

# Central Valley and Sierra Nevada

## 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)



## Sacramento Redband Trout

Category	Status	Explanation
Listing status	Yellow	Sensitive species (USFS, BLM) Species of Special Concern (CA, OR)
Current range	Yellow	22 percent of historical habitat currently occupied
Historical range	Yellow	3,500 stream miles historically occupied + Goose, Abert Lakes
Climate change	Red	Drought, loss of snowpack, and wildfires are major issues
Energy development	Yellow	Range overlaps where renewable energy from the Northwest and gas from Wyoming access California's energy grid – pipelines and transmission of moderate concern
Non-native species	Yellow	Introduced rainbow trout pose limited competition and hybridization risk; brown trout pose competition and predation risk; brook trout pose a competition risk; largemouth bass present in lower Chewaucan River
Water demand	Yellow	Many streams have diversions in lower reaches
Data issues	Yellow	Stream flow and temperature data need improving

## Eagle Lake Rainbow Trout

Category	Status	Explanation
Listing status	Yellow	Sensitive species (USFS), Species of Special Concern (CA), under evaluation as Threatened under Endangered Species Act
Current range	Green	38 percent of historical habitat currently occupied
Historical range	Red	Only 34 stream miles historically occupied + Eagle Lake
Climate change	Red	Drought, loss of snowpack, and wildfires are major issues
Energy development	Green	No known significant energy development issues
Non-native species	Red	Introduced brook trout pose competition risk
Water demand	Green	Diversions in headwaters and lake addressed in recent years
Data issues	Yellow	Stream flow and temperature data need improving



*Oncorhynchus mykiss aguabonita*

## California Golden Trout

Category	Status	Explanation
Listing status	Yellow	Sensitive species (USFS) Species of Special Concern (CA)
Current range	Green	49 percent of historical habitat currently occupied
Historical range	Red	Historical distribution poorly understood, but range covered approximately 570,000 acres
Climate change	Red	Drought, loss of snowpack, and wildfires are major issues
Energy development	Green	No known significant energy development issues
Non-native species	Red	Introduced rainbow trout pose competition and hybridization risk; brown trout pose competition and predation risk
Water demand	Green	No known significant water demand issues
Data issues	Yellow	Stream flow and temperature data need improving

## Little Kern Golden Trout

Category	Status	Explanation
Listing status	Red	ESA Threatened Species of Special Concern (CA)
Current range	Green	100 percent of historical habitat currently occupied
Historical range	Red	Only 100 stream miles historically occupied
Climate change	Red	Drought, loss of snowpack, and wildfires are major issues
Energy development	Green	No known significant energy development issues
Non-native species	Yellow	Non-native species present downstream below natural barrier
Water demand	Green	No known significant water demand issues
Data issues	Yellow	Stream flow and temperature data need improving

## Kern River Rainbow Trout

Category	Status	Explanation
Listing status	Yellow	Sensitive species (USFS) Species of Special Concern (CA)
Current range	Yellow	15 percent of historical habitat currently occupied
Historical range	Red	Historical distribution poorly understood, but range covered approximately 560,000 acres
Climate change	Red	Drought, loss of snowpack, and wildfires are major issues
Energy development	Green	No known significant energy development issues
Non-native species	Yellow	Introduced rainbow trout pose competition and hybridization risk; brown trout pose competition and predation risk; brook trout pose a competition risk
Water demand	Green	No known significant water demand issues
Data issues	Red	Poorly documented distribution and abundance; stream flow and temperature data need improving

### Sacramento Redband Trout (*Oncorhynchus mykiss stonei*)

Sacramento redband trout is the collective name for redband trout in the Chewaucan, Goose Lake, Warner Valley and McCloud River basins. Although the trout in each of these basins is considered somewhat distinct, genetic analysis has confirmed a shared history within the headwaters of what is or once was the Sacramento River basin (1).

