ARIZONA GAME AND FISH DEPARTMENT
HERITAGE DATA MANAGEMENT SYSTEM

Animal Abstract **Element Code:** AFCNB02060
Data Sensitivity: Yes

CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE

NAME: *Cyprinodon macularius*
COMMON NAME: Desert Pupfish
SYNONYMS: *Cyprinodon macularius macularius*
FAMILY: Cyprinodontidae

AUTHOR, PLACE OF PUBLICATION: Baird and Girard, 1853, Proceedings of the Academy of Natural Sciences of Philadelphia 6:1-155.

TYPE LOCALITY: San Pedro River, Arizona.

TYPE SPECIMEN: Unknown

TAXONOMIC UNIQUENESS: 41 extant species of *Cyprinodon* distributed across North, Central, and South America. 12 species of *Cyprinodon* in North America, two existing species in Arizona, *C. macularius* and *C. eremus,* and one extinct species, *C. arcuatus*. *C. macularius* and *C. eremus* are collectively referred to as the Desert Pupfish complex (Loftis et al. 2009).

DESCRIPTION: Small fish, less than 3 in (7.6 cm) long. Per Minckley (1973); "Body thickened, chubby, or markedly compressed, laterally, in adult males. Mouth superior, highly protractile, armed with tricuspid teeth. Circuli of scales with marked, spine-like projections. Dorsal profile smoothly rounded, not markedly concave posterior to origin of dorsal fin.

Body color of females and juveniles with silvery background, with narrow, vertical, dark bars on sides, generally interrupted laterally to give the impression of a disjunct, lateral band. Fins generally colorless, with the exception of an ocellate spot in dorsal, and rarely a dark spot in anal fin. Mature, breeding male with caudal fin and posterior part of the caudal peduncle yellow or orange, sometimes intense orange-red; other fins generally dark. Body iridescent light- to sky-blue, especially on dorsum of head and predorsal region."

AIDS TO IDENTIFICATION: *C. macularius* differs from the Quitobaquito Pupfish, *C. eremus*, by having a narrower head, body, and mouth; longer pelvic fins and depressed anal fins (Miller and Fuiman 1987). Male desert pupfish may be distinguished from male Quitobaquito Pupfish by breeding coloration. Male desert pupfish exhibit "bright yellow to brilliant yellow orange" on the caudal peduncle and caudal fin, while Quitobaquito Pupfish exhibit, at most, "yellow-to olive-yellow" coloration of the caudal fins with yellow coloration either absent on the body or extending just onto the posterior third of the caudal peduncle (Echelle et al. 2000).

ILLUSTRATIONS:
B&W photo (Minckley 1973:189)
Color drawing (Page and Burr 1991)
Color photo (Rinne and Minckley 1991:25)

TOTAL RANGE: Historic range spanned from the lower Gila River and tributaries (Santa Cruz, San Pedro, and Salt rivers) in Arizona and Sonora, Mexico, westward to the Salton Sea of southern California, and in the lower Colorado River from Arizona and California through to the Colorado River Delta region of Sonora and Baja California (Miller 1943)

RANGE WITHIN ARIZONA: There are no natural populations of this subspecies remaining in Arizona. Populations were introduced at Cold Springs in Graham County, AD Wash in Yavapai County, and Finley Tank in Santa Cruz County. There are also several (34) refugia populations in private ponds and aquariums (USDI FWS 2019).

SPECIES BIOLOGY AND POPULATION TRENDS

BIOLOGY: Species of the Desert Pupfish complex have tolerances for higher temperatures, higher salinities, and lower dissolved oxygen concentrations which exceed the tolerances of other freshwater fishes (USFWS 1993). The species appear to go through cycles of population expansion and contraction in response to precipitation patterns (Weedman and Young 1997). In very wet years, populations can rapidly expand into new habitats (Hendrickson and Varela-Romero 1989). Varela-Romero (2002) and Martin and Saiki (2005) reported abundance to be highly variable over time; positively correlated with salinity, cover, and pH; negatively correlated with dissolved oxygen.

REPRODUCTION: Males are larger than females, exhibit an intensification of color during the breeding season, and exhibit territorial behavior. When a female is ready to spawn, she enters a male's territory. Spawning occurs from spring through autumn, but reproduction may occur year-round in warm constant environments (Constanz 1981). Each female may lay 50-800 eggs per season, depending on her size (Moyle 1976). Fertilized eggs are deposited randomly in a territory, and defended by the male. Hatching occurs within 7-13 days. Growth of young is rapid, sexual maturity may be reached in six weeks under favorable conditions. Reproduces at age 2-3 months in constant warm temperatures, first breeds at about a year in variable temperatures (Matthews and Moseley 1990).

