

Distribution of Rio Grande Cutthroat Trout and its co-occurrence with the Rio Grande Sucker and Rio Grande Chub on the Carson and Santa Fe National Forests

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Abstract.—Studies were initiated in June, 1994 by the USDA Forest Service, Rocky Mountain Forest and Range Experiment Station to update knowledge on the distribution of the Rio Grande cutthroat trout a Forest Service Sensitive Species, and its co-occurrence with two native cypriniforms, Rio Grande sucker and Rio Grande Chub. The Rio Grande sucker is listed as endangered by the state of Colorado. The native cutthroat was found to co-occur with the native sucker in Tusas Creek on the Carson National Forest, and in the Rio de las Vacas, American Cr. and the Rito de las Palomas on the Santa Fe National Forest. By comparison, the native trout co-occurred with the chub in Canjilon Cr., El Rito Cr., Rio San Antonio, and Nutrias Cr. on the Carson National Forest. The three native species co-occurred in the Rio de las Vacas, Clear Creek, American Creek. and Rito de las Palomas on the Santa Fe National Forest. Seven new localities (Canada de Osha, Comales Cr., Agua Piedras, Rio de las Trampas, Rio San Leonardo, Italianos Cr. and Yerba Creek) were added to the distributional records of the native cutthroat-all on the Carson National Forest. Two new localities were added to the know distribution of the native sucker (Polvedera Cr. and Canones Cr.).

INTRODUCTION

The status and distribution of the Rio Grande cutthroat trout, *Oncovkynckus clarki virginalis*, has been an objective of research among professional fishery managers for several decades. The first specimens of Rio Grande cutthroat trout were

collected from Ute Creek, Costilla County, Colorado in 1853 near the site of Fort Massachusetts, by the Pacific Railroad expedition. The specimens were described by Girard (1856) as *Salar virginalis*. Collections of Rio Grande cutthroat trout were also taken from the Fort Garland area, which was approximately 7.2 km south of Fort Massachusetts. The Rio Grande cutthroat trout is presently classified as a subspecies of *Oncovkynckus clarki* instead of as a distinct species.

The original distribution of the Rio Grande cutthroat trout is unknown (Wernsman, 1973, Wallace and Behnke, 1974). Cope (1886) described a "black-spotted" trout with "basihyal" teeth from southern Chihuahua. The location of this collection

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has never been identified and the samples have subsequently been lost, which precludes taxonomic analysis (Propst, 1976). Needham and Gard (1964) described a Pacific Coast trout as *Salmo chrysogaster*; it, however, is not related to the Rio Grande cutthroat trout. Wallace and Behnke (1974) considered the old citations of Rio Grande cutthroat trout occurrence in Texas and old Mexico as dubious.

Behnke (1967) identified cutthroat trout from Indian Creek, a stream located in the Sacramento Mountains, Otero County, New Mexico, as Rio Grande cutthroat trout. These specimens more closely resembled the Pecos variant of *virginalis* than the Rio Grande variant and are believed to have been transplanted from the Pecos River (Propst, 1976). This location is the southern most extension of the known Rio Grande cutthroat trout distribution.

Indigenous occurrence of Rio Grande cutthroat trout in the Canadian River system has been questioned over time. An anonymous author with the appellation "Apache" stated in an 1877 article of Forest and Stream that trout were abundant "at the headwaters of the Vermejo." A fish survey by the New Mexico Department of Game and Fish reported that "native" cutthroat were found in the headwater streams of the Canadian (Propst, 1976). Wallace and Behnke (1974) stated "that the indigenous occurrence of cutthroat trout in the headwaters of the Canadian River basin of New Mexico has never been established, but if trout were native to the Canadian River drainage they would be *S. c. virginalis*, derived from headwater transfer from the Pecos River drainage." Stork (1975) believed that the evidence of Rio Grande cutthroat trout being indigenous to the Canadian River system was inconclusive. Behnke (1976) reported a collection of pure Rio Grande cutthroat trout from Ricardo Creek, a tributary to the Canadian River, Las Animas County, Colorado. In a report to the New Mexico Department of Game and Fish, Behnke (1982) concluded that the Rio Grande cutthroat trout is native to the Canadian drainage.

Currently, populations of Rio Grande cutthroat trout are extant in southern Colorado and in four drainages in New Mexico; the Rio Grande, the Pecos, the Canadian, including the Mora, and the Tularosa basin (Sublette et al., 1990).