Chewaucan, Goose Lake and Warner Valley populations occur in the high desert of northwestern California and south-central Oregon. These redband are a hold-over from the cooler, wetter climates of the Pleistocene and became increasingly isolated as the regional climate grew warmer and drier. They are mainly confined to headwater streams, except in Goose Lake and the Warner Valley lakes, all shallow alkaline lakes which boast lake-dwelling populations. In extremely dry years – for example, during the Dust Bowl years and during California’s current drought (2012 – 2015) – the lakes completely dry up during the summer dry season and must be recolonized during wet years from the headwaters populations.

The [McCloud River populations](#) persist in spring-fed streams that drain the southern slopes of Mount Shasta in northeastern California. Tributary streams north of the mainstem McCloud infiltrate

into the area’s porous volcanic geology and are typically disconnected from other surface waters. The mainstem McCloud and its southern, moderate-gradient tributaries are isolated from the larger Sacramento River basin by the Upper and Middle Falls.

Given the highly variable environmental conditions in the range of these populations, connectivity between populations is critical for allowing recolonization following local extinction events related to drought or disturbances like wildfire. Eliminating fish passage barriers in the basin remains the highest conservation priority for the subspecies. Threats for the Chewaucan, Goose Lake and Warner Valley populations include flow alteration associated with dams and diversions and sedimentation and channelization associated with livestock grazing and pasture irrigation.

For all populations and especially in the McCloud basin, the competition, exclusion and hybridization impacts of non-native trout introductions serve as an additional threat. Beginning in the early part of the 20th Century, stocked hatchery fish hybridized with redband in the McCloud. By the early 1970s, the distribution of non-introgressed, native fish was reduced to headwater tributaries, with the most distinct form limited to a 1.25-mile section of Sheephaven Creek. An impressive restoration effort since then has removed

rainbow trout from many streams and transplanted the subspecies to historically fishless streams in the basin, but rainbow trout still persist in the mainstem McCloud River. As a result, redband in the McCloud are isolated in small, fragmented streams and vulnerable to chronic habitat stressors associated with grazing and logging and acute threats such as stream drying associated with prolonged drought.

### Eagle Lake Rainbow Trout (*Oncorhynchus mykiss aquilarum*)

[Eagle Lake rainbow trout](#) are a lake-dwelling subspecies of rainbow trout found in Eagle Lake and its tributary streams on the east side of the Sierra Nevada in Lassen County, California. First described by J. O. Snyder in 1917, Eagle Lake rainbow trout were initially thought to be the hybrid offspring of Lahontan cutthroat and introduced rainbow trout. Recent genetic studies have shown the subspecies to be a distinct form of rainbow trout that colonized Eagle Lake through an ancient connection to the Feather River and the larger Sacramento River system.

Eagle Lake rainbow trout are uniquely adapted to the conditions in Eagle Lake, a 24,000 acre alkaline (pH 8 – 9) lake seasonally connected to its source tributaries only during the late spring snowmelt. Historically, long-lived and large adults – up

to 11 years old and 24 inches long – ran up the largest tributaries to reproduce in the spring-fed headwater streams. By the 1950s, overfishing and habitat degradation from logging, grazing and road development caused population declines so severe that the California Department of Fish and Game (now Department of Fish and Wildlife) initiated a hatchery program from the few remaining fish. In 2012, the US Fish and Wildlife Service funded and built a fish ladder at the mouth of Pine Creek to allow for passage to historic spawning grounds. Combined with a trap-and-haul program by the California Department of Fish and Wildlife, after years of being completely sustained by the hatchery, young Eagle Lake rainbow trout have been recently discovered in the headwaters of Pine Creek, providing hope that natural populations can once again flourish. Nonetheless, the legacies of habitat degradation - loss of meadow habitats and altered hydrology exacerbated by declines in winter snowpack and drought - and the homogenization of the subspecies through hatchery fish still threaten the survival of Eagle Lake rainbow trout. Other threats include competition with introduced brook trout and natural factors that threaten any species with a limited distribution.

