ARIZONA GAME AND FISH DEPARTMENT
HERITAGE DATA MANAGEMENT SYSTEM

Animal Abstract **Element Code:** AFCJB13080
Data Sensitivity: Yes

CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE

NAME: *Gila cypha*
COMMON NAME: Humpback Chub
SYNONYMS:
FAMILY: Cyprinidae

AUTHOR, PLACE OF PUBLICATION: Miller, Journal of the Washington Academy of Sciences 36(12): 409-415, fig. 1. 1946.

TYPE LOCALITY: Arizona, Coconino Co., near Phantom Ranch, w. end of Grand Canyon near Bright Angel Creek, a tributary of the Colorado River.

TYPE SPECIMEN: USNM - 131839, collected by N.N. Dodge, date of collection not reported in Miller (1946).

TAXONOMIC UNIQUENESS: There are 15-19 species in the genus, all of which occur in Western North America. 9 species of Gila occur in Arizona. Taxonomy within the genus remains controversial, as *G. robusta, G. nigra,* and *G. intermedia* have been declared the same species by several authors (Page et al. 2017). There are no subspecies of *G. cypha.* Substantial evidence of introgressive hybridization between *G. cypha, G. robusta,* and *G. elegans* exists (Dowling and DeMarais 1993). Available evidence indicates that the three taxa should continue to be recognized as distinct species that are "on their own evolutionary trajectories" (Douglas and Douglas 2007).

DESCRIPTION: A large cyprinid, reaching a total length of approximately 48 cm (18.9 in) and a weight of approximately 1.2 kg (2.6 lb) (Valdez and Ryel 1997). Juveniles have cylindrical bodies with silvery sides, a greenish back, and a whitish belly. Adults have a laterally-compressed, fusiform body, an enlarged nuchal hump rising abruptly behind the head, a long snout that overhangs the jaw, and a slender tail. The body is olive-colored dorsally, fading to a whitish belly. Scales are deeply embedded and small, absent from the nuchal hump and belly and sparse towards the back. The fins are large and falcate and the tail is deeply forked. Dorsal fins typically have 9 principal rays and anal fins typically have 10. The pharyngeal arch is small with a short lower ramus and deciduous teeth in a 2,5-4,2 pattern (Miller 1946, USFWS 2017).

Spawning adults develop small tubercles on the head and paired fins. Gill coverings, paired fins, anal fin, and belly become orange tinged in spawning adults (USFWS 2017).

AIDS TO IDENTIFICATION: In addition to the nuchal hump, the small eye, the inferior, nearly horizontal mouth separate the humpback chub from other chub species.

ILLUSTRATIONS:
Color Photo (USFWS 2017)
Line drawing (Miller 1946:412)
B&W photo (Minckley 1973:98)
Color drawing (Page and Burr 1991)
Color photo (Rinne and Minckley 1991:29)
Photos (Suttkus and Clemmer 1977:17-30)

TOTAL RANGE: Endemic to the warm-water portions of the Colorado River system. Historical range included portions of the Colorado (from Black Canyon near present-day Hoover Dam, AZ/NV to Debeque Canyon, CO), Green (from confluence with the Colorado to the Blacks Fork River, WY) and Yampa (from confluence with the Green through Cross Mountain Canyon, CO) rivers in Arizona, Utah, Colorado and Wyoming. Historical collections show *G. cypha* was confined to mid- and low-elevation canyons, including six in the upper basin and two in the lower basin. Two of these eight documented populations have been extirpated due to the construction of Flaming Gorge (Hideout Canyon) and Hoover dams (Black Canyon). A third population in Dinosaur National Monument is considered functionally extinct, as individuals have not been detected since 2004. Five extant populations include four upstream of Lake Powell (Black Rocks in Colorado, Westwater Canyon, Desolation/Gray Canyons, and Cataract Canyon, all in Utah), and one downstream of Lake Powell (Grand Canyon in Arizona). Small enclave groups of fish are present in localized canyon-like reaches of the upper basin (USFWS 2017).

RANGE WITHIN ARIZONA: Colorado and Little Colorado rivers and Havasu Creek in Grand Canyon, Coconino and Mohave counties.

SPECIES BIOLOGY AND POPULATION TRENDS

BIOLOGY: Population in Grand Canyon infested with the parasitic copepod *Lernaea cyprinacea* (Carothers and Minckley 1981, Kaeding and Zimmermann 1983), and Asian tapeworm, *Bothriocephalus acheilognathi* (Angradi et al. 1992, Clarkson and Robinson 1993). Kaeding and Zimmermann (1983) also reported 13 species of bacteria, six protozoans, and the fungus *Saprolegnia* to infect humpback chub.

