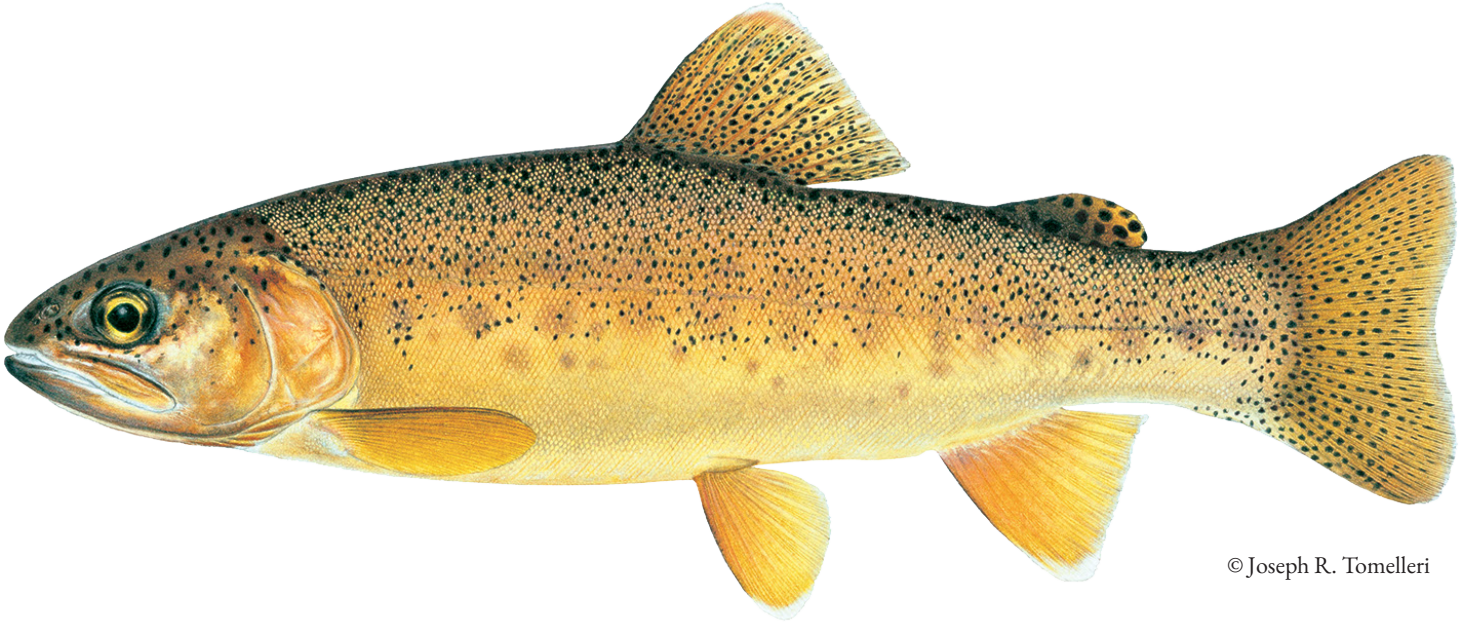
Gila Trout

(Oncorhynchus gilae)



Data:

Gila Trout Recovery Plan - 2022

Partners: Arizona Game and Fish Department, New Mexico Department of Game and Fish, U.S. Fish and Wildlife Service, U.S. Forest Service

Introduction

The Gila trout (*Oncorhynchus gilae*) is endemic to mountain streams in the Gila, San Francisco, Agua Fria, and Verde River drainages in New Mexico and Arizona. Although Gila trout had been known in the upper Gila River basin since at least 1885, the species was not described until 1950, by which time its distribution had been dramatically reduced.

The Gila Trout was originally recognized as endangered under the Federal Endangered Species Preservation Act of 1966 (U.S. Fish and Wildlife Service, 1967). Federal designated status of the fish as endangered was continued under the Endangered Species Act of 1973 until 2006 when the species was down-listed to threatened (U.S. Fish and Wildlife Service, 2006). The Gila Trout was listed as endangered by the New Mexico Department of Game and Fish in 1975 under the Wildlife Conservation Act and was down-listed to threatened in 1988 and remains listed as threatened by the New Mexico Department of Game and Fish. Gila Trout are considered a Species of Concern by the Arizona Game and Fish Department.