**TROUT OF THE KERN PLATEAU**  
**–California Golden Trout (*Oncorhynchus mykiss aguabonita*), Little Kern Golden Trout (*Oncorhynchus mykiss whitei*) and Kern River Rainbow Trout (*Oncorhynchus mykiss gilberti*)**

The Kern River basin drains the southern extent of the Sierra Nevada in California. The system was connected to the San Joaquin River and first occupied by ancestral rainbow trout around 10,000 years ago. As the connection to the San Joaquin River valley and Tule Lake dried up and natural barriers within the system developed, three distinct forms of trout developed through isolation: the Little Kern golden trout found in the Little Kern River, the California golden trout found in the South Fork Kern River and Golden Trout Creek basins and the Kern River rainbow trout found in the mainstem and tributaries of the Kern River.

Beginning in the late 1800s and continuing through the 1960s, rainbow and brown trout were widely introduced into the Kern River basin and the primary

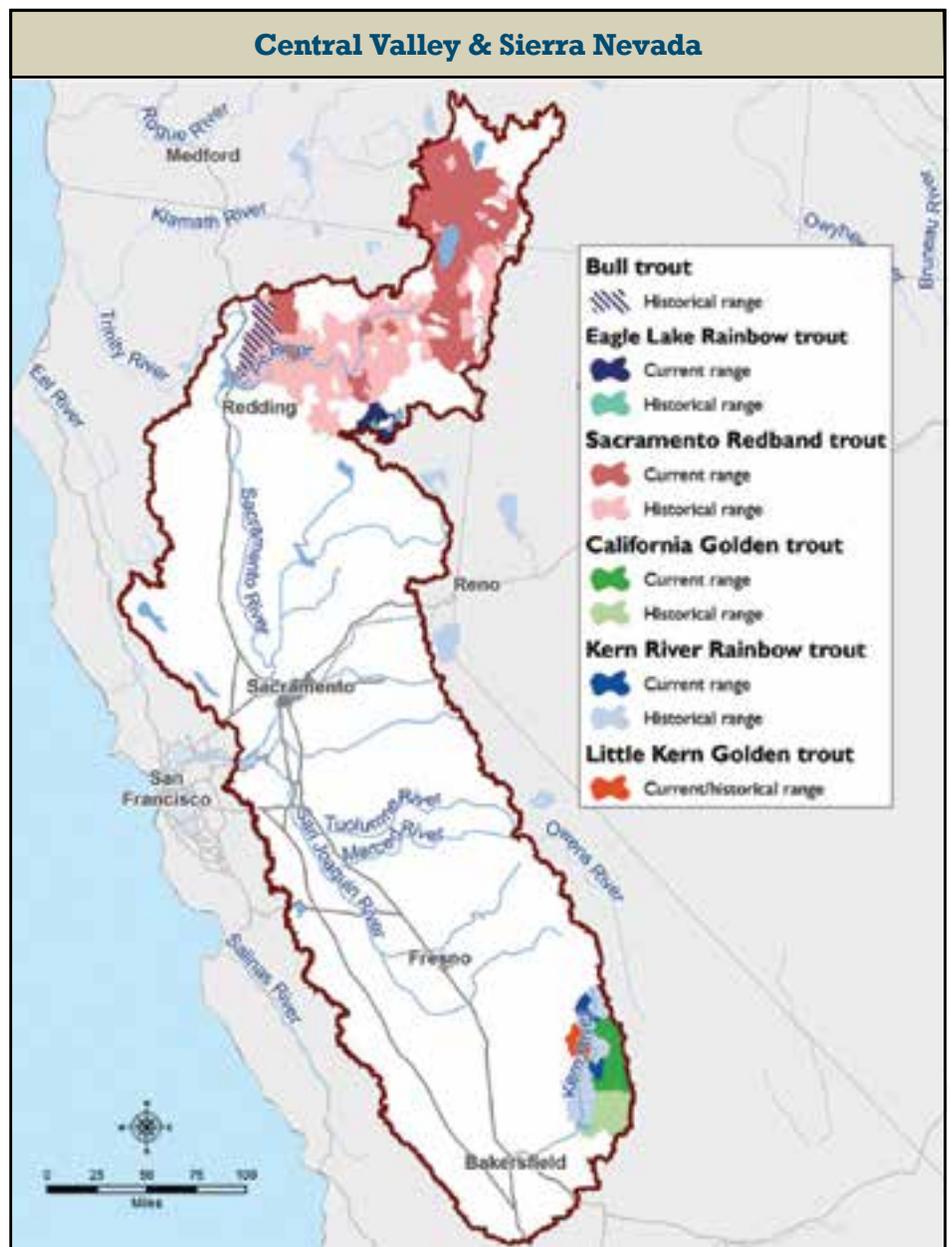
conservation issue for all three subspecies is hybridization with non-native species. Widespread restoration efforts – including construction of artificial barriers in the range of California golden trout and piscicide treatments of streams in the range of California golden trout and Little Kern golden trout – have eliminated non-native trout from portions of the basin, but the genetic legacy and loss of historical habitat remain major consequences of the introductions. Introgression was the primary motivation for the listing of Little Kern golden trout as Threatened under the Endangered Species Act in 1978.