REPRODUCTION: Spawning takes place in spring, usually along river margins and on mid-channel bars with boulder, cobble, and clean gravel substrate. Communal broadcast spawner. Fertilized eggs become semi-adhesive and lodge in crevices and interstitial spaces. In the upper basin, Humpback Chub spawn in seasonally-warmed rivers and tributaries, usually in April-July, during or immediately after the peak of spring runoff. Evidence of spawning in the Yampa River has been documented as late as September (Muth and Nesler 1993). In the Grand Canyon, spawning occurs March-April (Valdez and Ryel 1995). Spawning likely historically occurred in the mainstem, but low water temperatures resulting from hypolimnial releases from Glen Canyon Dam have precluded spawning, and fish spawn primarily in the seasonally warmed Little Colorado River. Spawning may have historically occurred in large tributaries, but reduced flow and predator presence have rendered these tributaries largely unusable by the Humpback

Chub. There is recent evidence of mainstem spawning in the western Grand Canyon (Rogowski et al. 2017).

Humpback Chub spawn at a wide range of flows and times, but at a fairly narrow temperature range; 15-24°C (59-75°F) (Valdez and Clemmer 1982; Kaeding et al. 1990; Muth and Nesler 1993; Nelson et al. 2016).

FOOD HABITS: Larvae and young-of-year juveniles feed on diatoms, algae, and small invertebrates (i.e., rotifers, cladocerans, copepods) (Jacobi and Jacobi 1982). Juvenile Humpback Chub consume a variety of foods, including aquatic insects (i.e., black flies and midges) and crustaceans as well as terrestrial insects (i.e., grasshoppers, Mormon crickets). Adults feed actively on floating material entrained in low-velocity areas, and consume aquatic insects, crustaceans, plants, seeds, terrestrial insects, and occasionally small fish and reptiles (Valdez and Ryel 1995).

HABITAT: In general, the species persists only in turbulent, high gradient, canyon-bound reaches of large rivers in the Colorado River Basin. Spawning and egg development require rocky complex habitat and warm water temperature. Larvae utilize shallow sheltered habitat with warm water temperature, such as low-velocity nearshore pools. The majority of larvae in the Grand Canyon are produced and remain in the lower 14 km of the Little Colorado River. Some drift downstream into the colder mainstem and likely die of thermal shock when mainstem temperatures are cold (Clarkson and Childs 2000). Warmer dam releases starting in 2004 have resulted in higher survival of young transitioning from the Little Colorado to the mainstem (Dodrill et al. 2014). Juveniles use rocky complex habitat, such as deep mid-channel pools and chutes with large boulders and cobble, moving to increasingly deeper and faster areas as they age. Juveniles in the Grand Canyon use rocky talus shorelines, moving up and downslope to maintain position with variable water conditions from dam operations (Korman et al. 2004). Adults are associated with large eddy complexes (Valdez et al. 1982, 1992, Valdez and Hugentobler 1993). Humpback chub appear to be more active at night (Kaeding and Zimmermann 1983, Gorman 1994).

The timing and age for Humpback Chub development are largely temperature dependent, with fish in warm habitats reaching maturity in 3–4 years, whereas fish in the colder Colorado River in Grand Canyon may require 8–15 years to reach maturity (Coggins and Pine 2010; Yackulic et al. 2014). Measureable growth of adults occurs at 12-27°C (54-81°F) but is optimal at 16-22°C (61-72°F). In the cooler water of the Grand Canyon (12-18°C (54-64 °F) the species experiences slower growth but higher survival and greater longevity, living up to 40 years. Fish in the upper basin and Lower Colorado River live up to 20 years. Fish in cool water habitats also exhibit skip spawning; where individuals do not spawn every year (USFWS 2017).

ELEVATION: Arizona records include elevations from 1,530 - 4,400 ft. (467 - 1,342 m).

PLANT COMMUNITY:

POPULATION TRENDS: Historic status uncertain, but distribution presumably more continuous than present. Two of eight documented populations have been extirpated due to the

construction of Flaming Gorge (Hideout Canyon) and Hoover dams (Black Canyon). A third population in Dinosaur National Monument is considered functionally extinct, as individuals have not been detected since 2004. Distribution in Grand Canyon has contracted since construction of Glen Canyon Dam (Angradi et al. 1992). Since population estimates began in 1989, the number of adults in the Lower Colorado River core population decreased by 54% from 10,946 in 1989 to 5,021 in 2001, and then increased by 52% from 5,021 to 7,650 in 2008. Abundance estimates of this population appear stable since 2009. This population appears to be continuing to expand in numbers and distribution into the western Grand Canyon and translocations to Havasu Creek (USFWS 2017).