Rio Grande sucker, *Catostomus plebeius*, was first described by Baird and Girard (1854) and later

reported on by Koster (1957). Its current distribution is reported as the Rio Grande, above the 36th parallel, its tributaries, primarily north of the 35th parallel, and the Mimbres River. Introduced populations of Rio Grande sucker also occur in the headwaters of the Gila River, the Rio Hondo (Pecos drainage) and in the San Francisco drainage, Sacramento Mountains (Sublette et al., 1990). Populations of this species also inhabit six river basins encompassing three states of Mexico (Smith, 1966; Hendrickson et al., 1980; Sublette et al., 1990). Rio Grande sucker co-occurs with Rio Grande cutthroat trout and with other exotic salmonids where only Rio Grande cutthroat were once present.

Rio Grande sucker are found in small to large, middle elevation streams with gravel/cobble/rubble substrates. They can also be found in backwater, beaver ponds, and pools proximate to riffles. Major spawning efforts occur in spring over medium gravel (8-16 mm) (Calamusso and Rinne in prep; Sublette et al., 1990). Koster (1957) suggested a second spawning in the fall. Rinne (1995a) during a study of the reproductive biology of the Rio Grande sucker in the Rio de las Vacas, did not find the autumnal spawning evident. The species is classified as a benthic lithophil (Mike Hatch, New Mexico Game and Fish Department, Pers. comm.) feeding on periphyton algae, and benthic invertebrates scraped from rocks with its cartilaginous upper mandible.

The Rio Grande sucker is listed as endangered in the state of Colorado, where one population exists in Hot Creek, a tributary to the Conejos River. Substantial populations are extant in New Mexico, however, there is concern that the species may be declining. Calamusso (1992) documented the absence of Rio Grande sucker in two watersheds of the Carson National Forest where prior records indicated its presence. Decline of the Rio Grande sucker is believed to be due to competition and genetic swamping by the white sucker, *Catostomus commersoni* (Rinne, 1995). Rio Grande chub, *Gila pandora*, were first reported and described from the Sangre de Cristo pass in the headwaters of the Rio Grande basin, New Mexico (Cope, 1871). Rio Grande chub are distributed in the Rio Grande, Canadian, and Pecos River drainages. Preferring pools in small to moderate streams, the species is also commonly associated

with instream woody debris and undercut banks (Rinne, 1995b). Spawning occurs in late spring and early summer. Rinne (1995b) found Rio Grande chubs exhibited a bi-modal spawning pattern in the Rio de las Vacas. Chubs had an extended spawning peak in spring (March to June) followed by a briefer, less marked autumnal spawning event. Nest construction and parental care was not observed (Koster, 1957). The species is a mid-water carnivore feeding on zooplankton, aquatic insects and juvenile fish. Detritus is also taken in limited amounts (Sublette et al., 1990). Currently, information is sparse on the ecology and life history on this species (Rinne, 1995b). The status of the Rio Grande chub in New Mexico is considered stable and reproducing (Sublette et al., 1990).

Studies were initiated in 1994 by the USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, in cooperation with New Mexico State University, because of:

1. The lack of knowledge of the ecology of these three native species,
2. The sensitive status of these species,
3. The inherent ecological and cultural value of **these** species, and
4. These species are the under the auspices of ecosystem management.

The main objectives of study were:

1. To develop a comprehensive statement on the distribution of Rio Grande cutthroat trout, the Rio Grande sucker, and the Rio Grande chub and
2. To define the co-occurrence of the three species in an effort to help resource professionals better manage these species.

OBJECTIVES

This paper discusses: 1) the relative distribution of the Rio Grande cutthroat trout, Rio Grande sucker and Rio Grande chub on the Carson and Santa Fe National Forests, 2) the co-occurrence of the Rio Grande sucker and chub with Rio Grande cutthroat trout, and 3) the comparative elevation, water temperature and gradient in reaches inhabited by these three species.

STUDY AREA

The study area comprised the Carson and Santa Fe National Forests, of north-central New Mexico (Figure 1). The Carson National Forest encompasses 563,185 ha and the **Santa Fe** 634,230 ha of National Forest System Lands. These Forests are administrative units of the Southwestern Region of the Forest Service, U.S. Department of Agriculture.

