

# Southwest

## Species Summaries

**LISTING STATUS:** red (ESA listed as Threatened or Endangered), yellow (not ESA listed but federal sensitive species or state species of concern (majority of states), green (not listed in majority of states)

**CURRENT RANGE:** red (10 percent or less), yellow (11 -25 percent), green (>25 percent)

**HISTORICAL RANGE:** red (<1,000 miles), yellow (1,000-10,000 miles), green (>10,000 miles)



## Rio Grande Cutthroat Trout

Category	Status	Explanation
Listing status	Yellow	Sensitive species (USFS, BLM) Species of Special Concern (CO, NM)
Current range	Red	10 percent of historical habitat currently occupied
Historical range	Yellow	Moderate distribution historically, 6,650 miles
Climate change	Red	Drought, stream warming and wildfires are major issues, most streams with <1 cfs baseflow
Energy development	Yellow	Some overlap with oil/gas leases and potential solar
Non-native species	Red	Introduced rainbow trout pose hybridization risk; brown trout invading many streams as temperatures warm
Water demand	Yellow	Many streams have diversions in lower reaches
Data issues	Yellow	Interagency workgroup maintains good population data; flow data needs improving

## Apache Trout

Category	Status	Explanation
Listing status	Red	ESA Threatened Species of Special Concern (AZ)
Current range	Yellow	25 percent of historical habitat currently occupied
Historical range	Red	Limited distribution historically, 680 miles
Climate change	Red	Drought, stream warming and wildfires are major issues
Energy development	Green	No known significant energy development issues
Non-native species	Red	Introduced rainbow trout pose hybridization risk; brown trout invading many streams as temperatures warm
Water demand	Yellow	Many streams are small and susceptible to diversions in lower reaches
Data issues	Yellow	Recovery Team maintains good population data; habitat conditions and barriers need improved monitoring

# Gila Trout

Category	Status	Explanation
Listing status		ESA Threatened Species of Special Concern (NM, AZ)
Current range		5 percent of historical habitat currently occupied
Historical range		Limited distribution historically, 600 miles
Climate change		Drought, stream warming and wildfires are major issues
Energy development		No significant energy development issues
Non-native species		Introduced rainbow trout pose hybridization risk; brown trout and smallmouth bass invading streams as water warms
Water demand		Many streams are very small and susceptible to any diversions
Data issues		Recovery Team maintains good population data; habitat monitoring often lacking; tracking needed for non-native species



*Oncorhynchus clarkii virginalis*

## Rio Grande Cutthroat Trout (*Oncorhynchus clarkii virginalis*)

[Rio Grande cutthroat trout](#) were first discovered in 1541 by Francisco Coronado's expedition in the upper Pecos River although they were not formally described until 1856. They represent the southern extent of the cutthroat trout species, historically ranging from the mountainous headwaters of the Rio Grande, Pecos and Canadian rivers in Colorado and New Mexico to small streams in the Guadalupe and Davis Mountains of Texas. Today 121 populations of Rio Grande cutthroat trout occupy less than 10 percent (about 680 miles) of their historical stream habitat in [Colorado and New Mexico](#) and they have long since been extirpated from west Texas. Remaining populations primarily occur in small high elevation tributaries, disconnected from the larger rivers they once occupied.

Fragmentation of habitat from man-made structures such as diversions, dams and culverts and a management strategy of isolation above barriers for protection

from non-native species have separated historically migratory populations of Rio Grande cutthroat trout from their feeding and growing habitats in larger rivers. Although 75 percent of Rio Grande cutthroat trout populations are genetically pure, none of the populations support a migratory life history. The average extent of occupied stream habitat is less than 6 miles, leaving them highly vulnerable to environmental disturbances such as wildfire and drought.



*Oncorhynchus gilae apache*

## Apache Trout (*Oncorhynchus gilae apache*)

[Apache trout](#) are found only in the White Mountains of east-central Arizona where they historically occupied about 680 miles of stream habitat in the headwaters of the Little Colorado and Salt rivers. In the late 1800s, early settlers reportedly caught hundreds of the 'yellow bellies' in a single outing. However, by the mid-1900s habitat degradation from timber harvest, livestock grazing, road construction, water diversions, dams and the introduction of non-native trout had

taken its toll on Apache trout, reducing the occupied habitat to less than 30 miles. Consequently, in 1969 Apache trout became one of the first species to be federally listed as Endangered.