Historical and Current Distribution

The extent of the historical distribution of the Gila Trout is not known with certainty. It is known to be native to higher elevation streams in portions of the Gila River

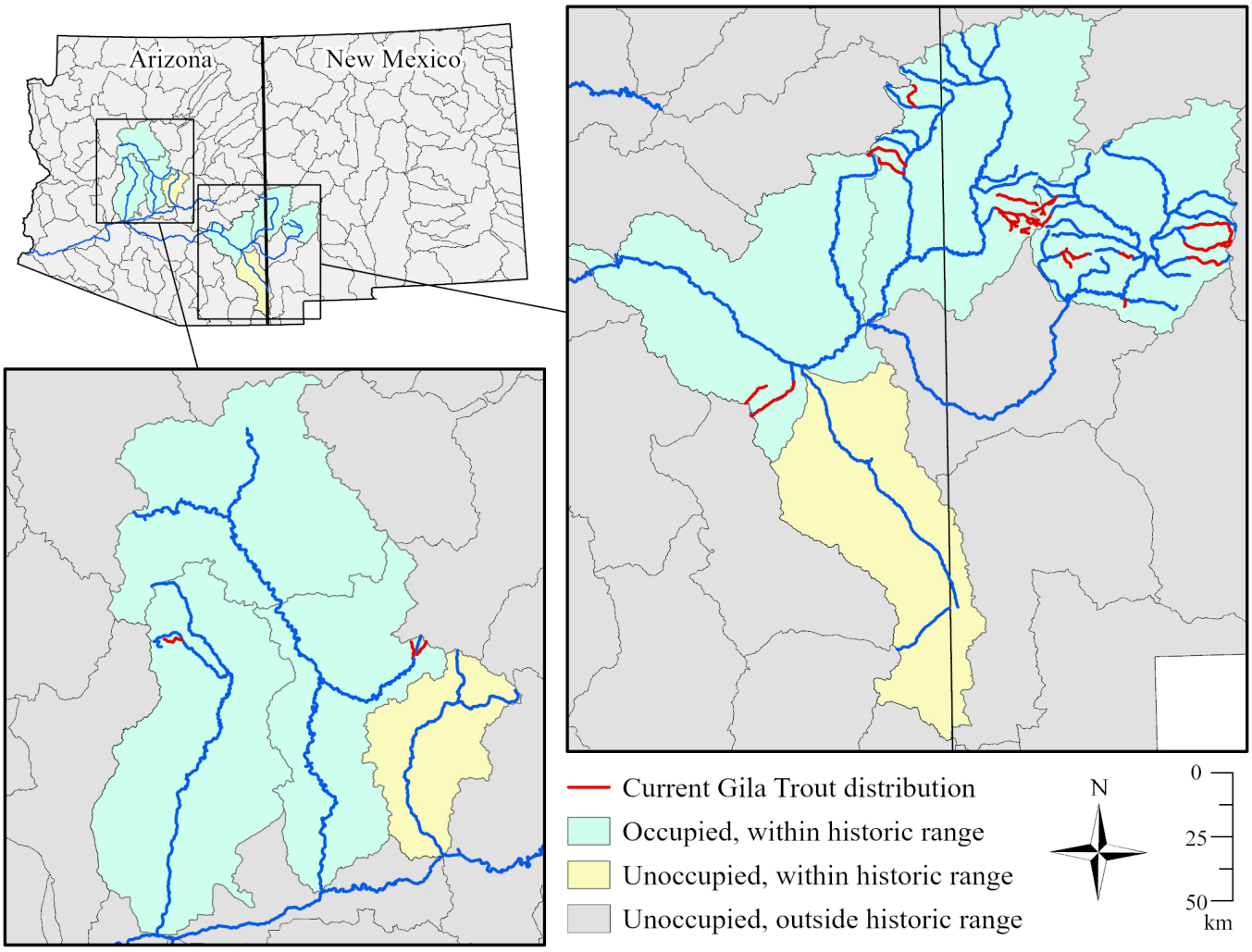


Figure 1. Current distribution of Gila Trout in Arizona and New Mexico (2022)