The majority of the remaining

distribution for the species is found in US Forest Service wilderness areas or Sequoia National Park and Monument such that very few development related stressors exist beyond the widespread legacy and ongoing effects of grazing meadows that the California golden trout depends upon have been particularly impacted. Climate change threats include drought, altered fire regimes, warmer summer stream temperatures and decreased snowpack and associated late summer stream flows.

**Regional Trends**

By virtue of time and the isolating effects of an active geology and climate, multiple



Historical and current distributions of native trout and char in the Central Valley/Sierras Region.

distinct trout species and subspecies have evolved in the Sierra Nevada region. All of these species persist in very limited footholds and in often harsh environments above the distributional limits of more widely occurring coastal rainbow trout (including steelhead). All these unique trout have a precarious existence in the face of increasing threats. The region has already witnessed the loss of bull trout.

The native trout of the Sierra Nevada have some of the smallest ranges of any North American trout and populations within the wider ranges of the species are typically fragmented. The Sheephaven Creek population of Sacramento redband trout persists in a mere 1.25 miles of stream that starts at a spring and disappears in porous volcanic rock. Periods of drought can cause portions of the stream to dry up and the overall lack of habitat limits the populations' ability to recolonize or move if a disturbance like wildfire eliminates fish from some portion of the stream. Furthermore, most species exist as populations at the upper headwaters, where their ranges cannot shift upstream in response to warming climate (2).

When non-native trout are introduced into streams where native trout were once the only salmonid, they often out-compete, hybridize and prey on native trout. Since the native fish evolved under local conditions for long periods, the loss of their genetic legacy often means the loss of adaptations for long-term survival in extreme environments.