In 1975 successful recovery efforts, including habitat restoration as well as stocking from hatcheries and protection from non-natives, led to the reclassification of Apache trout from Endangered to Threatened and some areas were re-opened to limited fishing. By 2010 there were 30 populations occupying nearly 180 miles of stream habitat, many of which were protected from invading rainbow and brown trout by stream barriers. However, their isolation in small fragmented streams left these populations vulnerable to rapid environmental changes such as the 2011 Wallow Fire that burned more than 490,000 acres, impacting seven populations in the Black and Little Colorado River watersheds. Although the fire was a setback to recovery efforts, it also provided some new restoration opportunities by eliminating non-native trout from many of the burned tributaries. Currently there are approximately 28 populations of Apache trout in 170 miles of habitat with plans to reestablish populations in 30-40 miles of unoccupied stream habitat, including the restoration of a metapopulation in the West Fork Black River.



*Oncorhynchus gilae gilae*

**Gila Trout (*Oncorhynchus gilae gilae*)**

The historical distribution of [Gila trout](#) included nearly 620 miles of small stream habitat within two separate population centers: one in the upper portion of the Gila River basin in western New Mexico, including the Blue and San Francisco rivers, and the other in the headwaters of the Verde River in central Arizona. Early reports of the ‘speckled’ trout in the Gila River drainage date back to the late 1800s, but Gila trout was not described as a separate species until 1950 when its distribution had already been dramatically reduced. This population decline led to an “Endangered” classification by the U.S. Fish and Wildlife Service in 1966. By 1975 only five relict populations of the species remained representing five ancestral lineages - two of which (Iron and McKenna creek populations) were

later found to be hybridized with rainbow trout and were no longer included in recovery efforts. A sixth genetically pure relict population was discovered in Whiskey Creek in 1992. Despite its precarious status, in 2006 the U.S. Fish and Wildlife Service reclassified Gila trout from Endangered to Threatened.

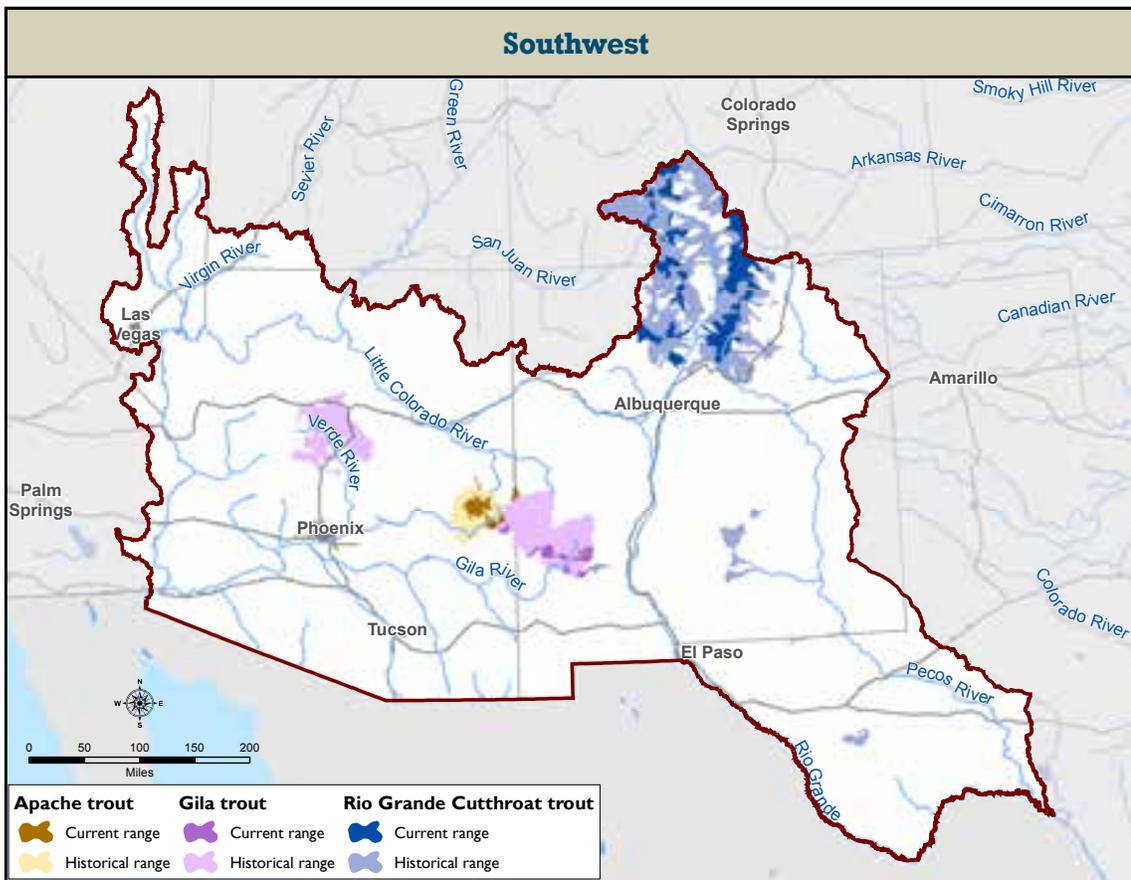
The protection of remnant populations of Gila trout in small mountain streams is challenging given their vulnerability to wildfire, floods and drought. These vulnerabilities are compounded by the presence of non-native species such as rainbow trout, even in the remote rugged landscape of New Mexico’s Gila Wilderness Area. In 2010, fifteen populations of Gila trout occupied about 80 miles of stream habitat primarily in the upper Gila River drainage. Ten of these populations were in the Gila Wilderness Area. In 2012 the Whitewater Baldy fire burned more than 300,000 acres through the core of remaining Gila trout strongholds within the wilderness area. In 2014 there were eight populations remaining in about 30 miles of habitat while the post-fire status