SPECIES PROTECTION AND CONSERVATION

ENDANGERED SPECIES ACT STATUS:
LT (USDI, FWS 2021)
Critical Habitat (CH) Designation (USDI, FWS 1994)
[PT due to partial recovery (USDI, FWS 2020)]
[P-CH USDI, FWS 1993]
[LE (USDI, FWS 1967)]

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

OTHER STATUS:
Not Forest Service Sensitive (USDA, FS Region 3 1999, 2013)
[Forest Service Sensitive, USDA, FS Region 3 1988]
Group 2 (NNDFW, NESL 1994, 2000, 2008)

MANAGEMENT FACTORS: River flow and predation/competition are the key factors controlling upper basin populations; river flow, water temperature, food supply, and predation/competition are the key factors controlling the lower basin population. **Threats:** altered hydrology and cold tailwater releases from reservoirs; Water depletions from the Lower Colorado River, changing it to an intermittent stream from a perennial stream; Decreased sedimentation and turbidity leading to increased risk of predation by sight feeders; Genetic isolation of populations and lack of connectivity between populations; Hybridization is a concern for upper basin populations; Predation by and competition with nonnative fishes; Water quality and contamination; and, parasitism. **Management needs:** ameliorate effects of reservoirs; ameliorate effects of nonnative fish and parasite sources in chub waters; monitor status of all populations. Also need to be concerned about genetic isolation of populations by emplacement of dams.

PROTECTIVE MEASURES TAKEN: Effective April 20, 1994, seven reaches of the Colorado River System (totaling 379 miles) were designated as Critical Habitat for *Gila*

cypha. Grand Canyon Protection Act of 1992 reduced stage fluctuation of water releases from Glen Canyon Dam. Glen Canyon Environmental Studies Phase I (1984-1987) and Phase II (1990-1995) research data used in development of Glen Canyon Dam Environmental Impact Statement and Biological Opinion. Upper Colorado River Basin Recovery and Implementation Plan guides recovery efforts for the species in the Upper Basin. Recovery Goals that amended and supplemented the 1990 revised plan were approved in 2002 (USFWS 2002), but were withdrawn and declared of no force and effect by court order on January 18, 2006 (Grand Canyon Trust et al. vs. Gale Norton et al.). The Grand Canyon population occurs on lands administered by Grand Canyon National Park, as well as the Navajo, Hopi, Hualapai, and Havasupai Tribes. In 2004, the temperature of water released through Glen Canyon Dam increased in summer and fall when lower levels in Lake Powell allowed warm surface water to be entrained in penstocks. Control of nonnative fish in Black Rocks, Westwater Canyon, Desolation/Gray canyons, Dinosaur National Monument, and the Grand Canyon. Translocations to Havasu Creek, Shinumo Creek, Bright Angel Creek and the Little Colorado River. The Glen Canyon Dam Adaptive Management Program (GCDAMP) coordinates protection of natural resources of the Colorado River from Glen Canyon Dam to the Lake Mead inflow and The Lower Colorado River Multi-Species Conservation Program (LCR MSCP) coordinates conservation of multiple species, including the Humpback Chub, downstream of the Lake Mead inflow. A refuge population from the Little Colorado River has been established at the Dexter National Fish Hatchery. Fish that are translocated in the Grand Canyon are captured as live, 2–4 month old fish, taken to SNARRC for grow-out, cleansed of parasites and diseases, and returned to Grand Canyon as PIT-tagged individuals. This strategy of using wild mixed fish ensures that genetic diversity is maintained throughout the canyon (Pine et al. 2013).

SUGGESTED PROJECTS: Continued study of effects of water temperature on ecology and life history; determine effects of fluctuating flows on movements and fate of early life stages in the Colorado River below Glen Canyon Dam; determine food web relationships in the Little Colorado and Colorado rivers using stable isotope analysis.

LAND MANAGEMENT/OWNERSHIP: BIA - Hualapai Reservation and Navajo Nation; NPS - Grand Canyon National Park and Glen Canyon National Recreation Area; State; Private.

SOURCES OF FURTHER INFORMATION

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ADDITIONAL INFORMATION:

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