ARIZONA GAME AND FISH DEPARTMENT
HERITAGE DATA MANAGEMENT SYSTEM

Animal Abstract **Element Code:** AFCHA02101
Data Sensitivity: Yes

CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE

NAME: *Oncorhynchus gilae*
COMMON NAME: Gila Trout
SYNONYMS: *Salmo irrideus, Salmo gilae, Oncorhynchus gilae gilae*
FAMILY: Salmonidae

AUTHOR, PLACE OF PUBLICATION: *Salmo irrideus* Gibbons; Snyder 1915: (misidentification). *Salmo gilae* Miller 1950a: Occasional Papers of the Museum of Zoology, University of Michigan.

TYPE LOCALITY: Main Diamond Creek, 53 KM ESE Beaverhead. T11S, R10W, Gila National Forest, Sierra Co., New Mexico; Gila National Forest, New Mexico.

TYPE SPECIMEN: The holotype, a mature male 204.0 mm (8.0 in.) in standard length, University of Michigan Museum of Zoology No. 137088, was secured by R.R. Miller from brood stock at the Glenwood Fish Hatchery, Glenwood, Catron County, New Mexico, on July 17, 1939. The stock reared at this hatchery came from Diamond Creek, a tributary of Gila River, approximately 33 miles east-southeast of Beaverhead, Sierra County, New Mexico. Twelve paratypes, U.M.M.Z. NO. 137089, 110.0 to 225.0 mm (4.3 to 8.9 in.) long, were obtained with the holotype. Sixty-two paratypes, 53.0 to 128.0 mm (2.1 to 5.0 in.) long, U.M.M.Z. No. 137090, were seined from Diamond Creek on July 18, 1939, by R.R. Miller and J. Davis.

TAXONOMIC UNIQUENESS: Fifteen species in the genus *Oncorhynchus*, eleven of which occur in North America. Two are native to Arizona, *O. apach*e (Apache Trout) and *O. gilae* (Gila Trout). Behnke (1992) recognized *Oncorhynchus apache* as a subspecies of *O. gilae* with Apache Trout as *O.g. apache* and Gila Trout as *O.g. gilae*. This was adopted by Nelson et al. (2004). *O apache* was recognized as a separate species from *O. gilae* by Page and Burr (1991) and Page et al. (2013).

DESCRIPTION: "Coloration: Head yellow with black spots; "cutthroat mark" yellowish; opercles dark copper; back and side above lateral line with a golden iridescence, sometimes washed with metallic blue, scattered with numerous dark spots (maximum, 30 per cm^2), spots larger dorsally, diminishing in size toward lateral line; a pinkish lateral band present; lower sides deep yellow; abdomen grayish white to pinkish orange. Fins: Dorsal yellow, first three or four rays yellowish orange to white, round or oval spots fine and dense; adipose deep yellow marked with large spots; caudal yellow, spotting dense; anal yellow with first five or six rays tipped with white, lower rays becoming reddish; pectorals and pelvics yellowish orange edged with white. Parr marks of young retained throughout life, becoming fainter with age" (Sublette et al. 1990).

"Head: Conical; SL/HL = 3.4-4.1; SL/HW = 6.5-6.7. Maxillary extending beyond eye. Basibranchial teeth usually absent (Behnke and Zarn 1976) although occasionally present in the

Spruce and Dry Creek populations. Branchiostegal rays 10 (9-11). Gill rakers 19 (18-20)" (Sublette et al. 1990).

"Body: Average total length about 300.0 mm (11.8 in.); maximum total length approximately 550.0 mm (21.7 in.). SL/BD = 3.6-3.9. Lateral series with 130-165 scales. Scales above lateral line 24-38; below lateral line 23-27. Pyloric caeca 25-46 (Behnke and Zarn 1976). Vertebrae 59-63 (Minckley 1973; Behnke and Zarn 1976)" (Sublette et al. 1990).

"Fins: Dorsal triangular, origin anterior to that of pelvics. Adipose present dorsally, length about 11.6 per cent standard length. Caudal shallowly forked, lobes rounded. Anal triangular. Pectorals bluntly pointed. Pelvics short, about 14.0 per cent of standard length. Rays: Dorsal 9-12; pectorals 14 (13-15); pelvics 10 (9-10); anal 10 (9-11); caudal 18-19" (Sublette et al. 1990).

