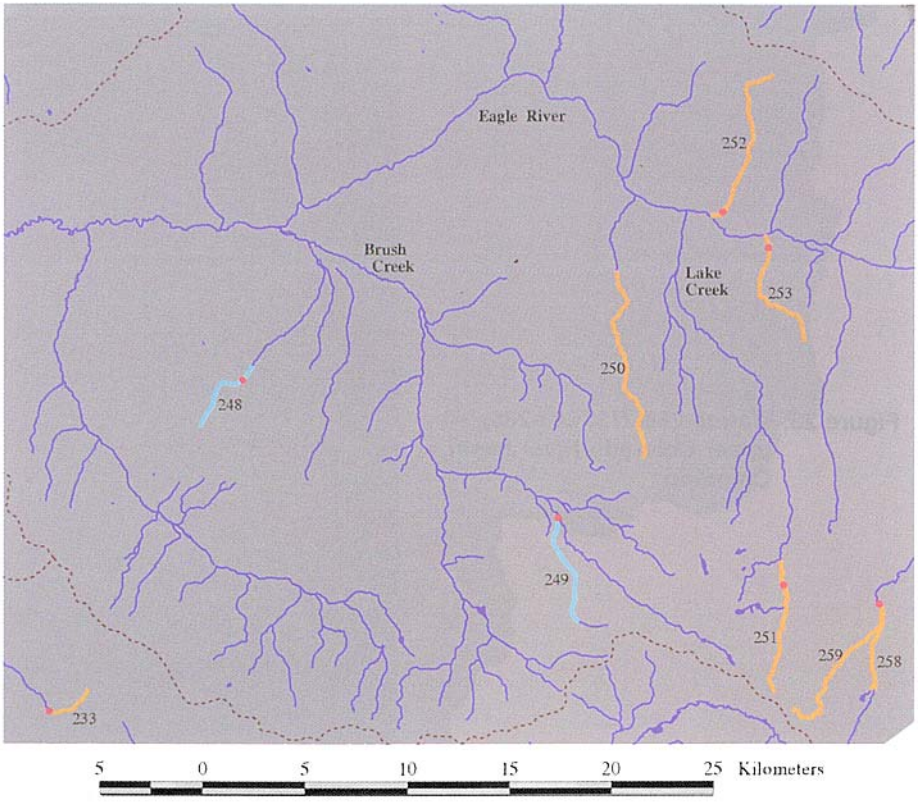


Figure 21. Waters 233, 248-253, 258-259, Eagle River basin, Colorado

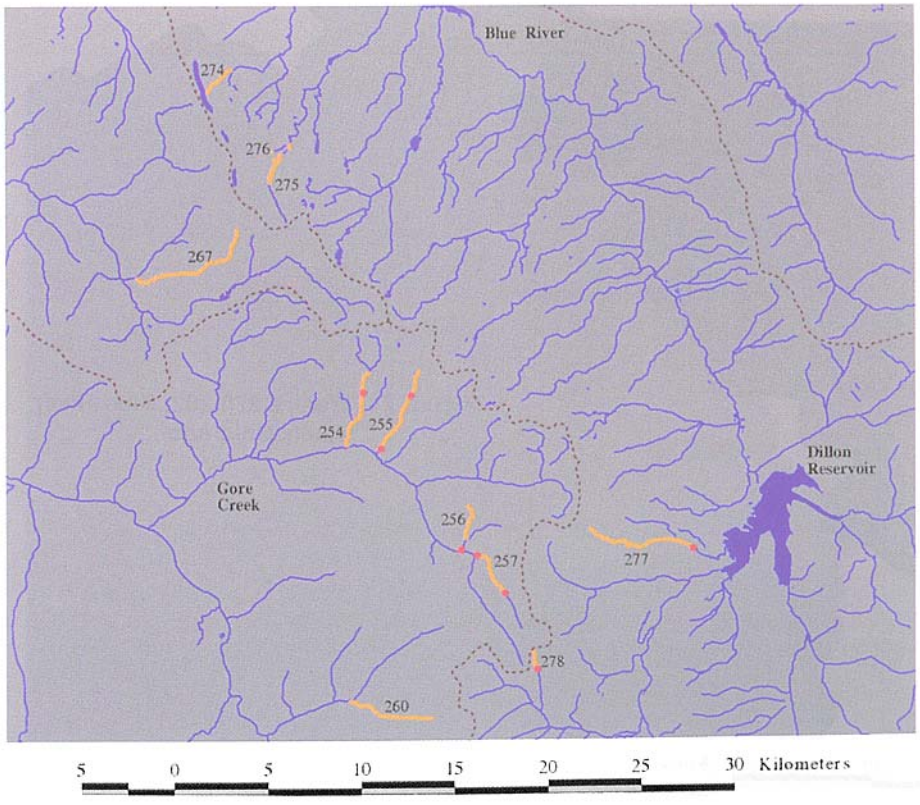


Figure 22. Waters 254-257, 260, 267, 274-278, Eagle River and Blue River basins, Colorado