drainage in New Mexico, San Francisco River drainage in Arizona and New Mexico, and tributaries to the Gila River in Arizona. Currently, there are 24 populations of Gila Trout in the wild. Extant populations occur in the Upper Gila and San Francisco watersheds in New Mexico, and the San Francisco, Middle Gila, Agua Fria, Lower Verde and Blue River watersheds in Arizona (Figure 1). Additionally, the Mora National Fish Health and Technology Center (U.S. Fish and Wildlife Service) maintains captive populations of all five Gila Trout lineages.

Four of the five relict populations are self-sustaining in the wild. The Main Diamond Creek (Upper Gila) population was restored to its original habitat following its loss in the wild from the 1989 Divide Fire. Replicates of the Main Diamond Creek population persist in Sheep Corral Canyon (Upper Gila), lower Little Creek (Upper Gila), and Black Canyon (Upper Gila). Main Diamond lineage Gila Trout were recently stocked in upper Langstroth Creek (Upper Gila) in 2015, but this population was eliminated in the 2021 Johnson Fire.

Similarly, the South Diamond Creek (Upper Gila) population was restored to its original habitat following its loss in the wild from the 1995 Bonner Fire. The South Diamond Creek population is replicated in Grapevine Creek (Agua Fria), Frye Creek (Middle Gila), Willow Creek (Upper Gila), and the Mogollon Creek (Upper Gila) drainage, which includes a portion of the main stem of Mogollon Creek, Trail Canyon, Woodrow Canyon, and South Fork Mogollon Creek. The Whiskey Creek relict population was eliminated by the 2012 Whitewater Baldy Fire but has been replicated in McKenna Creek (Upper Gila), Mineral Creek (Upper Gila), Raspberry Creek (Blue River), and upper Marijilda Creek (Middle Gila). The Whiskey Creek population was also replicated in upper White Creek (Upper Gila), but this population was eliminated in the 2021 Johnson Fire. The Spruce Creek (San Francisco) population was also eliminated by the 2012 Whitewater Baldy Fire but was restored in 2018. The Spruce Creek population is replicated in Big Dry Creek (San Francisco) and Coleman Creek (Blue River). The Iron Creek (Upper Gila) population is replicated in Chase Creek (Lower Verde) and KP Creek (Blue River). Mixed lineage populations were established in Dude Creek (Lower Verde) and Ash Creek (Middle Gila) in 2015, and in lower Marijilda Creek (Middle Gila) in 2020, but Ash Creek was eliminated following a fire in 2017. Natural recruitment has been documented in Dude Creek over the last four years (2018-2022). A third mixed lineage population was recently restored to Whitewater Creek (San Francisco), but natural recruitment has not yet been documented.

Habitat Requirements

Habitat of Gila Trout consists of perennial montane streams ranging from 1,660 m (5,400 ft) to over 2,800 m (9,200 ft) elevation. Suitable stream habitat within the range of the species is situated between about 33° to near 35° north latitude and 107° 45’ to near 112° 15’ west longitude. Streams with suitable habitat for Gila Trout are found in coniferous and mixed woodland, montane coniferous forest, and sub-alpine coniferous forest. Stream flow is characterized by a snowmelt-dominated hydrograph in most years and snowmelt runoff typically begins in February, peaks in March, and gradually decreases through May. Base flow conditions prevail in June and into July. Mean monthly discharge characteristically increases in July through September coinciding with runoff from convectional summer thunderstorms.

Sporadic periods of runoff from winter rains or mid-season snowmelt often result in flows slightly elevated above base levels in December and January. Gila Trout require water temperatures below 25°C (77°F), clean gravel substrate for spawning, continuous stream flow of sufficient quantity to maintain adequate water depth and temperature, and pool habitat that provides refuge during low flow conditions and periods of thermal extremes. Abundant invertebrate prey, cover, and water free from contaminants are also required. Cover typically consists of undercut banks, boulder alcoves, large woody debris, deep pools, exposed root masses of trees at water’s edge, and overhanging vegetation.

