Gila Trout
(Oncorhynchus gilae)

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
New Mexico Ecological Field Office
Albuquerque, New Mexico

5-YEAR REVIEW
Gila Trout *(Oncorhynchus gilae)*

1.0 GENERAL INFORMATION

1.1 Listing History

Species: Gila Trout *(Oncorhynchus gilae)*

Originally listed: Federal Endangered Species Preservation Act of 1966

Reclassification: July 18, 2006

FR citation(s): Federal Register 32: 4001; Federal Register 71: 40657-40674

Classification: Threatened

Critical habitat/4(d) rule/Experimental population designation/Similarity of appearance listing: The 2006 reclassification from endangered to threatened also included a special rule under section 4(d) of the Endangered Species Act that enabled the New Mexico Department of Game and Fish (NMDGF) and the Arizona Game and Fish Department (AGFD) to promulgate special regulations, in collaboration with the Service, allowing recreational fishing for Gila trout (Service 2006).

1.2 Methodology used to complete the review:

In accordance with section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act), the purpose of a 5-year review is to assess each threatened species and endangered species to determine whether its status has changed and it should be classified differently or removed from the Lists of Threatened and Endangered Wildlife and Plants. The U.S. Fish and Wildlife Service (Service) evaluated the biology and status of the Gila trout (*Oncorhynchus gilae*) as part of a draft recovery plan revision (Service, 2020) to inform this 5-year review. The New Mexico Ecological Services Field Office, New Mexico Fish and Wildlife Conservation Office, and Arizona Ecological Services Field Office prepared the draft revised Gila trout recovery plan (Service, 2020). The revised recovery plan includes: updated background and biological information on the species; a broad, prioritized list of recovery actions; objective, measurable delisting criteria; and estimated time and costs of recovery. The Service plans to open a 60-day comment period to invite the public; local, state, and Federal agencies; and tribes to provide information and comments on the draft revised recovery plan. We solicited data for this current review from interested parties through a Federal Register notice announcing the review on May 31, 2018.

1.3 FR Notice citation announcing the species is under active review:

The Federal Register Notice: Federal Register 83: 25034-25038, published May 31, 2018, announced the active review of the Gila trout.

2.0 REVIEW ANALYSIS

2.1 Recovery Criteria:

A recovery plan for the Gila trout was first developed in 1979 (Service, 1979), with three revisions being completed in 1984, 1993, and 2003, respectively (Service, 1984, 1993, 2003). The current draft revised Gila trout recovery plan (Service, 2020) includes four objective, measurable criteria which, when met, would result in a determination that Gila trout be removed from the endangered species list:

Criterion A – Area of Occupancy

Gila trout occupy 280 kilometers (174 miles) of stream within the presumed historical range of the species. Occupancy, in the context of this criterion, refers to streams being inhabited by viable populations.

Criterion B – Remnant Genetic Lineages

Each remnant genetic lineage of Gila trout is represented by at least three geographically separate, viable populations and requires one replicate population of each lineage to be geographically separated by at least 34.0 kilometers (21.1 miles) from the other two replicate populations of that genetic lineage.

Criterion C – Dendritic Metapopulations

At least four dendritic metapopulations of Gila trout are established. These metapopulations and the streams they inhabit would contribute to meeting the area of occupancy threshold in criterion A.

Criterion D – Absence of Nonnative Salmonid Species

Nonnative salmonids are absent from recovery streams and measures are in place to prevent re-invasion by nonnative salmonids. In limited circumstances where non-hybridizing, nonnative salmonids persist in recovery streams, active management and suppression may occur to mitigate effects on the Gila trout recovery populations until complete eradication of nonnative salmonids is achieved.

Although the criteria outlined in the draft revised recovery plan have not been fully implemented, biologists are taking action to conserve the species, establish new populations, and reach recovery goals.

2.2 Updated Information and Current Species Status

2.2.1 Biology and Habitat:

The Gila trout is endemic to mountain streams in the Gila, San Francisco, Agua Fria, and Verde River drainages in New Mexico and Arizona. A detailed account of the biology and habitat of the Gila trout is found in the Final Rule reclassifying the trout as a threatened species (Service, 2006) and in the draft revised recovery plan (Service, 2020). The information provided in those documents is included herein by reference.

2.2.2 Threats Analysis (threats, conservation measures, and regulatory mechanisms):

This threats analysis summarizes the threats identified in the listing rules (Service, 1967, 2006) and recovery plans (Service, 1979, 1984, 1993, 2003), with a focus on the threats identified in the most recent draft revised recovery plan (Service, 2020). The threats are cited and justified using current information pertaining to habitat shifts and environmental change. As required under section 4(a)(1) of the Act, a five-factor analysis was completed. The factor(s) that each threat satisfies is listed in parentheses; the five factors include: (A) the present or threatened destruction, modification, or curtailment of its habitat or range; (B) over-utilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; and (E) other natural or humanmade factors affecting its continued existence.