of another three populations in 15 miles of habitat remains unknown. As with Apache trout, the wildfire may have created some opportunities for reestablishing populations within the burned area where non-native trout have been eliminated.

**Regional Trends**

The Southwest includes the lower Colorado River basin and the Rio Grande basin, including major tributaries such as the Gila and Pecos rivers. The diverse landscapes of the Southwest range from the 13,458-foot Canby Mountain in the San Juans of Colorado to the desert scrublands along the US-Mexico border in southwest Texas. Although the southern extent of this region is characterized by arid landscapes including the Mojave, Sonoran and Chihuahuan deserts, the Rio Grande, Little Colorado, Pecos and Gila rivers emerge from high elevation forests and mountain meadows that receive more than 30 inches of precipitation a year. These cold mountain waters are the lifeblood of the region’s three native trout: Rio Grande cutthroat, Gila and Apache.

These native trout of the Southwest have survived for thousands of years, adapting to many environmental changes along the way. Gila and Apache trout in particular evolved in small high elevation islands of clean, cold water rising above the surrounding arid landscape. Over the past century-and-a-half, as the region has been developed, these hardy fish have faced a series of increasing challenges and are now at a critical juncture. Logging and the associated roads and culverts, as well as dams and diversions to support agriculture, have contributed to the fragmentation and degradation of aquatic ecosystems in the region. However, of all of the historic alterations to coldwater habitats in



Historical and current distributions of native trout in the Southwest Region.

## Rio Grande Cutthroat Trout: The Pros and Cons of Life in Small Headwater Streams

A recent study by the U.S. Geological Survey of temperature and baseflow discharge throughout the range of Rio Grande cutthroat trout underscores the vulnerability of remaining populations to increasing summer temperatures and persistent drought (3). The study involved a network of 108 monitoring sites across the current distribution of Rio Grande cutthroat trout. Data was collected between May 2010 and October 2011 to assess the suitability of occupied habitat from a thermal and flow perspective - two environmental variables strongly influenced by climate change in the region.

The study found that although temperatures in several streams supporting Rio Grande cutthroat trout approached thresholds considered to be harmful to cutthroat trout,



Monitoring site on North Fork Carnero Creek: measured baseflow discharge of 0.07 cfs on 9/20/2010 (3). Photo from U.S.G.S.

the high elevation of most occupied streams maintained water temperatures well below critical limits. However, the study also found that over 70 percent of these streams had baseflows of less than 1.0 cubic feet per second in both 2010 and 2011. The isolation of remaining populations in small headwater streams behind barriers protects them from non-native species but limits their ability to move to more suitable habitat when their environment changes.

The sensitivity of these small

streams to persistent drought should be a consideration for the long-term conservation of Rio Grande cutthroat trout.

the region, perhaps the most pernicious has been the introduction of non-native trout to the streams and rivers historically occupied by the Southwest's native fish. These non-natives have displaced the native trout through hybridization, competition and predation, and the native trout now find themselves in the more isolated headwater streams, often upstream of constructed barriers designed to separate the native trout from invasive non-native fish from further downstream. These shrinking island habitats within their historically limited distribution further constrain their innate ability to adapt to changing conditions. Now, these problems are compounded by rapid population growth and climate change.