AIDS TO IDENTIFICATION: "The absence of both reddish markings on the inner border of the mandible (cutthroat markings) and large black spots (as large as the pupil of the eye) will distinguish *O. gilae* from *O. clarki*. The absence of reddish spots laterally will distinguish *O. gilae* from *Salmo trutta* and *Salvelinus fontinalis*. The golden yellow color dorsolaterally, and the presence of parr marks noticeable on fish up to 25.0 cm (9.8 in.) TL will distinguish *O. gilae* from *Oncorhynchus mykiss* (Walbaum). *Oncorhynchus gilae* superficially resembles *Oncorhynchus apache* which is known only from Arizona, although LaBounty and Minckley (1972) speculate that this species may have occurred in New Mexico in earlier times. However, *O. apache* has a spot behind the eye, on the head, and large spots on the body whereas *O. gilae* lacks the postorbital spot and is characterized by numerous small dark spots on the upper half of the body; spotting becomes more abundant on larger (>20.0 cm (7.9 in.) TL) adults" (Sublette et al. 1990). Gila Trout are also commonly confused by anglers with Roundtail Chub (*Gila robusta*) because the two species have similar distributions and are similar in size as adults (Minckley 1973). Gila Trout can be differentiated from the Roundtail Chub, a minnow in the family Cyprinidae, through close examination of the body shape and coloration (USDI, FWS 2005a).

ILLUSTRATIONS:
Color drawing (Behnke 1992)
B&W drawing (Behnke (1992:213)
B&W photo (Minckley 1973:60)
Color drawing (Page and Burr 1991)
Color photo (Rinne and Minckley 1991:9)
Color drawing (Sublette et al. 1990)

TOTAL RANGE: The true extent of the historical distribution of Gila Trout is not known with certainty (Behnke 2002). The Gila Tout occurs throughout the upper Gila drainage in New Mexico and Verde and Agua Fria drainages in Arizona. Its purported historical occurrence in Eagle Creek, Arizona, and the unique characteristics of individuals taken from Spruce Creek, suggest that it may also have been indigenous to the San Francisco drainage. Behnke and Zarn (1976) also cite the occurrence of trout similar to *O. gilae* from the Rio Yaqui of Mexico, a basin contiguous with the Gila River system. Gila Trout have persisted in five streams within the Gila National Forest, New Mexico, including: Iron, McKenna, and Spruce creeks in the Gila Wilderness Area, along with Main and South Diamond creeks in the Aldo Leopold Wilderness

Area. It was determined by Allendorf (1998) and Service (2003) that the McKenna and Iron Creek populations were not pure due to hybridization with Rainbow Trout, however another original pure population of Gila Trout was discovered in Whiskey Creek; consequently, there are four confirmed original pure populations of Gila Trout currently recognized (USDI, FWS 2005a). An introduced population previously existed in Gap Creek in Prescott National Forest in Arizona, but it has since been extirpated (USDI, FWS 2005a). As a result of transplants, six additional populations of Gila trout exist in the Gila National Forest including populations in Sheep Corral (Canyon) Creek, a tributary of Sapillo Creek; McKnight Creek, a tributary of the Mimbres River; Little Creek, a tributary of the West Fork of the Gila River; Big Dry Creek (upstream of Golden Link Cabin) in the San Francisco River drainage; and Trail Canyon and Woodrow Canyon creeks along with the East Fork of Mogollon Creek, all tributaries of Mogollon Creek. The transplanted populations in Sheep Corral (Canyon) and McKnight come from Main Diamond Creek, while the populations in Little Creek is from McKenna Creek. The populations in the Mogollon Creek drainage are from South Diamond Creek. McKnight Creek is east of the Continental Divide and, therefore, outside the historical distribution of the Gila Trout. Hybridized populations (with *O. mykiss*) occur on the Gila National Forest in Black Canyon, Langstroth, Lipsey, upper Mogollon, White and Sycamore Canyon creeks (David 1976). Standing crops of Gila Trout in the original headwater streams range from 25.7 kg/ha to 200.3 kg/ha, thus equaling or exceeding those for other salmonids from comparable sized streams (Turner 1986)" (Sublette et al. 1990). A large wildfire burned over 200,000 acres of the Gila National Forest in 2003 (USDI, FWS 2004) which significantly impacted the watersheds of Little Creek, Black Canyon, White Creek, and Mogollon Creek, stalling consideration of Gila Trout populations in these waters for contribution to species recovery.

