# Little Kern Golden Trout

*(Oncorhynchus mykiss whitei)*



**Data:**

1984 Revised Fishery Management Plan for the Little Kern Golden Trout

2014 Genetic Monitoring Plan

2022 Monitoring Report for Little Kern Grazing Allotment Little Kern Golden Trout Critical Habitat

Draft Range-wide Assessment of Little Kern Golden Trout (CDFW unpublished)

**Partners:**

California Department of Fish and Wildlife (CDFW), US Fish and Wildlife Service (USFWS), National Park Service, Sequoia National Park (NPS), US Forest Service, Sequoia National Forest (USFS)

# Introduction

The Little Kern Golden Trout (*Oncorhynchus mykiss whitei*; hereafter LKGT) is one of three subspecies of Rainbow Trout endemic to the Kern River drainage (Tulare County, CA), occupying this area alongside the California Golden Trout (*O. mykiss aguabonita*) and the Kern River Rainbow Trout (*O. mykiss gilberti*; RBT). A waterfall separating the Little Kern River from the remainder of the greater Kern River drainage acted as a natural barrier, allowing Little Kern Golden Trout to develop in isolation from these other subspecies. Little Kern Golden Trout are brightly colored fish, with olive green backs, red-orange cheeks and lateral bands, and gold-colored sides below their lateral lines. They are similar in appearance to California Golden Trout, though they typically have more spots on the head and below the lateral line, and their coloration often presents darker or more subdued (Figure 1); because of their relatively unique appearance they are highly sought-after by recreational anglers.

Extensive stocking of non-native trout in the Little Kern basin, subsequent hybridization with non-native Rainbow Trout strains, and competition with Eastern Brook Trout (*Salvelinus fontinalis*) and Brown Trout (*Salmo trutta*) contributed to precipitous declines in LKGT populations. These declines were further exacerbated by environmental degradation associated with logging and grazing, which reduced the amount of suitable stream habitat in their native range. In 1978 LKGT were listed as a Threatened species under the Endangered Species Act (ESA), citing

*Figure 1. Little Kern Golden Trout. Photo Credit CDFW*

concerns about their limited distribution, declining population abundance, the introgression of non-native genetics, and reduced habitat quality. They are also recognized as a Species of Special Concern by the State. LKGT are currently managed as a Heritage and Wild Trout species by the California Department of Fish and Wildlife (CDFW). CDFW prepared a management plan for the species in 1978 (Christenson 1978) and revised the plan in 1984 (Christenson 1984). This plan also serves as a de facto Federal recovery plan but is in need of updating by the recovery partners.