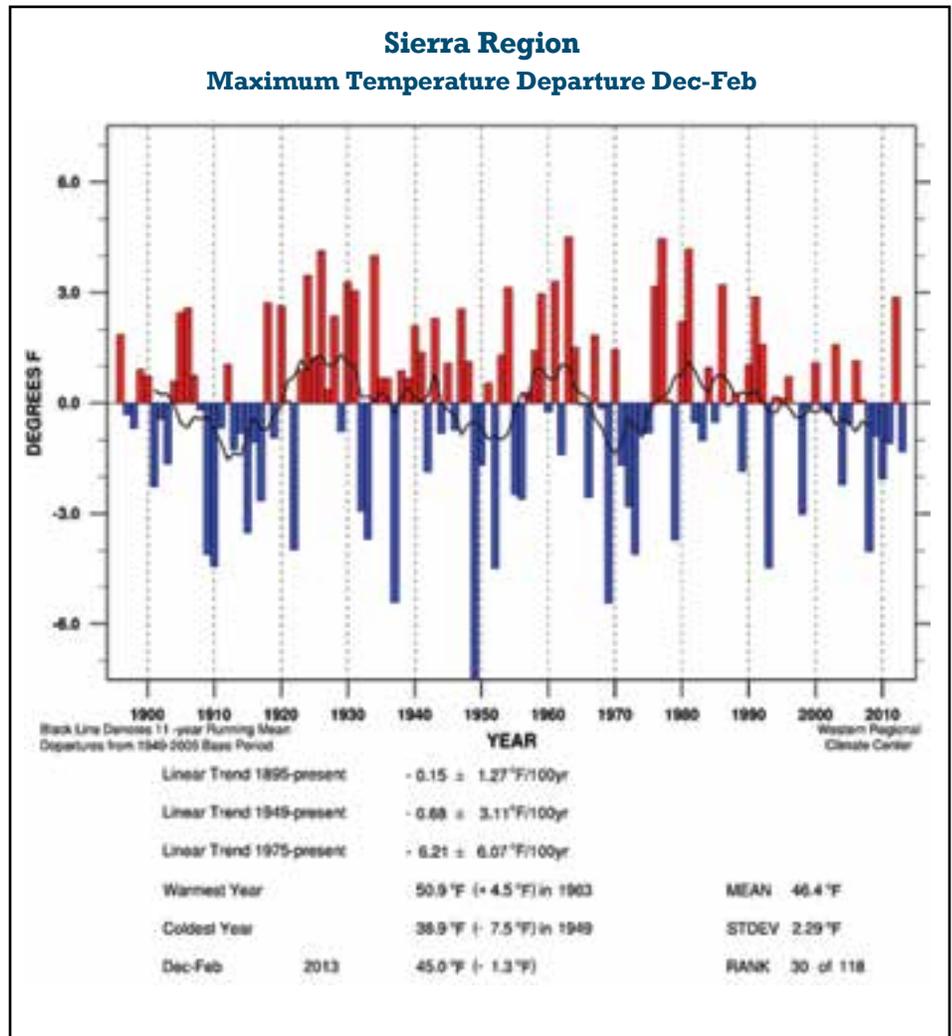
[California](#) is in the fourth year of one of the most severe droughts on record. Beyond the lack of precipitation for providing stream flow and recharging groundwater for storage later in the year, the continued drought in 2015 has been particularly consequential for all species that depend on water – humans and trout included – due to warmer than normal winter temperatures. Following the warmest calendar year on record in California, December 2014 through February 2015 were the warmest in the state's recorded history. These warm temperatures mean that what precipitation does fall in the Sierra Nevada largely falls as rain rather than snow. California's streams typically receive much of their flow from water stored in snowpacks in the highest elevations. Without that stored water and

with decreasing annual precipitation, total stream flow will decrease, low flow periods will be longer and peak flows will shift earlier in the year (3).

Severe droughts are often associated with severe summer wildfire seasons that start earlier and end later than historical seasons. In 2013, the Rim Fire in the Stanislaus National Forest made history as the third largest recorded wildfire in California. The fire started in August and burned for over nine weeks into late October, scorching nearly 260,000 acres. A fire of that size within the remaining range of Eagle Lake rainbow trout, Little Kern golden trout, California golden trout, or Kern River rainbow trout would burn their entire distribution.

There are several restoration strategies that have been widely successful in recovering populations of native Sierra Nevada trout

and more that show promise for the future. Manual or chemical removal of non-native trout above natural or artificial barriers has occurred in the range of Sacramento redband trout, Eagle Lake rainbow trout, Little Kern golden trout and California golden trout as a tool for limiting the impacts of non-native trout and is becoming a more widely accepted tool for such work by the California Department of Fish and Wildlife, which is a cultural shift from the past decade. Translocation of populations of Sacramento redband trout and California golden trout is a strategy for "spreading the risk" of extinction for the inherently vulnerable, small populations. Within the historical habitats of Sierra Nevada trout, meadow restoration is increasingly seen as a tool with promise for sustaining streamflows to benefit high mountain fish populations and downstream water users in cities and farms.



Over 100 years of record, the winter of 2015 is the warmest, nearly 6 degrees F warmer than average. Data from Western Regional Climate Center, Desert Research Institute

SUCCESS STORY:

# Meadow Restoration

Montane meadows can provide habitat for a diverse array of species, lower summer stream temperatures and serve as important groundwater recharge and storage zones (4). Because of this last aspect, the restoration of functioning mountain meadows is widely regarded as a win for both fish and people.