The landscape is generally mountainous with elevations ranging from 1,708 m in low elevation grasslands to Wheeler Peak at 4,011 m located **on** the Carson National Forest. North-central New Mexico can be characterized by a mild climate with cool summers, moderate winter snows, and many days of sunshine. Air temperatures vary from -31.70 c to 100 c in the winter. Summer air temperatures vary from -1.10°C to 350°C. Extended periods of **heat** or **cold** are rare.

Streams on the Carson and Santa Fe National Forests range from low elevation, low gradient streams to high elevation, high gradient streams, dominated by a boulder/cobble substrate. Riparian vegetation is well developed **on most** streams

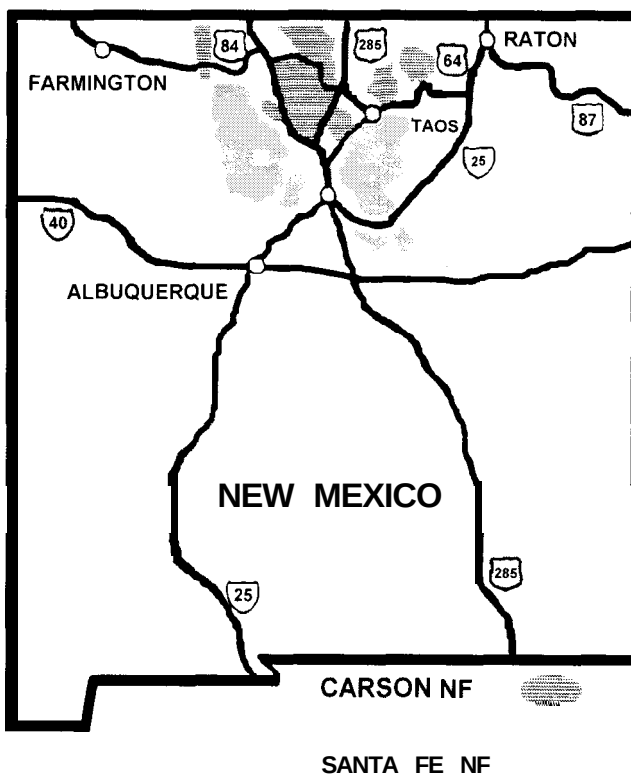


Figure 1. Carson and Santa Fe National Forest, New Mexico.

in the absence of livestock grazing. All streams surveyed were potentially impacted by one or more forest multiple use activities: logging, mining, road building, livestock grazing, and recreation.

METHODS AND MATERIALS

A review of the published literature, museum records and unpublished agency reports on the Rio Grande cutthroat trout, sucker and chub was conducted to determine known distributions of these species. Middle elevation tributaries to the Rio Grande that had no prior records of these species were selected for field investigations. Ichthyofauna of streams surveyed was sampled between June and August, 1994 using a Smith-Root Model 12 backpack electrofisher. Fish captured were weighed, measured, sexed, and released alive to the stream.

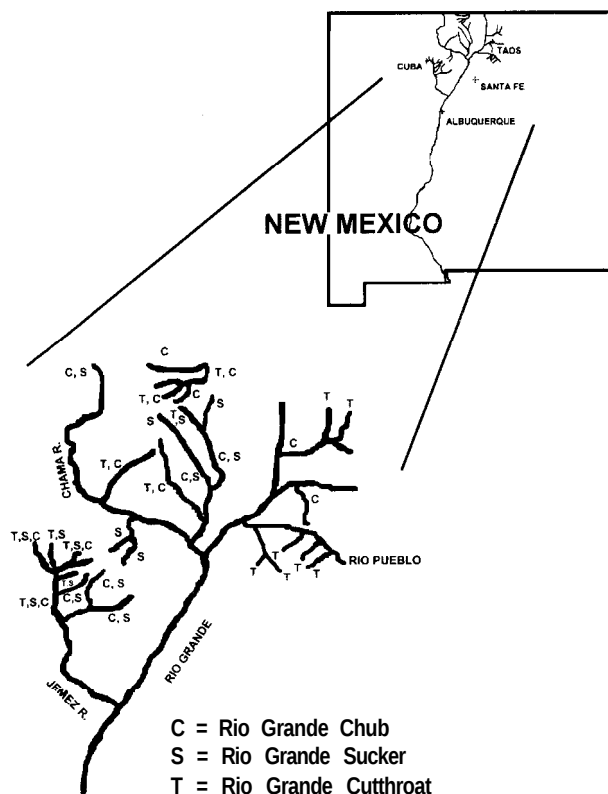


Figure 2. Distribution of Rio Grande chub, Rio Grande cutthroat and Rio Grande sucker in Carson and Santa Fe National Forest, New Mexico.