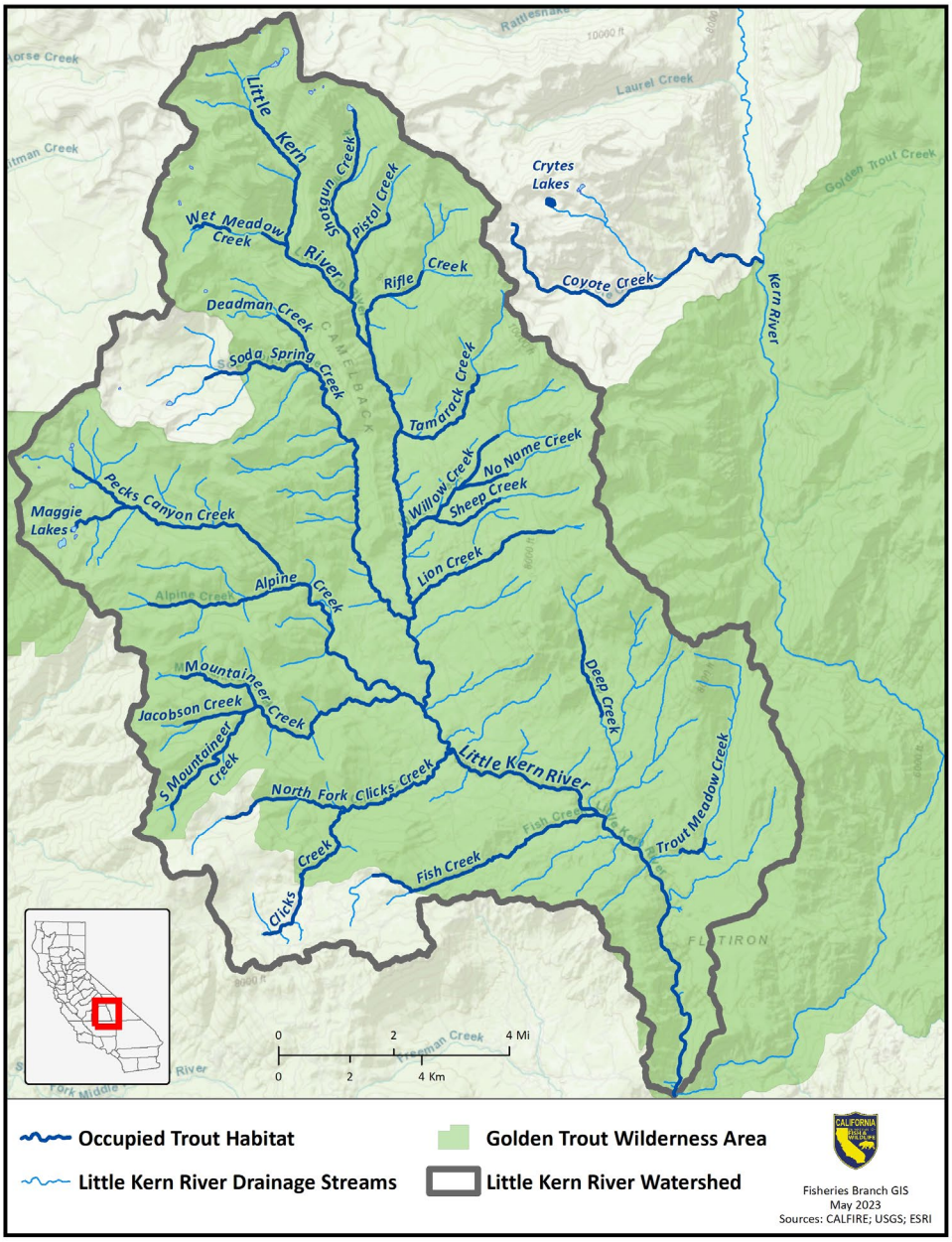


*Figure 2. Distribution of the Little Kern Golden Trout illustrated by thick, dark blue lines.*

# Historical and Current Distribution

Little Kern Golden Trout historically occupied 160 km of the Little Kern River basin above the lowest fish migration barrier upstream of the confluence with the Kern River ("Forks of the Kern"). By the time they were designated as Threatened in 1978, the distribution of their unhybridized population had diminished to 10% (16 km) of their historical range: five subpopulations, occupying six headwater streams in their endemic basin (Soda Spring Creek, Deadman Creek, Wet Meadows Creek, Willow and Sheep creeks, Fish Creek) and two additional introduced populations in the greater Kern River drainage (Coyote Creek and one of the Crytes lakes).

Due to habitat restoration efforts and non-native trout removals, the current distribution of LKGT has expanded to include approximately 138 km of streams within the Little Kern River basin (Figure 2).

# Habitat Requirements

Little Kern Golden Trout evolved in isolation in the Little Kern River basin, and are adapted to the small, meandering stream habitat present there. Habitat in the Little Kern watershed is typified by clear, cold water (3-22° C) with

little riparian vegetation. LKGT require suitable spawning gravels, perennial flows with oxygen levels greater than 5 mg/L, and the provision of other life stage requirements: food (aquatic and terrestrial insects), cover, rearing habitat and protection from disturbances that degrade the water quality and stream bed. Most of the Little Kern watershed has been designated as critical habitat for the LKGT by the USFWS.