2.1.2.1 Large-Scale, High-Severity Wildfire:

Although Gila trout have evolved with and adapted to natural forest fire regimes (Gresswell, 1999), natural fire regimes have been altered or interrupted throughout the historical range of Gila trout, leading to increased occurrence and probability of uncharacteristic, high-severity, large-scale wildfires (Covington *et al.*, 1994; Allen *et al.*, 2002; Fulé *et al.*, 2013; Dennison *et al.*, 2014; Hunter *et al.*, 2014; O'Connor *et al.*, 2014). This departure from natural fire regimes has created novel disturbance conditions and processes in cold-water stream habitats, often resulting in dramatically reduced abundance or extirpation of local populations of Gila trout. Local extirpation of trout populations caused by high-severity wildfire has been documented throughout the historical range of Gila trout.

Indirect effects of high-severity wildfire may include post-fire habitat degradation and loss of watershed function. Examples of post-fire habitat degradation include: changes in the hydrologic cycle that affect stream flow as well as changes in physical channel conditions (e.g., habitat simplification), altered water quality (e.g., increased sedimentation, increased water temperature), and reduced aquatic macroinvertebrate abundance (i.e., reduced prey base) (Bixby *et al.*,

2015). Examples of loss of watershed function include: increased peak flows, reduced groundwater and stream base flows, and higher flow variation (Neary *et al.*, 2008). (Factor A)

2.1.2.2 Climate Change:

Using a regional climate model, Kennedy *et al.* (2008) predicted a 20 percent reduction in summer precipitation, an increase in summer average temperature of approximately 2ºC (3.6ºF), and a pronounced increase in the number of days with temperature above 32ºC (90ºF) and 37ºC (99ºF) by 2040-2059. The modeling indicated that the projected climate changes would result in the lower elevation limit of Gila trout habitat rising 269 meters (882 feet) to 286 meters (938 feet; Kennedy *et al.*, 2008). In addition to changing the geographic extent of suitable habitat, increased water temperatures can result in direct mortality. Increased water temperatures may also cause shifts in aquatic macroinvertebrate community structure and abundance, increased microbial metabolism and reduced dissolved oxygen concentration (Poff *et al.*, 2002). Warmer winter temperatures are likely to result in reduced snowpack, earlier runoff, and reduced summer flows (Poff *et al.*, 2002; Williams *et al.*, 2009; Luce *et al.*, 2012). (Factor A)

2.1.2.3 Unregulated Harvest:

In the reclassification rule, we determined that overutilization of Gila trout would not be a threat to the species because of the remoteness of recovery streams, the special regulations that would be imposed on angling through implementation of a 4(d) rule, and the small amount of Gila trout collected for scientific and educational purposes (Service, 2006). The magnitude of this threat remains ranked as low. Currently, angling for Gila trout is allowed only in selected areas, thus has a localized geographic extent, and is regulated to ensure that populations are not adversely affected, making for a moderate intensity of the stressor. (Factor B)

2.1.2.4 Nonnative Predation and Competition:

Gila trout likely negatively respond to predation by and competition with brown trout, similar to other native western U.S. trout species, via reduced abundance, reduced growth and survival, and reduced reproductive output. Nonnative trout predation on young Gila trout may reduce year-class strength and result in population decline. Mello and Turner (1980) reported the absence of Gila trout less than 150 millimeters (6 inches) total length in a pool in Iron Creek that was occupied by one large (303 millimeters [12 inches]) brown trout that had a high condition factor (K_{TL} = 1.02), suggesting that small Gila trout were eliminated from the pool by brown trout predation. Competitive interactions may result in reduced condition of Gila trout with cascading effects on survival and reproductive output. While the threat is considered imminent, the intensity of the threat is ranked as moderate because in cases where non-hybridizing nonnative

trout are found subsequent to Gila trout repatriation, predation and competition can be alleviated through removal of nonnative trout before a population of Gila trout is lost. (Factor C)

2.1.2.5 Disease:

Potential diseases that may affect Gila trout include whirling disease and bacterial kidney disease. Other diseases may affect populations of Gila trout. For example, there is an anecdotal report from 1924 of a fungal infection in the trout population in Big Dry Creek (Sportsmen's Association of Southwestern New Mexico, 1924). Whirling disease and bacterial kidney disease both lead to stressors on Gila trout that include impaired metabolic function. Currently, the overall magnitude of the threat of disease is ranked as low. There are no indications that diseases are currently affecting any population of Gila trout. However, considering an increase in water temperature and lower dissolved oxygen due to climate change, Gila trout may experience increases in rates of disease threatening populations or contributing to the vulnerability of Gila trout in the future. The geographic extent of the threat of disease is considered localized, as it may impact some populations and not others and the intensity of this threat is considered low based on the low prevalence of disease within populations of Gila trout. (Factor C)