The Southwest is one of the fastest growing regions in the United States with population growth of 75 percent in

Arizona, 125 percent in Nevada and 35 percent in New Mexico since 1990. Much of the growth has occurred in the Phoenix and Las Vegas metropolitan areas, where average annual rainfall totals are less than 10 inches and surface water is scarce. This amount of growth in an arid region obviously results in an inordinate amount of pressure on scarce water resources. Rivers such as the Salt, Verde, Colorado and Rio Grande that have supported native trout in their headwaters are also important to municipal water supplies downstream while aquifers underlying the surrounding watersheds are pumped to help meet the growing demand.

Agriculture is of even greater significance to the Southwest's water supply. The region supports a robust agricultural economy dependent on the availability of water for irrigation which comes from

both groundwater pumping as well as elaborate delivery systems such as the Central Arizona Project (CAP). The Central Arizona Project uses more than 336 miles of aqueducts and pipelines to bring water from the Colorado River to central Arizona for agriculture. Although agriculture is a historical land use in the Southwest, projects such as the CAP have allowed for a shift from smaller farms to large industrial complexes dependent on the availability of an abundant water supply. However, climate change and associated record high temperatures and persistent drought in the region have contributed to water shortages throughout the Southwest, placing additional stress on the region's hydrologic system.

The Southwest has been in a drought for nearly a decade with the effects of reduced precipitation being exacerbated by increased evaporative losses due to rising temperatures. The decade 2001 – 2010 had regional temperatures almost 2° F higher than historic averages with longer and hotter summer heat waves and fewer wintertime cold air outbreaks. When rain occurs, it often falls in large storm events. During this same time period average streamflow totals in the region were up to 37 percent lower than the 20th Century average flows due to reduced winter snowpack and increased evaporative losses (1). This trend continued as the summer of 2014 found that almost all of New Mexico and Arizona were considered under moderate to extreme drought with warmer-than-average temperatures. Recent studies project that the 21st Century may bring unprecedented mega droughts to the region, surpassing the driest centuries of the Medieval period as well as the more recent drought conditions associated with the dust bowl of the 1920s (2).

Prolonged drought has severe implications on the region's native fish and wildlife, especially as populations are already threatened by a variety of activities and invasive species. The isolation of remaining populations of native trout in small stream habitats above barriers leaves them particularly vulnerable to drought conditions since they are unable to access the larger river systems downstream. Warming temperatures may also alter the thermal regime of the hydrologic

system and create conditions that favor the invasion of non-native fish such as brown trout and smallmouth bass into previously coldwater habitats.

In addition to the direct effects of stream drying, the drought conditions have also contributed to an increase in wildfires throughout the region. Although the Southwest's native trout evolved in a

fire-prone landscape, the intensity and severity of the wildfires today are much greater than under historical conditions and the isolation of populations leaves them unable to escape when a wildfire or post-fire debris flow moves through. Between 2009 and 2013, [more than 2 million acres burned](#) within the historical ranges of Rio Grande cutthroat, Gila and Apache trout,

resulting in local extirpations. Many of these wildfires burned at high intensities over large landscapes. The Wallow Fire of 2011 became the largest blaze in Arizona history, burning nearly 470,000 acres, while the Whitewater-Baldy Fire became the largest wildfire in New Mexico history in just the following year.

## SUCCESS STORY:

# Rio Costilla Watershed Restoration Project

For over 10 years the Truchas Chapter of Trout Unlimited has been engaged in a collaborative effort with the U.S. Fish and Wildlife Service, New Mexico Department of Game and Fish, Carson National Forest, the Rio Costilla Cooperative Livestock Association, private landowners, the Quivera Coalition and numerous nonprofit organizations in an ambitious effort to restore Rio Grande cutthroat trout to 125 miles of stream habitat and 25 lakes within the Rio Costilla watershed of northern New Mexico. Where suitable habitat exists, the Rio Grande sucker, Rio Grande chub and longnose dace will also be restored, creating a self-sustaining native fish community free of non-native fishes.

Reconnecting the isolated populations that currently occupy the watershed and establishing a large genetically pure migratory population will provide some much needed resilience to climate change for Rio Grande cutthroat trout.

As wildfire and drought continue to impact the region, the availability of high quality diverse habitats in a well-connected system allows fish to move when temperatures become too warm or a wildfire renders their current habitat unsuitable. Migratory populations are able to recolonize the disturbed habitat once it has recovered.

A restoration project of this magnitude requires a long-term vision and commitment that can't be replicated in every watershed. However, where possible the restoration of other migratory populations of Rio Grande cutthroat trout in well-connected habitat free of non-natives should be a conservation priority.



Bank stabilization work on Comanche Creek. Photo by Bill Schudlich.