# Summary of Management Actions

In the 1940's CDFW biologists recognized the impact that non-native trout were having on LKGT populations and advocated for the immediate cessation of harmful stocking practices. Then in the 1970's, CDFW biologists began an effort to eliminate non-native trout from the basin to allow pure populations of LKGT to spread across their historical range. The basin was divided into subunits based on the location of the six pure populations of LKGT identified from early genetics analyses. The idea was to pair newly recovered waters with the known pure LKGT populations to expand the distribution of the pure populations. Tributaries to the Little Kern River are generally steep and many natural barriers to upstream movement are present. However, numerous man-made barriers were also constructed to facilitate the recovery effort. Rotenone and antimycin were used to systematically eliminate non-native or introgressed trout populations, and LKGT from nearby streams were used to establish new LKGT populations in recovered streams. This process moved very slowly and carefully. Recovered streams were monitored to ensure chemical treatments were successful prior to stocking with LKGT.

Beginning in 1984, some local sportsmen's organizations expressed concern the recovery program was moving too slowly and insisted that CDFW accelerate their efforts. Beginning in 1985 CDFW brought LKGT from the basin into Kern River Planting Base (KRPB), near Kernville, to establish several broodstocks. A building was constructed to isolate the LKGT from the catchable-sized rainbow trout distributed to area waters from this facility. The five broodstock populations, each corresponding to a pure population identified at the time of their initial listing under the ESA, were marked with various fin clips for identification. LKGT were spawned and their offspring were planted in sections of stream newly cleared of non-native trout. The fish produced at the KRPB were never planted back into the sections of stream where the broodstock were collected to avoid negative impacts to known, pure populations of LKGT. By 1997, it was thought that the entire basin had been restored to LKGT through a program of chemical treatments, transplants, and supplementation with hatchery produced LKGT. However, in the late 1990's CDFW biologists suspected, and then later confirmed, that some of the fish produced at the KRPB had been inadvertently hybridized with non-native Rainbow Trout.

As new genetic tools emerged, more robust methods became available to describe the genetic diversity of LKGT and the extent of introgressive hybridization with non-native Rainbow Trout. These new methods were applied to samples opportunistically collected from 1995-2011, results of which were used to inform the 2014 Genetic Management Plan (GMP). In 2011, the Lion Fire burned more than 20,000 acres of the watershed; some of the most intensely burned habitat coincided with the occurrences of important recovery populations. Suddenly, the need to comprehensively survey LKGT populations became more urgent, and in 2012 a range-wide assessment of LKGT was initiated by CDFW and partners from the USFWS, US Forest Service, and National Park Service to:

- document presence/absence throughout extent of their range
- document species assemblages in creeks in the Little Kern drainage
- identify, assess, measure, and photograph barriers to fish passage (natural and man-made)
- evaluate and document habitat conditions
- collect tissue samples for genetic analyses with a more

robust collection of Single Nucleotide Polymorphism (SNP) markers to evaluate changes in heterozygosity, update assessment of introgression, and determine if new methods support changing the management units identified in the 2014 GMP

- collect data necessary to back-calculate length-at-age and build growth curves for various populations of LKGT.

The range-wide assessment documented 37.2 km of occupied habitat in the mainstem of the Little Kern River and an additional 101.1 km of occupied stream habitat in its tributaries (total mileage of approximately 138 km). Mean LKGT densities, estimated from multipass depletion electrofishing surveys were variable, ranging from >625 fish/km (e.g., South Mountaineer, Wet Meadow, Tamarack, Clicks, Soda Springs, Pistol, and Alpine creeks) to <313 fish/km (e.g., Maggie Lakes Outlet, North Fork Clicks, Trout Meadow, No Name, and Willow creeks). It is noteworthy that Trout Meadow and No Name creeks were within the high-intensity burn-zone of the 2011 Lion Fire. Trout handled during these surveys ranged from 21 to 286 mm in total length, with estimated ages from <1 to 7 years. Most fish were estimated to be age-2 (29%) or age-3(35%).