Sportfishing

Fishing for Gila Trout was once restricted under its status as an endangered species. The down-listing to threatened in 2006 includes a special provision that allows the states of New Mexico and Arizona to manage the species as a sportfish in select areas for the first time in almost 50 years. Guidelines have been developed to allow for limited sport fishing in specific waters where stocking of non-native trout was replaced by stocking of Gila Trout. All relict populations and most restoration streams continue to be protected from angling. However, allowing for limited angling for a unique native species can increase public knowledge and support for its conservation. Such support may come from both sport fishing enthusiasts and private landowners that might benefit from allowing access to fishing on their property. Involvement from the general public and landowners provides opportunity for increased Gila Trout restoration and should result in a conservation benefit to the species. The U.S. Fish and Wildlife Service and the State wildlife and fisheries management agencies responsible for establishing fishing regulations work to ensure that angling pressure does not prevent, but enhances, progress toward full recovery. Gila Trout angling will continue to be managed by the States as long as the population remains above the recovery threshold.

Threats

Water Condition Concerns

High stream discharge variability is a defining characteristic of the environment to which Gila Trout has adapted. During low-flow years, marginal habitats may become too warm to support trout or surface flow may cease and stream segments may dry.

Pool depth may diminish to the extent that winter mortality of trout is greatly increased. Large magnitude flood events during high flow years may scour stream channels and eliminate year classes of trout. These frequent, recurring extremes in flow conditions are a basic element of the relatively harsh environment that distinguishes habitat of Gila Trout from the typical trout streams of more northern latitudes. Wildfire impacts and drought in recent years have exacerbated the impacts of flow variability.

Non-native Sportfish

Stocking and naturalization of non-native trout within the range of Gila trout and ensuing hybridization, predation, and competition are major causes for the imperiled status of the species. Rainbow Trout and Brown Trout have become naturalized and are widespread within the historical range of Gila Trout. Current stocking of Rainbow Trout is conducted only in stream segments not inhabited by Gila Trout, however, hybridization with Rainbow Trout remains a prominent threat to Gila Trout. A vital component of recovery and long-term survival of Gila Trout is removal of non-native trout through chemical piscicide treatments and electrofishing.

Land Use and Management Issues

Forest management includes activities that directly or indirectly affect species composition, density, and vertical structure of vegetation.

Changes in these forest variables may affect watershed characteristics such as infiltration, runoff, and erosion, and stream habitat characteristics such as sediment transport, nutrient cycling, physical habitat features, and water temperature. Forest management includes silvicultural treatments (e.g., timber harvest, thinning, prescribed burning) and wildfire control. Although much of the habitat of Gila Trout is within designated wilderness where timber harvest is not allowed, historical logging activities likely caused major changes in watershed characteristics and stream morphology.

Poorly managed livestock grazing can degrade watershed condition, stream habitat and riparian environments, resulting in decreased production of salmonids. Historically, widespread, uncontrolled livestock grazing likely contributed to habitat degradation modifications cited as a cause for the decline of Gila Trout. Severe forest

fires capable of extirpating or decimating fish populations are a relatively recent phenomena, resulting from the cumulative effects of historical or ongoing overgrazing by domestic livestock and fire suppression.

Wildfire and Climate Change

Over the last decade, large scale wildfires have occurred on a more regular frequency than historically observed. The immediate aftermath of large-scale, high-severity wildfire can result in ash flows, sediment slugs, and low dissolved oxygen, which results in mortality or in some cases complete eradication of Gila Trout from a stream. In addition, large-scale, high-severity wildfires can result in the degradation of habitat (e.g., sedimentation, increased water temperatures, reduced prey base, and habitat simplification) and a loss of watershed function (e.g., increased peak flows, reduced phreatic groundwaters and stream base flows, high flow variation). These fires have eliminated several populations of Gila Trout and drastically altered the hydrology in many watersheds. Views of the geographic replication of Gila Trout have changed as a result of these fires, and the recovery team is considering alternative methods for recovery actions. Along with large-scale, high-severity wildfires, climate change is also reducing suitable habitat for Gila Trout. Increasing stream temperatures, and shifts in precipitation patterns (e.g., earlier snowmelt, increased storm intensity) are shrinking the geographic range of suitable habitat for Gila Trout.