Table 1. Streams surveyed on the Carson and Santa Fe National Forests, 1994.

Carson NF streams	Santa Fe NF streams
Rio San Antonio	Rio Guadalupe
Canjilon Creek	Rio de las Vacas
Tusas Creek	Rio de las Palomas
Little Tusas Creek	American Creek
Tienditas Creek	Clear Creek
Rio Chiquito	Chihauhuenones Creek
Frijoles Creek	Canones Creek
Rito de Olla	Polvadera Creek
Rio Grande del Rancho	Coyote Creek
Rio Pueblo	Rito Resumidero
Canada de Osha	Rio Puerco
Comales Canyon	Rito Redondo
Agua Piedras	Rito Capulin
Canada Tio Maes	Canyoncito Creek
Rio Flechado	Corrales Creek
Gallegos Canyon	
San Cristobal Creek	
Cabresto Creek	
Rito del Medio	
Rio de las Trampas	
Rio San Leonardo	
Yerba Creek	
Italianos Creek	

RESULTS

Thirty eight streams were surveyed, (23 on the Carson and 15 on Santa Fe National Forest) for presence/absence and co-occurrence of Rio Grande cutthroat trout, Rio Grande sucker, and Rio Grande chub in 1994 (Table 1). Of the streams surveyed, seven streams on the Carson were identified as new distributions for the Rio Grande cutthroat trout. Nine streams, two on the Carson and seven on the Santa Fe National Forest, contained Rio Grande sucker (Figure 2). Rio Grande chub were found in five streams on the Santa Fe and three streams on the Carson. Co-occurrence of the Rio Grande cutthroat trout with the Rio Grande sucker and chub was documented in two streams on the Carson and six streams on the Santa Fe National Forest.

Rio Grande cutthroat trout distributions

Upon completion of a review of agency records and the 1994 field season, 93 populations of Rio Grande cutthroat trout have been identified for the Carson and Santa Fe National Forests (Stumpf 1993). Purity among these populations range from grade F, which is less than 25% pure, to grade A, which is 95-100% pure.

Seven are new locations identified through field efforts in 1994, an increase in known locations of 8.0%. They are Canada de Osha, Comales Canyon, Agua Piedras, Rio San Leonardo, Rio de las Trampas, Yerba Canyon and Italianos Creek. All are located on the Carson National Forest. Table 2 lists the distributions, elevations, and gradients of these streams; Table 3 shows number and size of Rio Grande cutthroat captured in these streams. Knowledge of Rio Grande cutthroat distribution was expanded for two streams on the Santa Fe National Forest; American Creek and Rito de Las Palomas. Electrofishing surveys found populations of Rio Grande cutthroat trout extant in both streams to the upper reaches.

Rio Grande sucker distributions

A total of 14 populations of Rio Grande sucker were found to occur within the study area. Three streams on the Carson and eleven streams on the Santa Fe contain the native sucker. Distribution, gradient, and elevation of Rio Grande sucker by stream are listed in Table 4.

Subjective observations indicated that streams in which Rio Grande sucker occurred held stable

Table 2. New distributions for Rio Grande cutthroat trout, Carson National Forest, 1994.

Stream	UTM	Gradient (%)	Elev. (m)
Canada de Osha	446050E,400224N to 448140E,399565N	3.0 15.0	2,400 3,277
Comales Creek	447750E,4001190N to 448640E,3999620N	8.0 16.0	2,540 2,730
Agua Piedras	452640E,3998770N to 451490E,3993150N	9.0 12.0	2,583 3,669
Rio de las Trampas	429450E,4001150N to 442640E,3984480N	3.0 12.0	2,209 3,454
Rio San Leonardo	439360E,3988900N to 441460E,3984230N	5.0 12.0	2,720 3,748
Italianos Creek	455620E,4048670N to 453910E,4051400N	14.0 15.0	2,652 3,239
Yerba Creek	453430E,4046970N to 451320E,4050710N	10.0 18.0	2,497 3,436

populations. Relative abundance estimates were performed in 1992, 1994 and 1995 and are currently being evaluated for population trends. Number and size of Rio Grande sucker captured in the study area in 1994 are shown in Table 5.