RANGE WITHIN ARIZONA: *Oncorhynchus gilae* was found historically in the Verde and Agua Fria drainages in Arizona. Gila Trout from Main Diamond Creek, Gila National Forest, New Mexico, were introduced into a tributary of the Verde River, Gap Creek, Prescott National Forest, Arizona, in 1974. Fisheries surveys in 1993 revealed no Gila Trout and they were considered extirpated from Arizona. Historically, Gila Trout may have occupied tributaries of the San Francisco River drainage, particularly Eagle Creek (Arizona) and Spruce Creek (New Mexico) (Minckley 1973, Mulch and Gamble 1956). Possible tributaries of the Verde River drainage, Arizona, Oak Creek and West Clear Creek may have had populations of Gila Trout (Miller 1972). Sycamore Creek, a tributary of the Aqua Fria River, Arizona, historically may have had Gila Trout (Behnke and Zarn 1976). Introduced into Dude Creek in September 1999. This population is in jeopardy stemming from problems resulting from the Dude Creek Fire. Gila Trout are also stocked into the East Verde River, Frye Mesa Reservoir, Watson Lake, Lynx Lake, and Goldwater Lake in Arizona for non-recovery purposes to maintain sport fisheries (AZGFD).

SPECIES BIOLOGY AND POPULATION TRENDS

BIOLOGY: Spawns in late spring and summer. Hybridizes with non-native salmonids. Attains 7.6-10 cm (3-4 in) in the first year of life with maximum size being about 28-33 cm (11-13 in).

REPRODUCTION: "Spawning appears to occur during spring and summer in New Mexico. In McKnight Creek, where the population density is relatively low, female Gila Trout mature at age III at a minimum size of 172.0 mm (6.8 in.) TL. In the more highly populated Main Diamond Creek, females reach maturity at age IV or V at a minimum size 133.0 mm (5.2 in.) TL (Nankervis 1988). Males tend to mature one to two years earlier than females in any given stream (P. Turner, pers. comm.). Rinne (1980) reported spawning from April through June when water temperatures were 8NC or greater; incubation required 8-10 weeks with the larvae emerging from the redds at 15.0-20.0 mm (0.59-0.79 in.) total length. Redd construction and spawning occurs as early as March in lower elevation streams and incubation and emergence probably can occur in less than eight weeks in warmer water temperatures (P. Turner, pers. comm.). Redds are usually constructed in water 7.6-15.2 cm (3-6 in) deep, with substrate 3.8 cm (1.5 in) or finer and range 0.8-1.4 m (2.5-4.5 ft) in diameter. Fecundity for Gila Trout is related to size, age, and rate of growth (Nankervis 1988). According to Regan (1966), the number of eggs produced from females held in hatcheries averaged about 150. Nankervis (1988) reported the mean fecundity per female to be 143 and 335 eggs in Main Diamond and McKnight Creeks respectively. Maximum fecundity observed was 686 eggs. Mean ova diameter ranges from 2.72-4.00 mm (0.11-0.16 in.)" (Sublette et al. 1990).

"Sexual Differences: Breeding males with the pinkish lateral band intensified and the abdomen streaked with yellow or orange" (Sublette et al. 1990).

FOOD HABITS: An opportunistic feeder utilizing aquatic invertebrates, and small fishes, although it feeds primarily on adult and nymph stages of aquatic insects; trichopterans, ephemeropterans, chironomids, coleopterans and terrestrial insects. Gila Trout diet shifts seasonally as the relative abundance of various prey changes. Gila Trout generally feed from 0900 - 1300 (Van Eimeren 1988). The primary insect taxa consumed by Gila Trout were also commonly found in stomach contents of nonnative trout species in the Gila River drainage, indicating the potential for interspecific competition (USDI, FWS 2005a).