Population Viability

Hybridization with Rainbow Trout is a major cause for the historical decline and continued imperilment of Gila Trout.

Stocking of Rainbow Trout within the historical range of Gila Trout began in the early 1900's. Although current stocking of Rainbow Trout occurs only in locations considerably distanced from extant Gila Trout populations, Rainbow Trout have become naturalized throughout the range of Gila Trout. Hybridization remains a prominent threat, as evidenced by detection of introgression of Rainbow Trout genes in the Mogollon Creek population. Resolution of the Mogollon Creek hybridization included capture, genetic characterization, and spawning of Gila Trout from Mogollon Creek and restocking after a piscicide treatment to remove all remaining trout. In addition, effective barriers continue to play an important role in the protection of pure Gila Trout populations. A waterfall barrier on the upper West Fork Gila River was thought to be sufficient for protection of Gila Trout upstream; however, Rainbow and Brown trout were able to pass the waterfall during high flow events resulting in hybridization of the Gila Trout population. Augmentation of the waterfall or a new, constructed barrier will be necessary to protect Gila Trout in the upper West Fork Gila River. Hybridization is a threat to Gila Trout because it results in the loss of the unique genetic identity of the species, which represents its evolutionary history and local adaptation to the environments it inhabits.

Continuous monitoring of the genetic structure of pure Gila Trout populations is necessary to ensure maintenance of the genetic purity of recovery populations by rapidly identifying compromised populations. Genetic diversity has been found to be low in the Spruce Creek lineage, and discussions have been ongoing to determine a strategy to preserve and ideally recover some of the genetic diversity in the lineage.

Conservation

Opportunities to Improve the Status of Gila Trout

Gila Trout were once widespread in the upper Gila River Basin but have declined because of hybridization with Rainbow Trout, predation by and competition with Brown and Brook trout, and habitat degradation. The current distribution of Gila Trout consists of 24 populations in headwater stream habitats in New Mexico and Arizona. Recovery efforts are intended to ameliorate the five main threats that have and continue to contribute to the imperiled status of Gila Trout. These efforts will restore the species to drainages within its historical range and ensure long-term survival of the species, as represented

by each of the five known, genetically pure lineages. Recovery of Gila Trout will serve to maintain biological diversity and restore a native faunal component of the Gila River drainage in New Mexico and Arizona. The Recovery Plan for Gila Trout was revised in 2022 to provide updated guidance and prioritization for species recovery actions (U.S. Fish and Wildlife Service, 2022).

Conservation of a species that has evolved and adapted over thousands of years will be accomplished by recovery of Gila Trout. Restoration streams for repatriating Gila Trout are largely on lands managed by the U.S. Forest Service. Many of the potential restoration streams are located within Federally-designated wilderness areas. Proposed actions to reach recovery and protect and secure long-term population viability include 4 priorities:

- Repatriate Gila Trout to at least 280 km (174 mi) of stream within their historical range;
- Replicate each genetic lineage at least three times on landscape with at least one replicate being separated by 34.0 km (21.1 mi) from the other two;
- Establish at least four dendritic metapopulations of Gila Trout; and
- Ensure that Gila Trout recovery streams remain free of non-native salmonids.

Population Manipulations

The strategy is to establish and maintain self-sustaining populations of Gila Trout. A population will be considered established when it sustains itself by natural reproduction and recruitment, is capable of persisting under the range of variation in habitat conditions that occur in the restoration stream, and when the population is protected from invasion by non-native trout.