Appendix B. Cont'd.

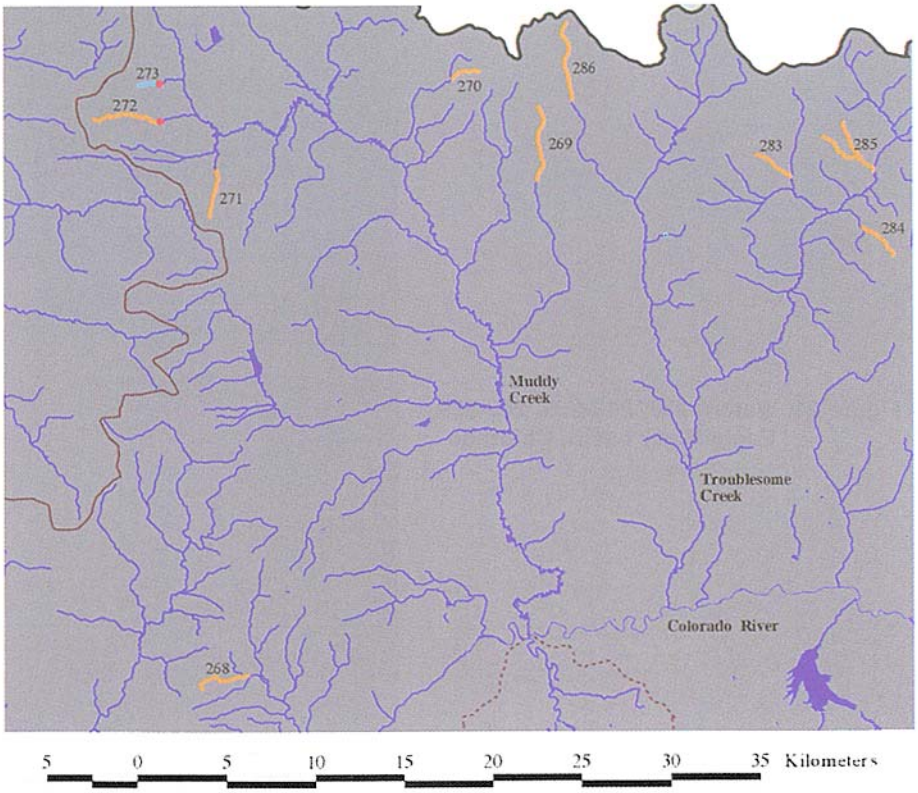


Figure 23. Waters 268-273, 283-286, upper Colorado River basin, Colorado

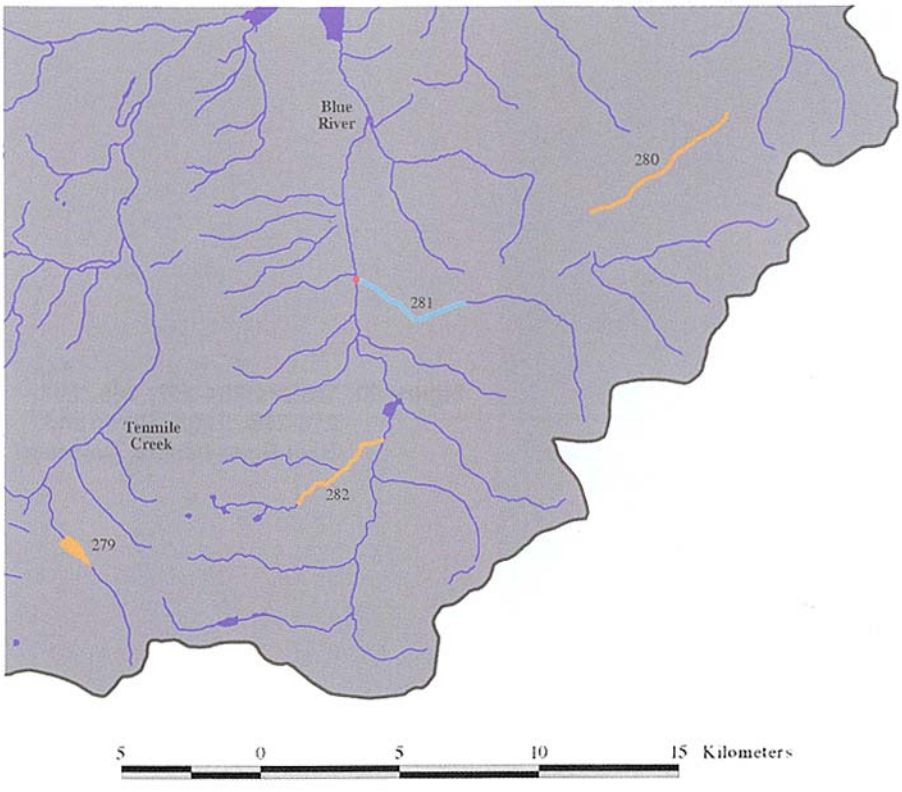


Figure 24. Waters 279-282, Blue River basin, Colorado

Appendix B. Cont'd.