Genetic analyses revealed that of the three native trout subspecies in the larger Kern River watershed, LKGT have the lowest levels of genetic diversity. This suggests that these typically small, isolated populations are extremely vulnerable to deleterious effects of random genetic drift and stochastic catastrophic events (e.g., fire or drought) and future intervention (i.e., genetic rescue) may be necessary to maintain populations with robust genetics health metrics. Results also indicated that some populations experienced bottlenecks, and as a result, potentially exhibit negative effects associated with inbreeding. The assessment also indicated high levels of introgression in Middle and Lower Pecks Canyon creeks, Upper and Lower Mountaineer creeks, South Mountaineer Creek, Maggie Lakes, Little Kern River between its confluences with Clicks and Trout Meadow Creeks, Jacobson Creek, Alpine Creek, Lower Shotgun Creek, and Little Kern River near Lion Creek. Low (less than 5%) to moderate (less than 10%) introgression was observed in the remaining subpopulations (Figure 3).

Currently, genetic analyses are underway to explore the utility of identifying distinct LKGT management units within the Little Kern basin. This work could form the foundation of a genetic rescue plan to be implemented, if necessary, to bolster the genetic health of LKGT populations and avoid catastrophic losses that often befall small populations. Fisheries biologists and geneticists will thoroughly consider tradeoffs between the benefits of maintaining diversity among distinct population units that may facilitate local adaptation against the consequences of the susceptibility of small, isolated populations to harmful effects from random genetic drift and inbreeding depression (e.g., loss of evolutionary potential to respond to a changing climate, negative survival/reproductive consequences from inbreeding depression, etc.).

# Sportfishing

Little Kern Golden Trout are found almost entirely within the USFS designated Golden Trout Wilderness and are generally present in moderate to good numbers. Although recognized as threatened under the Federal ESA, the listing package included a special 4(d) rule that allows the state to permit angling. Thus, wildlife managers in the state of California attempt to balance conservation priorities with demand from recreational anglers to provide fishing opportunities for these unique, colorful trout. There is a long history of anglers traveling to the Little Kern basin and enjoying fishing for LKGT as part of their backcountry experience. The California Heritage Trout Challenge, an angling recognition program established by CDFW, features opportunities for native trout angling and promotes angler and public awareness of native trout conservation issues. Many anglers come to the region seeking the LKGT and the other two subspecies of native trout endemic to the larger Kern River drainage in pursuit of completing the Challenge.

All the waters in the Little Kern River drainage are recognized by the California Fish and Game Commission as Heritage and Wild Trout Waters and are open to

recreational angling. For more angling notes, see the Angler's Guide to the Heritage Trout Challenge.

# Threats

## Non-native Fish Concerns

In the late 19th and first half of the 20th century Brown, Brook, Rainbow, and California Golden trout were stocked into the Little Kern watershed. Stocking ceased in 1944 because of concerns about hybridization with Rainbow Trout and competition for resources and predation by Brook Trout and Brown Trout. Brook Trout and Brown Trout no longer exist in the basin but hybridization with Rainbow Trout remains one of the primary threats to the species.