HABITAT: Gila Trout are found in small mountain headwater streams, which are generally narrow and shallow, and rarely exceed 21°C (70°F). Siltation is usually low and cobble is the predominate substrate. During drought years they tend to be confined to pools with sufficient depth and cover. Gila Trout use cover extensively (stream improvement structures, branches, logs and undercut banks). Tolerances to water chemical parameters (pH, conductivity dissolved oxygen, temperature, etc) are similar to other salmonids. Species requires water temperatures below 25°C (77°F) for persistence (USDI, FWS 1993).

ELEVATION: 1,660 - 2,810 m (5,446 - 9,220 ft.) in New Mexico (Gila National Forest).

PLANT COMMUNITY: Streams containing populations of Gila Trout encompass two riparian vegetative communities (Brown 1982). The arctic-boreal riparian community occurs within subalpine forest (about 2,450-3,500 m elevation) and extends to lower elevations in cool microclimates. Shrub willows (e.g., *Salix monticola, S. scouleriana, S. bebbiana, S. irrorata*) commonly form thickets along streams. Other deciduous shrubs such as red elderberry (*Sambucus racemosa*), goose-berry currant (*Ribes* spp.), raspberry (*Rubus* spp.), and thin-leaf

alder (*Alnus tenuifolia*) are also common. Tree species of the subalpine conifer forest such as Englemann spruce (*Picea englemannii*), blue spruce (*Picea pungens*), subalpine fir (*Abies lasiocarpa*), and aspen (*P. tremuloides*) are often present. The cold-temperate riparian community (about 1,700-2,300 m elevation) is the predominate type along streams currently occupied by Gila Trout. Major components of this community are narrowleaf cottonwood (*P. angustifolia)*, box elder (*Acer negundo*), alder (*A. oblongifolia*), and willows. Montane woodland and conifer forest species such as white fir (*A. concolor*), aspen, ponderosa pine (*Pinus ponderosa*), Gambel oak (*Quercus gambelii*), New Mexico locust (*Robinia neomexicana*), and smooth sumac (*Rhus glabra*) often occur. Shrub growth of willows and other species such as red-osier dogwood (*Cornus stolonifera*) and thin-leaf alder is frequently a dominant aspect.

POPULATION TRENDS: Historically and currently Gila Trout populations are subjected to floods, fires, low flows (drought years) and grazing which can severely limit population size and density of this species (McHenry 1986, Mello and Turner 1980, Regan 1964, and Turner 1989). Overall, the total wild population of Gila Trout has increased (USDI, FWS 2005a). Brown et al. (2001) reported an estimated population of 37,000 fish greater than age 1 in New Mexico in 2001, compared to less than 10,000 in 1992. As Gila Trout were more recently replicated in Arizona, there is not an estimated population number at this time (USDI, FWS 2005a). The nearly 300,000-acre Whitewater Baldy Fire, New Mexico's largest fire in history, burned through nearly half of the existing Gila Trout streams in the state in 2012 (NMGDF). Gila Trout were eliminated from six of the eight streams that were within the burned area.

SPECIES PROTECTION AND CONSERVATION

ENDANGERED SPECIES ACT STATUS: LT (USDI, FWS 2006)
[LE,PT (USDI, FWS 2005b)]
[LE,PT (USDI, FWS 1987)]
[LE USDI, FWS 1970]
[LE USDI, FWS 1967]

STATE STATUS: 1 (AZGFD, AWCS 2022)
[1A (AGFD SWAP 2012)]
[WSC (AGFD, WSCA 1996 in prep)]
[Endangered (AZGFD, TNW 1988)]

OTHER STATUS: Not Forest Service Sensitive (USDA FS Region 3 2007, 2013)
[Forest Service Sensitive (USDA, A/S National Forests 2000)]
[Forest Service Sensitive (USDA, FS Region 3 1988)]
State Endangered, Group II, State of New Mexico, 1975-01-24.