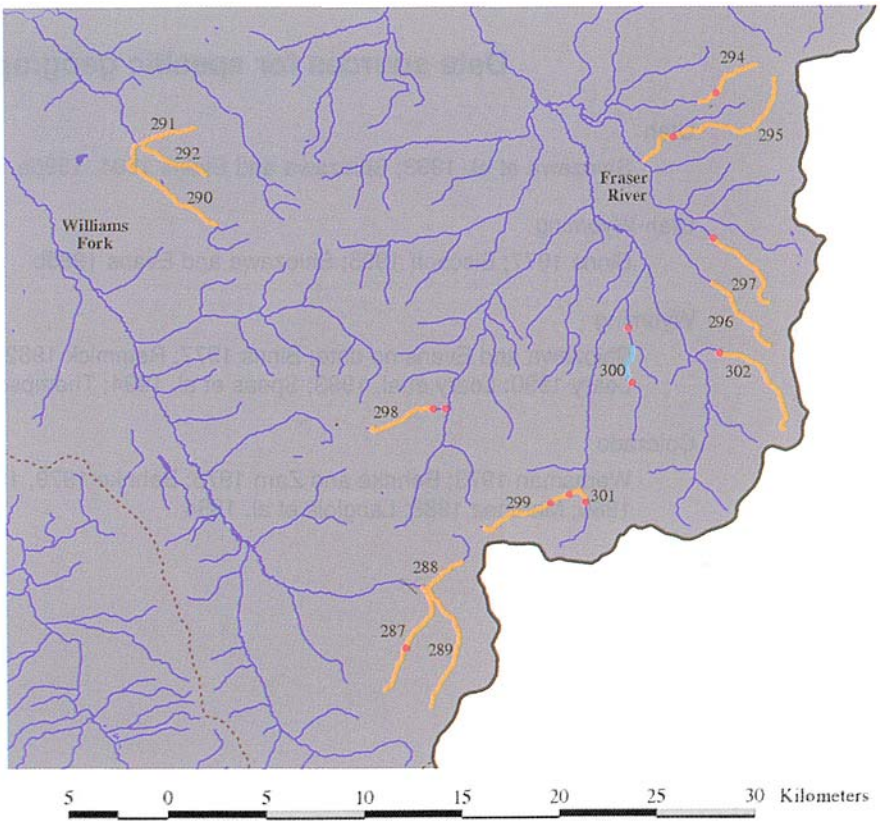


Figure 25. Waters 287-292, 294-302, upper Colorado River basin, Colorado

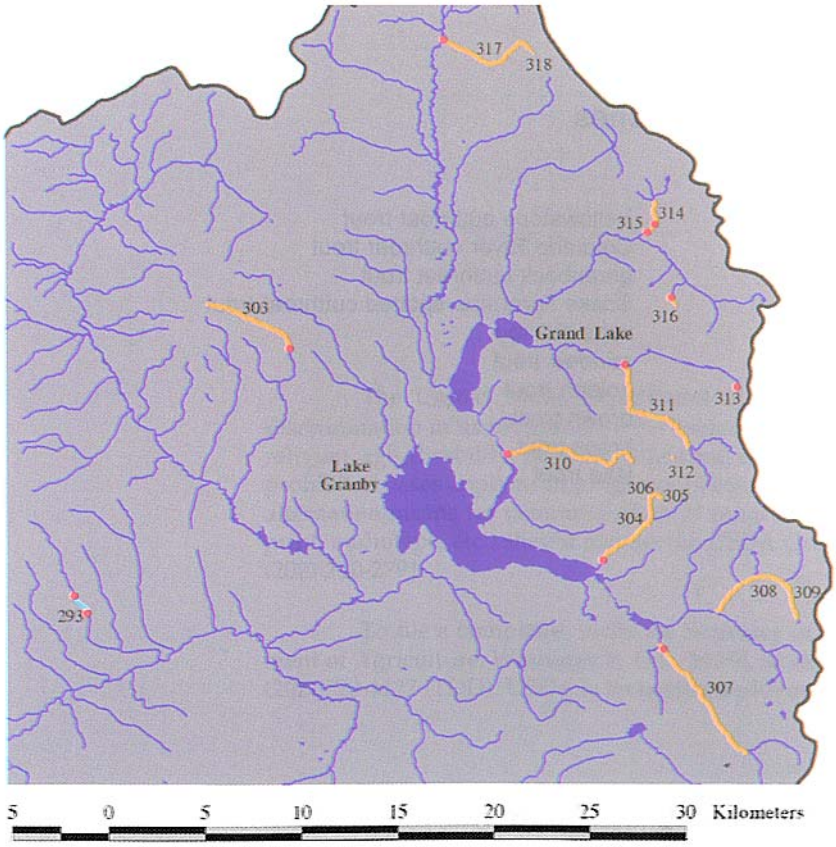


Figure 26. Waters 293, 303-318, upper Colorado River basin, Colorado

Appendix C

Data sources for specific geographic sites

Utah

Shiozawa et al. 1993; Shiozawa and Evans 1994, 1995a, 1995b

Utah-Wyoming

Binns 1977; Bischoff 1995; Shiozawa and Evans 1995b

Wyoming

Shiozawa and Evans no date; Binns 1977; Remmick 1982; Oberholtzer 1987, 1990; Leary 1990; Leary et al. 1993; Speas et al. 1994; Thompson 1995

Colorado

Wernsman 1973; Behnke and Zarn 1976; Behnke 1979, 1992; Behnke and Benson 1980; Martinez 1988; Langlois et al. 1994

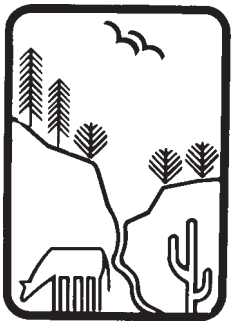
Appendix D

Names of fishes

Salmonidae

Oncorhynchus clarki bouvieri	Yellowstone cutthroat trout
Oncorhynchus clarki pleuriticus	Colorado River cutthroat trout
Oncorhynchus clarki stomias	greenback cutthroat trout
Oncorhynchus clarki subsp.	Snake River fine-spotted cutthroat trout
Oncorhynchus kisutch	coho salmon
Oncorhynchus mykiss	rainbow trout
Oncorhynchus mykiss aguabonita	golden trout
Salmo trutta	brown trout
Salvelinus fontinalis	brook trout
Salvelinus namaycush	lake trout

Rocky
Mountains



Southwest

Great
Plains

U.S. Department of Agriculture
Forest Service

Rocky Mountain Forest and Range Experiment Station

The Rocky Mountain Station is one of seven regional experiment stations, plus the Forest Products Laboratory and the Washington Office Staff, that make up the Forest Service research organization.

RESEARCH FOCUS

Research programs at the Rocky Mountain Station are coordinated with area universities and with other institutions. Many studies are conducted on a cooperative basis to accelerate solutions to problems involving range, water, wildlife and fish habitat, human and community development, timber, recreation, protection, and multiresource evaluation.

RESEARCH LOCATIONS

Research Work Units of the Rocky Mountain Station are operated in cooperation with universities in the following cities:

Albuquerque, New Mexico
Flagstaff, Arizona
Fort Collins, Colorado*
Laramie, Wyoming
Lincoln, Nebraska
Rapid City, South Dakota

*Station Headquarters: 240 W. Prospect St., Fort Collins,CO 80526