Table 3. Number and size of Rio Grande cutthroat trout sampled at new localities, Carson National Forest, 1994.

Stream	n	Mean length (mm)	Length range (mm)	Mean weight (g)	Length range (g)
Canada de Osha	13	145.7	69.0 - 232.0	34.1	3.0 - 98.0
Comales Creek	13	209.9	93.0 - 163.0	26.4	1.0 - 80.0
Agua Piedras	8	155.0	99.0 - 211.0	45.6	8.0 - 96.0
Rio de las Trampas	18	180.8	100.0 - 250.0	76.2	10.0 - 247.0
Rio San Leonardo	5	201.6	134.0 - 296.0	110.6	20.0 - 310.0
Italianos Creek	14	146.5	60.0 - 227.0	38.8	0.5 - 110.0
Yerba Creek	24	244.8	115.0 - 230.0	100.4	11.0 - 110.0

Table 4. Distribution of Rio Grande sucker, Carson and Santa Fe National Forests, 1994.

Stream	UTM	Gradient (%)	Elev. (m)	Stream	UTM	(%)	(m)
Carson NF				Santa Fe NF (Cont'd)			
Rio Tusas	T25N,R9E,S19	1.0	1,991	Rio de las Vacas	338490E,3965220N	1.5	2,205
	to				337030E,3985120N	4.0	2,540
	392400E,4066800N	2.7	2,785				
Little Tusas	39671 0E,406421 ON	1.0	2,692	Rito de las Palomas	338460E,3984370N	1.0	2,485
	to				339060E,3986460N	2.5	2,589
	393000E,4070400N	4.0	2,914				
Rio Vallecitos	T25N,R9E,S19	1.0	1,991	American Creek	338460E,398471 ON	1.0	2,500
	to				340070E,3986990N	2.5	2,604
	388300E,4059790N	1.0	2,8				
Santa Fe NF				Clear Creek	337560E,398452ON	0.75	2,500
Jemez River	351 00E,3965950N	0.05	1,717		335490E,3984900N	4.0	2,572
	to						
	343130E,3946320N	1.0	2,072	Rio Cebolla	338490E,3965220N	1.5	2,205
East Fork, Jemez River	351500E,395950N	2.0	2,072	Rock Creek	338440E,3983420N	2.0	2,482
	to				339200E,398398ON	3.5	2,497
	363630E,3965670N	1.5	2,548				
San Antonio Creek	351500E,3965950N	1.25	2,072	Canones Creek	369970E,4001820N	2.5	2,120
	to						
	351780E,3986540N	1.75	2,350	Polvedera Creek	371300E,4040900N	1.0	2,055
Rio Guadalupe	342240E,394855O	1.0	1,736				
	to						
	338490E,3965220N	1.5	2,205				

Table 5. Number and size of Rio Grande sucker sampled on the Carson and Santa Fe National Forests, 1994.

Stream	n	Mean length (mm)	Length range (mm)	Mean weight (mm)	Weight range (mm)
Carson NF					
Rio Tusas	56	111.3	51.0 • 162.0	14.4	1.0 • 40.0
Little Tusas*					
Rio Vallecitos*	61	133.7	70.0 • 195.0	37.6	6.0 • 95.0
Santa Fe NF					
Rio Guadalupe	13	164.5	105.0 • 197.0	50.1	11.0 • 77.0
Rio de las Vacas	24	168.7	112.0 • 192.0	50.5	9.0 • 82.0
Rito de las Palomas	17	95.2	40.0 • 140.0	10.1	0.5 • 26.0
American Creek	16	105.4	40.0 • 165.0	18.31	0.5 • 54.0
Clear Creek	4	124.5	97.0 • 135.0	19.0	0.5 • 39.0
Canones Creek	8	121.5	43.0 • 198.0	31.4	0.5 • 78.0
Polvedera Creek	50				
	YOY-adult				

Rio Grande chub distributions

A review of museum records and field surveys conducted in 1994 has identified and confirmed 17 populations of Rio Grande chub in the study area; 9 on the Carson and 8 on the Santa Fe National Forest (Tables 6, 7). The species is widely distributed, and populations are considered stable on both Forests. Rio Grande chub were extant in middle elevation streams where elevations ranged from 1,717 to 2,810 meters. Gradients within reaches of Rio Grande chub presence were mea-

sured at 2% or less. Chub were never found in a reach with a gradient above 2% unless there were long (30 m+) pools/runs within the reach that exhibited gradients of 2% or less. Distribution, elevation and gradients of streams containing Rio Grande chub are shown in Tables 6 and 7.