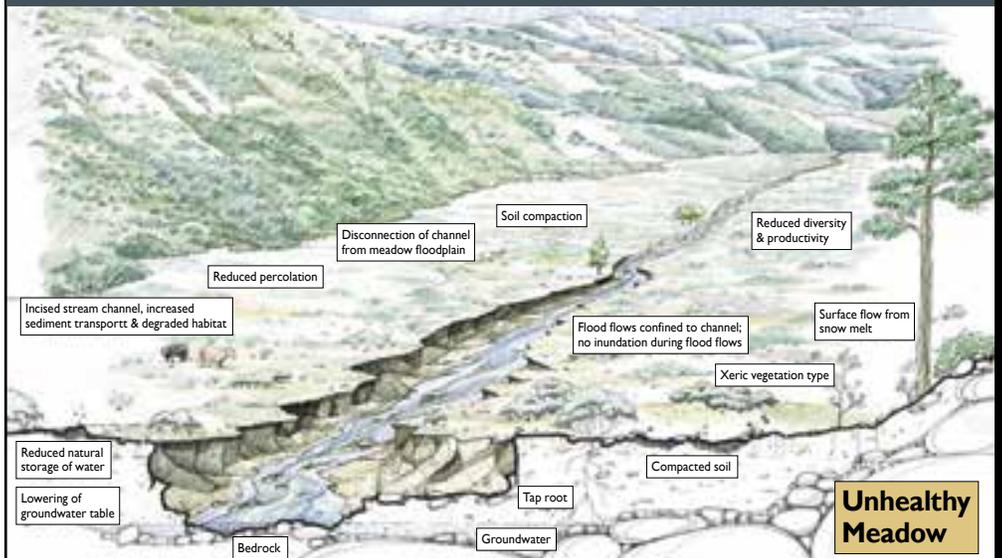
The last century has witnessed widespread degradation of meadows in the Sierra Nevada, the consequence of road construction, over-grazing and development. Over the past 20 years a range of mountain stream and meadow restoration methods has been increasingly applied to bolster upper elevation water retention and slow runoff. One of the main symptoms of a degraded meadow are incised, widened and downcut channels, which limit the ability of peak flows to access the floodplain and provide limited habitat diversity for fish. Meadow restoration helps reconfigure the channel to allow flood waters to spread out over valley bottoms. Fish benefit from increased habitat complexity, increased cover and stream shading, and bolstered supplies of cool groundwater. Downstream water users benefit from prolonged stream flow in summer, when demand is high. Research suggests that restored meadows in the Sierra Nevada could store and release between 50,000 and 500,000 acre-feet of water annually, an amount equivalent to several proposed water storage reservoirs in California (5).

In Pine Creek in the headwaters of Eagle Lake, a partnership of stakeholders including Trout Unlimited is prioritizing the sequence of events necessary for successful meadow restoration to benefit Eagle Lake rainbow trout. The groups believe that cultivating and maintaining collaborative partnerships will serve as the foundation for the recovery and stewardship of Eagle Lake rainbow

trout over the long-term and avert the listing of the subspecies as a Threatened or Endangered species under the Endangered Species Act through recovery of self-

sustaining populations. Key proposed actions include the eradication of non-native brook trout, monitoring of key habitat variables and assessment of trends over time.

**Degraded meadow system.** Deeply eroded stream channel directs snowmelt quickly downstream, and drawing down meadow water tables resulting in drier community vegetation and more conifer encroachment. Little habitat exists for meadow-dependent species when there are streams with warm water and periods of lower or no flow.



**Healthy meadow system.** Naturally meandering creeks support native fish, riparian cover including willow and alder thickets, lush wetland vegetation, healthy soil and high levels of infiltration into groundwater which subsequently recharges streams during drier months and creates rich biological diversity for meadow-dependent species. Illustration by American Rivers.