2.1.2.6 Human-mediated Introgressive Hybridization:

Stressors associated with human-mediated introgressive hybridization include genetic modification and genomic extinction (Allendorf *et al.*, 2013). Hybridization may also affect fitness-related traits (e.g., Drinan *et al.*, 2015). For example, Brown *et al*. (2004) reported faster hatching time in developmental crosses of rainbow x Apache trout compared to pure Apache trout crosses, which could potentially infer a competitive advantage to hybrids and accelerate introgression. Boyer *et al.* (2008) reported long-distance and stepping-stone dispersal of rainbow x cutthroat hybrid trout that promoted the spread of rainbow trout introgression in a drainage network. Hybridization may also result in reduced fitness due to outbreeding depression. For example, Muhlfeld *et al*. (2009) reported a 50-percent decline in reproductive success in a population of westslope cutthroat x rainbow trout with 20-percent admixture. However, hybridization spread rapidly despite this fitness cost. Repeated genetic modification may lead to genomic extinction, which would constitute the loss of the evolutionary legacy of remnant, pure Gila trout lineages. (Factor E)

2.1.2.7 Small Population Size:

Responses of Gila trout to the threat of small population size include increased vulnerability of populations to extirpation and reduced genetic variation. Isolated populations have been extirpated by the effects of wildfire, drought, suspected demographic stochasticity, or a combination of factors. For example, remnant populations of Gila trout were extirpated in a variety of locations as a result of

wildfire in 1989, 1990, 1995, 1996, 2007, 2011, 2012, and 2012 (Propst *et al.,* 1992; Rinne, 1996; Propst and Stefferud, 1997; Brown *et al.,* 2001; Gila trout Recovery Team, 2010; Gila trout Recovery Team, 2011; Wick *et al.,* 2014). Heterozygosity of all of the remnant lineages of Gila trout, with the exception of Iron Creek, has declined from 2002 to 2013 (Gila trout Recovery Team, 2014). Loss of genetic diversity has been particularly acute in the Spruce Creek lineage. The erosion of genetic diversity in the remnant lineages is likely due to the consequence of bottlenecks and small genetically effective population size in many of the occupied streams. The overall magnitude of the threat of small population size is ranked as high. As of 2017, only the Mogollon Creek and Willow Creek drainages had dendritically structured populations of Gila trout with some potential for colonization and movement dynamics. (Factor E)

2.3 Synthesis:

After reviewing the best available scientific information, we conclude that the Gila trout *(Oncorhynchus gilae)* remains a threatened species. This species is vulnerable to environmental changes and nonnative species, including both predation and hybridization. While these threats continue to act upon the species, recent and ongoing activities undertaken by the Service and its state and Federal partners, such as nonnative species management and reintroduction efforts of the Gila trout to its native range, have alleviated the immediate risk of extinction, but the species is likely to become an endangered species within the foreseeable future. The evaluation of threats affecting the species under the factors in 4(a)(1) of the Act and analysis of the status of the species in the draft revised recovery plan remains an accurate reflection of the species current status.

3.0 RESULTS

3.1 Recommended Classification:

____ **Downlist to Threatened**
____ **Uplist to Endangered**
____ **Delist** (*Indicate reasons for delisting per 50 CFR 424.11):*
____ *The species is extinct*
____ *The species does not meet the definition of an endangered species or a threatened species (i.e., is recovered, or new information on status and threats indicate species does not meet definitions)*
____ *The listed entity does not meet the statutory definition of a species.*
__X__ **No change is needed**

3.2 New Recovery Priority Number:

No change is needed.

Brief Rationale:

The Gila trout was assigned a recovery priority number of 8, meaning that the species has a moderate degree of threat with high potential for recovery. The designation of 8 is still appropriate due to the level of vulnerability and types of threats, as well as the opportunity for reintroduction of the Gila trout.

3.3 Listing and Reclassification Priority Number:

Not applicable.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

The Service has identified six actions that are needed aid in the recovery of Gila trout. The actions are:

1. Repatriate Gila trout to streams within its presumed historical range;
2. Establish and maintain captive propagation methods and conservation hatchery facilities in suitable locations;
3. Manage the presence of nonnative salmonid species in recovery streams in Arizona and New Mexico;
4. Monitor remnant and repatriated Gila trout populations within the Gila River drainage basin;
5. Conduct public education, involvement, and outreach in areas with an interest in Gila trout;
6. Develop and implement regulations to maintain sustainable Gila trout populations in recovery streams opened to sport fishing in Arizona and New Mexico.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Gila Trout *(Oncorhynchus gilae)*

Current Classification: Threatened

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X__ No change needed

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service, New Mexico Ecological Services Field Office

Approve SHAWN SARTORIUS Digitally signed by SHAWN SARTORIUS Date: 2020.09.16 11:48:19 -06'00' _____