A total of 82 Rio Grande chub were collected in 1992 on the Carson, and 34 were sampled on both the Carson and Santa Fe in 1994. Tables 8 and 9 list the number and size of Rio Grande chub sampled on the Carson and **Santa Fe** National Forests in 1994.

Table 6. Distribution of Rio Grande chub, Carson National Forest, 1994.

Stream	UTM	Gradient (%)	Elev. (m)
Rio de los Pinos	396650E,4090750N	0.80	2,640
	to 384930E,4093390N	3.0	2,655
Rio San Antonio	406360E,4094680N	1.25	2,690
	to 390380E,408110N	2.0	2,810
Rio Nutrias	392650E,4076720N	1.5	2,736
	to 392650E,4076720N	2.0	2,767
Tio Grande	397640E,4079790N	1.25	2,706
Rio Tusas	T25N,R9E,S19	1.0	1,991
	to 408830E,4044090N	3.5	2,256
Rio Vallecitos	T25N,R9E,S19	1.0	1,991
	to 395200E,4048850N	3.0	2,462
El Rito	394900E,4014100N	0.9	1,905
	to 386020E,4037700N	2.0	2,570
Canjilon Creek	364430E,4022400N	1.5	1,982
	to 376690E,4041550N	3.0	2,644
Rio Grande del Rancho	447010E,4020410N	1.4	2,178
	to 447950E,4015850N	2.2	2,255

Table 7. Distribution of Rio Grande chub, Santa Fe National Forest, 1994.

Stream	UTM	Gradient (%)	Elev. (m)
Jemez River	343130E,3946320N	0.05	1,717
	to 351500E,3965950N	1.0	2,072
East Fork, Jemez River	351500E,3965950N	2.0	2,072
	to 363630E,395670N	1.5	2,598
San Antonio Creek	351500E,3965950N	1.25	2,072
	to 351780E,3971150N	1.4	2,350
Rio Guadalupe	342240E,3948550N	1.0	1,736
	to 338490E,3965220N	1.5	2,205
Rio delas Vacas	338490E,3965220N	1.5	2,205
	to 337560E,3984520N	2.0	2,500
Rio Cebolla	338490E,3965220N	1.5	2,205
Rito de las Palomas	338250E,3984370N	1.0	2,485
	to 338460E,3984710	1.0	2,500
American Creek	338460E,3984710N	1.0	2,494
	to 340020E,3986540N	1.75	2,577
Clear Creek	337560E,3984520N	0.75	2,500
	to 335490E,3984900N	4.0	2,572

Table 8. Number and size of Rio Grande chub sampled on the Carson National Forest, 1994.

Stream	n	Mean length (mm)	Length range (mm)	Mean weight (mm)	Weight range (mm)
R. Grande del Rancho*	3	130.0	108.0 - 145.0	26.3	14.0 - 38.0
Rio de los Pinos*	6	73.2	62.0 - 92.0	5.3	2.0 - 12.0
Rio San Antonio	26	89.0	20.0 - 142.0	4.8	0.5 - 30.0
Rio Nutrias'	22	80.3	40.0 - 142.0	7.1	0.5 - 9.0
Tio Grande*	2	114.5	92.0 - 37.0	32.0	16.0
Rio Tusas	5	124.8	100.0 - 152.0	12.4	3.0 - 30.0
Rio Vallecitos'	82	116.5	43.0 - 178.0	17.3	0.5 - 85.0
El Rito Creek*	97	107.9	25.0 - 176.0	21.4	0.5 - 64.0
Canjilon Creek*	19	87.7	43.0 - 123.0	9.5	0.5 - 51.0

Sampled by Carson NF personnel, 1992.

Table 9. Number and size of Rio Grande chub sampled on the Santa Fe National Forest, 1994.