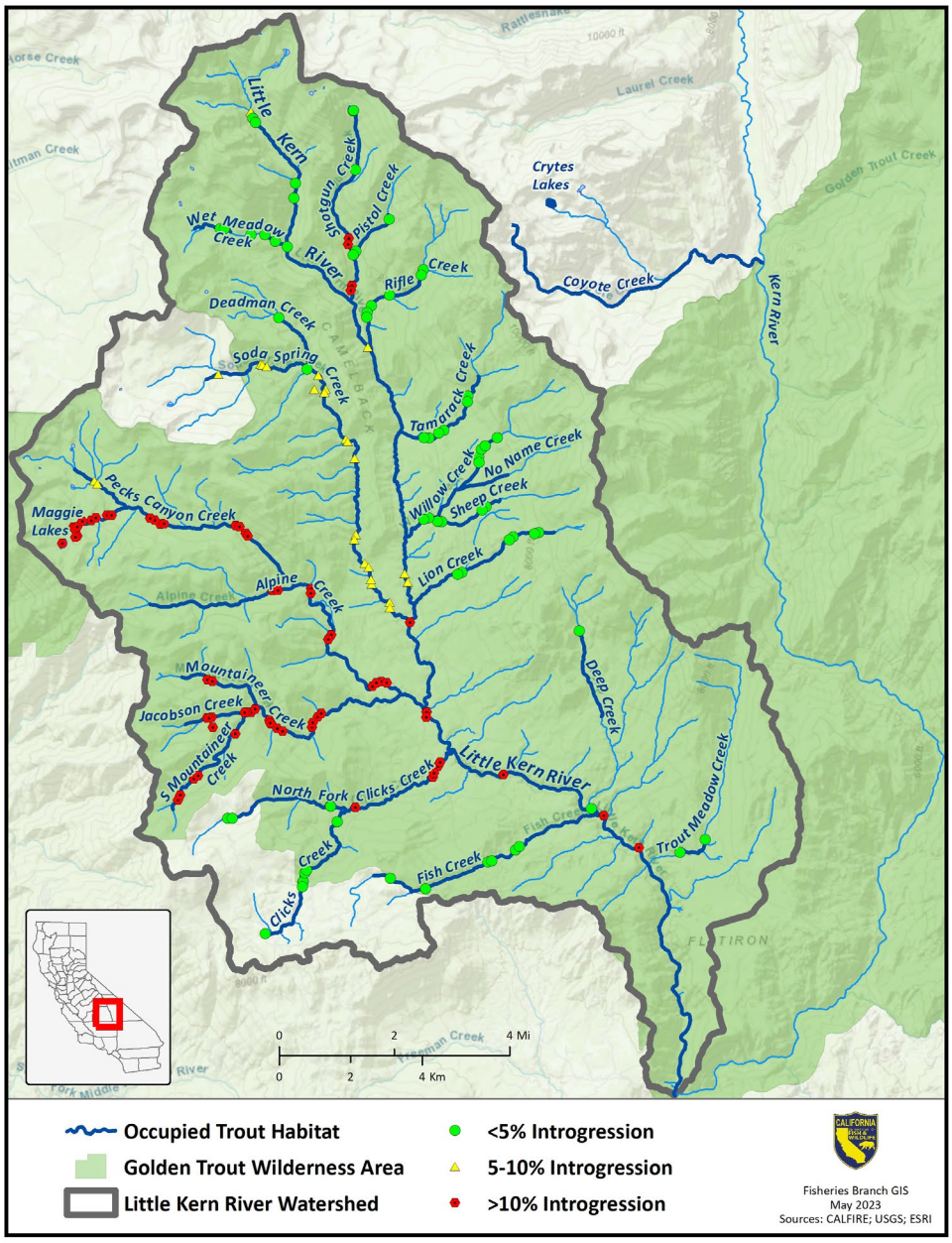


*Figure 3. Extent of introgressive hybridization among Little Kern Golden Trout populations.*

## Genetic Concerns

Despite efforts in the 1970's, 1980's, and 1990's to eliminate non-native trout and restore LKGT throughout the watershed, recent genetic analysis has identified high levels of hybridization in major portions of the watershed, as much as 50% genetic influence from Rainbow Trout has been documented in some creeks. Populations with low levels of introgression (less than 5%) are typically protected from hybridized populations by natural waterfall barriers.

Analysis of genetic samples collected in 2012-2018 showed low levels of heterozygosity across LKGT populations, especially among populations with low rates of introgression. In most cases these populations are isolated from one another by natural barriers eliminating any chance of genetic exchange. Low levels of genetic diversity may limit the ability of LKGT to adapt to a rapidly changing climate.

## Habitat Degradation

Although the Little Kern watershed is relatively large, the creeks occupied by LKGT with low introgression rates are small and isolated. These creeks are susceptible to drought conditions including desiccation, increased summer water temperatures, and freezing solid during the winter. Erosion, sedimentation, landslides, and increased water temperatures resulting from recent wildfire activity also

threaten the habitat of Little Kern Golden Trout.