FOOD HABITS: Omnivorous; small invertebrates, mosquito larvae, detritus, algae, and small bits of aquatic vegetation (Naiman 1979). In softer substrates, dig small pits in search of food and then aggressively defend the pits (Minckley 1973).

HABITAT: Historically occupied clear, shallow waters with soft substrates associated with cienegas, springs, streams, margins of larger lakes and rivers, shoreline pools, and irrigation drains and ditches.

ELEVATION: Below 1,500 m [4,920 ft.] (Rinne and Minckley 1991). Based on records in the Heritage Data Management System (HDMS), elevation ranges from 1,200 to 3,450 ft (366 - 1,052 m) (AGFD, unpublished data accessed 2001).

PLANT COMMUNITY: Lower Colorado River Sonoran Desert scrub

POPULATION TRENDS: Once common fish, now extirpated from most of natural range. Trend since early 1900's has been loss of habitat and declining numbers. Current status poor but stable, with an increasing population trend in Arizona due to an active recovery program (Duncan and Clarkson 2013; Robinson and Crowder 2015; Robinson and Mosher 2018).

SPECIES PROTECTION AND CONSERVATION

ENDANGERED SPECIES ACT STATUS: LE (USDI, FWS 1986), with Critical Habitat

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 Status (USDA, FS Region 3 2013)
[Forest Service Sensitive, USDA, FS Region 3 1988]
Bureau of Land Management Sensitive (USDI, BLM AZ 2017)
P, Determined Endangered in Mexico (NORMA Oficial Mexicana NOM-059-SEMARNAT-2010).
[PR, Determined Subject to Special Protection, Secretaría de Medio Ambiente, 2000]
IUCN VU

MANAGEMENT FACTORS: Activities that are known to be detrimental to pupfish populations should be avoided i.e.: dewatering of habitats, stream impoundment, channelization, domestic livestock grazing, timber harvesting, mining, road construction, polluting, and stocking non-natives.

Threats: Water loss from groundwater extraction and drought; habitat destruction; soil erosion leading to degrading watershed health; habitat alteration; predation by and competition with nonnative fishes and ranid frogs; genetic bottleneck in isolated populations and lack of genetic diversity in refugia populations.

Management needs: protect existing populations; assess genetic composition of remaining naturally occurring populations; identify refugium populations; re-establish populations; monitor and manage reintroductions to maintain minimum of 55 sites in Arizona.

PROTECTIVE MEASURES TAKEN: Recovery plan developed in 1993. Refugia populations established in private ponds and aquariums. Reintroduction efforts made in natural and "quasi-natural" locations. About 16 transplanted populations exist in the wild (all in Arizona); number fluctuates with establishment and failure of populations (Moyle 2002). The completion of Safe harbor Agreements that include the desert pupfish with the Arizona Department of Transportation, The Nature Conservancy, and the AGFD has provided opportunities to expand desert pupfish populations on non-Federal lands. Most reestablished populations are in human-constructed environments. Long-term viability of these populations is uncertain (USFWS 2010).

SUGGESTED PROJECTS: A specific genetic protocol should be developed, using work by Echelle et al (2007) as a template for management of *C. macularius* and *C. eremus* refuge populations. Their recommendations include establishing at least four large primary refuge populations, with each one representing one of the four groups of wild *C. macularius* and *C. eremus.* The primary refuge populations would receive periodic supplementation with wild fish. They also recommend that 10 or more secondary refuges representing each of the four wild source regions be established. Their report contains additional recommendations on management of the refuge populations (Echelle et al. 2007). Emphasize conservation at wild sites, using Safe Harbor Agreements only where no other progress can be made. Emphasize enrollment of large sites under SHA, ensuring genetic integrity is maintained and adequate numbers are available for conservation activites. Determine additional areas where wild populations may be established.

LAND MANAGEMENT/OWNERSHIP: BLM - Kingman, Safford and Tucson Field Offices; USFS - Tonto National Forest; TNC - Hassayampa River Preserve; Roper Lake State Park; Private.

SOURCES OF FURTHER INFORMATION

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ADDITIONAL INFORMATION:

Revised: 1994-09-15 (JNY)
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