Stream	n	Mean length (mm)	Length range (mm)	Mean weight (mm)	Weight range (mm)
Rio Guadalupe	1	80.0		3.0	
Rio de las Vacas	9	123.0	112.0 - 136.0	16.7	13.0 - 22.0
Rito de la Palomas	3	103.7	75.0 - 140.0	14.3	5.0 - 29.0
American Creek	2	101.5	75.0 - 128.0	7.7	0.5 - 15.0

Co-occurrence of species

Ten streams on the Carson and Santa Fe National Forests exhibited co-occurrence of the Rio Grande cutthroat trout with the Rio Grande sucker or chub (Table 10).

Co-occurrence of Rio Grande cutthroat trout with the Rio Grande sucker was documented in one stream on the Carson (Rio Tusas) and five streams (Rio de las Vacas, Rito de las Palomas, American Creek, Clear Creek and Canones Creek of Abiquiu Reservoir on the Santa Fe. The location of co-occurrence, gradient and elevation of these streams are in Table 11.

Rio Grande cutthroat trout were found to co-occur with Rio Grande chub in four streams on the Carson. They were Rio Nutrias, Rio San Antonio, El Rito Creek and Canjilon Creek. On the Santa Fe National Forest co-occurrence of Rio Grande cutthroat trout with Rio Grande chub was documented in two streams; Rio de las Palomas and American Creek. Location, gradient and elevation of these stream reaches are shown in Table 12.

Table 10. Co-occurrence of Rio Grande cutthroat trout, sucker and/or chub, Carson and Santa Fe National Forests, 1994.

Stream	Rio Grande cutthroat trout	Rio Grande sucker	Rio Grande chub
Carson NF			
Rio Tusas	X	X	
Canjilon Creek	X		X
El Rito	X		X
Rio San Antonio	X		X
Rio Nutrias	X		X
Santa Fe NF			
Rio de las Vacas	X	X	X
Rito de las Palomas	X	X	X
American Creek	X	X	X
Clear Creek	X	X	X
Canones Creek	X	X	

Totals of 43 Rio Grande cutthroat trout, three Rio Grande sucker and 46 Rio Grande chub were sampled in reaches of co-occurrence on the Carson. Number and size of these species are compiled by stream in Table 13. For the Santa Fe, 53 Rio Grande cutthroat trout, 48 Rio Grande sucker and 10 Rio Grande chub were sampled in reaches of the streams that exhibited co-occurrence. Table 14 shows the number and size of these fishes.

DESIRED FUTURE CONDITION

To manage Rio Grande cutthroat trout, sucker and chub resources effectively, managers of all agencies must have the latest information on their distribution and status. It was with this goal in mind that we initiated our study. Information concerning these species is dynamic, that is, we are gaining information on new populations and monitoring changes or maintenance of existing populations. The addition of seven new populations of Rio Grande cutthroat trout and two of Rio Grande sucker during one season of field work

Table 11. Co-occurrence of Rio Grande cutthroat trout and Rio Grande sucker, Carson and Santa Fe National Forests, 1994.

Stream	UTM	Gradient (%)	Elev. (m)
Carson NF			
Tusas Creek	392400E,4066800N	1.5	2,770
Santa Fe NF			
Rio de las Vacas	337240E,3984850N	2.5	2,521
	to 337030E,3985120N	4.0	2,540
Rito de las Palomas	338250E,3984370N	1.0	2,485
	to 339060E,3986460N	2.5	2,589
American Creek	338460E,3984710N	1.0	2,494
	to 340020E,3986540N	1.75	2,577
Clear Creek	337560E,3984520N	0.75	2,500
	to 335570E,3984710N	1.5	2,558
Canones Creek	369970E,4001820N	2.5	2,125

substantiates that much is still unknown about the distribution and status of both these species. Future goals for this study are to continue to document new distributions of Rio Grande cutthroat trout and sucker, and to describe the physical and biological processes involved in delimiting populations of these species.

The desired future condition for the three species of fish is to maintain wild, self-sustaining populations of each. Specific strategies will need to be developed and implemented for each species. Results from our study indicate that Rio Grande chub are widely distributed in the study area and populations are stable. Protection of wild chub populations from habitat loss, alteration or introduction of non-native species will achieve the desired future condition for this species.

Rio Grande sucker are also distributed throughout the study area, but are considered to be vulner-

Table 12. Co-occurrence of Rio Grande cutthroat trout and Rio Grande chub, Carson and Santa Fe, 1994.