Key actions include:

- Survey and manage existing Gila Trout populations;
- Re-establish populations with genetically appropriate fish in renovated streams;
- Continue to utilize the Gila Trout broodstock management plan for hatchery propagation of fishes for repatriation to the wild; and
- Prevent reinvasion of non-natives by maintaining or establishing in-stream barriers as needed.

Maintenance of Quality Habitat

Recovery streams that are subject to multiple land-use practices, such as timber harvest or thinning, prescribed fire, livestock grazing, and intensive recreation, should be managed to maintain healthy riparian corridors that promote sufficient habitat conditions for all Gila Trout life functions.

Occupied streams that have unstable or declining conditions should be the focus of remedial actions. Routine monitoring should be used to assess stream conditions.

Key actions include:

- Determine baseline habitat conditions using a standard protocol;
- Complete habitat improvement or protection on a priority basis;
- Develop BMPs, AMPs or FPs for land use activities in Gila Trout drainages to reduce impacts; and
- Manage human impacts through appropriate regulations.

Assessment of Appropriate Regulatory Functions and Mechanisms

Gila Trout recovery depends, in part, on adequate regulatory mechanisms and management programs remaining in existence to ensure that all populations of Gila Trout and their habitats are maintained.

Key actions include:

- Identify regulatory mechanisms, laws, and policies that are insufficient to fulfill all recovery objectives and protect Gila Trout;

- Monitor, prevent, and control disease and/or causative agents, parasites, and pathogens; and
- Implement appropriate laws and regulations to allow Gila Trout populations to persist in light of commercial, scientific, and recreational uses.

Highest Priority Actions for Gila Trout Protection and De-listing

Gila, San Francisco, Agua Fria, Verde River and Tonto Creek Watersheds

- Repatriate Gila Trout to streams within its historical range. Cow Creek in New Mexico has been identified for a potential restoration project;
- Enhance waterfall on the West Fork Gila River to create a barrier to upstream movement of non-native trout. Restoration of Gila Trout to the upper West Fork Gila River is needed to meet recovery goals;
- Build a barrier and remove non-native salmonids from Haigler Creek (Tonto Creek) and establish a recovery population of Gila Trout;
- Habitat restoration projects in Dude and Chase Creeks (Lower Verde);
- Establish and maintain captive propagation methods and conservation hatchery facilities;
- Manage the presence of non-native salmonids in recovery streams;
- Monitor populations and habitat;
- Conduct public education, involvement, and outreach in areas with an interest in Gila Trout; and
- Develop and implement regulations to maintain sustainable Gila Trout populations in recovery streams opened to sport fishing.

Estimated duration and costs for key Gila Trout protection and conservation actions:

	ACTION DURATION	TOTAL ESTIMATED COST
Manage the presence of nonnative salmonids	8 years	$3,437,000
Monitor populations and habitat	10 years	$1,391,000
Conduct public education, involvement, and outreach	10 years	$320,000
Develop and implement regulations	10 years	$351,000

Ongoing Partnerships and Joint Ventures

- Recovery Activities-New Mexico Dept. of Game and Fish, Arizona Game and Fish Dept., U.S. Fish and Wildlife Service, U.S. Forest Service, Trout Unlimited.
- Genetics-University of New Mexico, New Mexico Dept. of Game and Fish, U.S. Fish and Wildlife Service.
- Captive Propagation-U.S. Fish and Wildlife Service Mora National Fish Hatchery and Technology Center.

WNTI Completed or Ongoing Projects

- Black Canyon Barrier Renovation (2007)—$94,775
- Haigler Creek Renovation (2010)—$30,000
- Wallow Fire Habitat Assessment (2012)—$40,000
- Whitewater-Baldy Fire Habitat Assessments (2013)—$53,000; (2014) —$53,000
- Apache and Gila Trout Management Conference (2014)— $2,950
- Willow Creek Fish Barrier (2015)—$70,000
- Gila Trout Restoration Project Informational Signage: Willow Creek, NM (2017)—$1,650
- Get to Know Your Native Trout Gila Trout poster (2017)—$1,500
- Willow Creek Habitat Monitoring (2019)—$2,500

Literature

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