Protection afforded by the watershed's critical habitat designation, as well as its remote nature, has helped to limit (or eliminate) several anthropogenic threats to habitat such as land development, timber harvest, and water diversion. Grazing occurs throughout the watershed and has been known to deteriorate meadow and riparian habitat. While these impacts may not be the most pressing threat to the continued existence of the LKGT, habitat degradation can impact the size, abundance, physical condition, and demographic structure of populations. In addition to trout, this degradation can impact other riparian and instream dependent species. Efforts undertaken to reduce impacts from grazing may take years to be fully realized, as recovery involves geomorphic processes that take place over long timescales. While areas impacted by grazing are good candidates for restoration, long term studies within the Little Kern River watershed suggest ecological conditions within grazing areas are currently stable, rather than declining.

### Climate Change

Threats to the LKGT habitat have been exacerbated by the effects of climate change. While drought periods are part of the natural variation of the Mediterranean hydrologic cycle in California, their consequences are intensified by human activity and global climate change. For example, anthropogenic warming has increased the likelihood of experiencing co-occurring warm and dry conditions in Mediterranean climate zones, like those that resulted in drought conditions throughout California from 2012-2016. Fisheries managers in California are planning for a future with longer, more frequent, and more severe drought conditions. Climate change is a defining environmental problem challenging global biodiversity today, in particular for those species that are found in freshwater environments and endemic to a single watershed.

During extreme drought conditions, the headwaters of several tributaries in the Little Kern watershed significantly receded, considerably reducing the amount of available habitat. Wildfires are occurring with increasing frequency and intensity within the Little Kern watershed. Recent fires including the Lion Fire (2011), Lion Fire (2017), and Castle Fire (2020) have impacted genetically important populations. For instance, surveys in 2021, following the Castle Fire, showed a considerable reduction in available habitat in the headwaters of Fish Creek and Clicks Creek. Additionally, areas impacted by wildfires are susceptible to damage from flooding, erosion, and adverse water quality conditions during high flow events.

# Conservation

## Priority actions to improve the status of Little Kern Golden Trout

### Population Surveys, genetic analyses, and fish population manipulation

**Key actions will include:**

- Conducting regularly timed standardized surveys and genetic analyses (i.e., long-term monitoring) to evaluate trends in population dynamics.
- Using the information from the range-wide assessment and recent genetics analyses to inform the USFWS 5-year status review, to update the LKGT management/recovery plan, and to update the genetic management plan. In the revised plan, outline a framework to eliminate introgressed trout populations, manage, and further restore LKGT in the basin.

### LKGT Habitat Manipulations

Restoration of LKGT habitat will have to address both habitat quality issues and issues of spatial limitations. Current efforts to manage LKGT have been directed toward improving in-stream and meadow conditions and restoring limited stream fragments.

**Primary Habitat Actions to be addressed:**

- Improve riparian and instream habitat.
- Perform a thorough, watershed-wide barrier evaluation; then establish and/or maintain barriers necessary to protect populations with low levels of introgression from RBT.

- Evaluate the potential for restoring connectivity between isolated populations of pure LKGT.
- Evaluate public and private land management practices to improve habitat quality.
- Monitor and evaluate impacts from catastrophic events like fire and drought.
- Continue interagency cooperation to include improved fire management activities (water transfers) to reduce the possible introduction of harmful organisms.

### Expand Education and Outreach programs to garner public support for LKGT

**Priority Actions to be addressed:**

- Expand public education efforts regarding LKGT restoration efforts.
- Update and replace informational signage that may have been destroyed by recent wildfires; include information about ongoing LKGT recovery actions.
- Expand interagency coordination and collaboration.
- Enforcement of State Fish & Game laws to protect Little Kern golden trout

### Data Shortfalls

Recent genetic tissue collections covered the entire watershed, however, very few samples were collected from some streams with small populations. More samples would be beneficial to better understand the levels of hybridization and heterozygosity in these populations.

Several recent wildfires have occurred in the headwaters of tributaries with genetically important populations. The long-term impacts of these fires on the population density and extent of occupied habitat as well as the post fire recovery are not well known. Several of these tributaries have seasonal and permanent barriers that may impede post-fire recolonization of habitat.

## WNTI Completed or Ongoing Projects

- Little Kern Golden Trout Population Assessment and Post Fire Monitoring/Habitat Assessment (2012)—$40,000

## Literature

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