Stream	UTM	Gradient (%)	Elev. (m)
Carson NF			
Canjilon Creek	364430E,4022400N	1.5	1,982
	to 376690E,4041550N	3.0	2,644
El Rito	387570E,4029110N	2.5	2,337
	to 386020E,4037700N	2.0	2,570
Rio San Antonio	399430E,4079640N	1.25	2,704
Nutrias Creek	394520E,4078370N	1.5	2,730
	to 392640E,4076720N	2.0	2,767
Santa Fe NF			
Rito de las Palomas	338250E,3984460N	1.0	2,580
	to 392640E,4076720N	2.0	2,495
American Creek	338460E,3984710N	1.0	2,495
	to 340020E,3986540N	1.75	2,577
Clear Creek	337560E,3984520N	0.75	2,500
	to 335570E,3984710N	1.5	2,558

Table 13. Number and size of Rio Grande cutthroat trout, sucker and chub found in co-occurrence, Carson National Forest, 1994.

Stream	n	Mean length (mm)	Length range (mm)	Mean weight (mm)	Weight range (mm)
Tusas Creek					
RG cutthroat trout	3	153.0	70.0 - 231.0	53.3	3.0 - 120.0
Rio Grande sucker	3	100.0	81.0 - 109.0	10.3	5.5 - 13.0
Rio San Antonio					
RG cutthroat trout	3	110.3	108.0 - 115.0	11.0	10.0 - 12.0
Rio Grande chub	24	81.2	45.0 - 142.0	6.1	1.0 - 30.0
Rio Nutrias					
RG cutthroat trout	2	306.0	297.0 - 315.0	305.0	300.0 - 310.0
Rio Grande chub	16	57.1	40.0 - 96.0	2.4	0.5 - 9.0
Canjilon Creek					
RG cutthroat trout	8	160.1	96.0 - 212.0	54.0	8.0 - 103.0
Rio Grande chub	6	47.0	43.0 - 60.0	1.2	1.0 - 2.0
El Rito					
RG cutthroat trout	27	145.4	82.0 - 264.0		
Rio Grande chub	94	108.9	25.0 - 176.0		

Table 14. Number and size of Rio Grande cutthroat trout, sucker and chub found in co-occurrence, Santa Fe National Forest, 1994.

Stream	n	Mean length (mm)	Length range (mm)	Mean weight (mm)	Weight range (mm)
Rio de las Vacas					
RG Cutthroat trout	1	184.0	50.0		
Rio Grande sucker	3	183.0	178.0 - 188.0	58.7	50.0 - 68.0
Rito de las Palomas					
RG cutthroat trout	7	136.4	96.0 - 169.0	25.7	8.0 - 42.0
Rio Grande sucker	17	95.2	40.0 - 140.0	10.1	0.5 - 26.0
Rio Grande chub	3	103.7	75.0 - 140.0	14.3	5.0 - 29.0
American Creek					
RG cutthroat trout	26	150.0	105.0 - 231.0	36.9	7.0 - 118.0
Rio Grande sucker	16	105.4	40.0 - 165.0	18.3	0.5 - 54.0
Rio Grande chub	2	128.0		15.0	
Clear Creek					
RG cutthroat trout	7	145.9	136.0 - 150.0	28.1	20.0 - 38.0
Rio Grande sucker	4	124.5	97.0 - 135.0	19.0	6.0 - 25.0
Rio Grande chub	5	115.0	55.0 - 155.0	16.3	0.5 - 39.0
Canones Creek					
RG cutthroat trout	12	212.6	105.0 - 275.0	124.7	16.0 - 208.0
Rio Grande sucker	8	121.5	43.0 - 198.0	31.4	0.5 - 70.0

able to reductions in range because of the introduced white sucker. Remaining stocks of Rio Grande sucker need to be monitored and protected. If further declines are observed, such as has occurred in the State of Colorado and on the Carson National Forest, management efforts may be required to accomplish this goal. Research needs to be implemented in an effort to identify the mechanisms by which the white sucker contributes to the decline of the native sucker.

Rio Grande cutthroat trout has been reduced to 5-7% of its former range. The decline continues. Remaining populations of pure Rio Grande cutthroat need to be protected, and management efforts need to continue to reintroduce the species into its former range. Research efforts should focus on the role that non-native salmonids have in delimiting distribution, abundance, and sustainability of this rare southwestern trout.

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