MANAGEMENT FACTORS: Gila Trout populations in small headwater streams are susceptible to natural disasters; floods, fires, and drought. Habitat loss is a concern. Exotic fish species threaten the population with predation, competition, and hybridization (especially

Rainbow and Brown Trout). All lineages have experienced population bottlenecks associated with mortality from drought and severe wildfires (Camak et al. 2021). Predation by Brown Trout has also been a serious problem, and continues to be a problem for fish below stream barriers, which has severely depressed Gila Trout populations. Kennedy et al. (2009) project a 70% decrease in suitable, warm season habitat for Gila Trout in the next 50–100 years, finding that increasing temperatures and decreasing summer precipitation will increase the intensity and frequency of forest fires that are a major threat to Gila Trout survival.

Management needs: delineate specific conservation waters; maintain and/or enhance habitats; ameliorate effects of nonnative fishes from selected waters; reintroduce into selected habitats; adapt current management strategies to better account for long-term effects of climate change.

PROTECTIVE MEASURES TAKEN: Recovery plan completed, 1984. Selected streams have been renovated with antimycin A, fish barriers installed, habitat improvement structures installed, and reintroduced with pure strain Gila Trout. The Gila Trout was downlisted from endangered to threatened on August 17, 2006. Existing pure strain populations of Gila Trout in 10 streams of New Mexico are being maintained and improved. Fish culture of Gila Trout is being investigated. Currently, two Gila Trout recovery streams in Arizona (Dude and Grapevine Creeks) are open to seasonal catch-and-release only angling regulations (AZGFD). However, stocked Gila Trout in the East Verde River, Frye Mesa Reservoir, Watson Lake, Lynx Lake, and Goldwater Lake can be angled year-round. Public education efforts are ongoing.

SUGGESTED PROJECTS: Additional streams need to be selected for introduction of Gila Trout to maintain genetic purity and diversity of the species. Logging, mining, cattle and sheep grazing, and other developmental activities should be prohibited in drainages that could or already have Gila Trout populations. Reserve streams for genetically pure Gila Trout, with no stocking of non-native salmonids. A suitable fish hatchery should be selected for raising Gila Trout for possible reintroductions into suitable habitats. As the species has been downlisted to threatened status, stocking Gila Trout in additional waters could increase the overall security of the species and allow for angling to resume. “Once a stream or lake occupied by Gila Trout is opened to angling, the trout can be designated as a ‘sport fish’ and the potential funding available to Gila Trout restoration projects may increase” (USDI, FWS 2006). Potential reintroduction sites for Gila Trout should be investigated in the Verde River and Agua Fria River drainages. Possible streams to be investigated should include; Sycamore Creek, Oak Creek, Fossil Creek and East Verde River. If these sites are selected protection of these watersheds is crucial to the survival of Gila Trout.

LAND MANAGEMENT/OWNERSHIP: USDA, Forest Service, Gila National Forest (New Mexico) and Tonto National Forest (Arizona).

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MAJOR KNOWLEDGEABLE INDIVIDUALS:

Zach Beard – Arizona Game and Fish Department, Phoenix, Arizona

Julie Carter – Arizona Game and Fish Department, Phoenix, Arizona

John N. Rinne – USDA, Forest service Rocky Mountain Forest and Range Experimental Station, Flagstaff, Arizona

Robert Behnke – Professor of Fisheries, Colorado State University, Fort Collins Colorado, 80523

David Propst – New Mexico Department of Game and Fish, Santa Fe, NM; Adjunct Professor, University of New Mexico, Department of Biology

ADDITIONAL INFORMATION:

Gila Trout was the first western North American fish to be actively managed for conservation. The Gila Trout Recovery Team, a Multi-Agency task force, recommended that the USFWS downlist the species to threatened in 1987. However, before the comment period was over, a flood eliminated more than 80% of the McNight Creek, NM population, a forest fire along with subsequent flooding eliminated the Main Diamond Creek population (the Type Locality) and drought and forest fire eliminated 90% of the South Diamond Creek population. The proposal to downlist this species was thus aborted. These events point out the fragility of small populations and dramatically demonstrates the potential for serious problems in recovery strategies.

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