Scientific Name: *Cyprinodon macularius*
Common Name: Desert pupfish
BISON No.: 010352

Legal Status:

- Arizona, Species of Special Concern
- ESA, Endangered
- ESA, Proposed Endangered
- ESA, Proposed Threatened
- ESA, Threatened
- New Mexico-WCA, Endangered
- New Mexico-WCA, Threatened
- USFS-Region 3, Sensitive
- None

Distribution:

- Endemic to Arizona
- Endemic to Arizona and New Mexico
- Endemic to New Mexico
- Not Restricted to Arizona or New Mexico
- Northern Limit of Range
- Southern Limit of Range
- Western Limit of Range
- Eastern Limit of Range
- Very Local

Major River Drainages:

- Dry Cimmaron River
- Canadian River
- Southern High Plains
- Pecos River
- Estancia Basin
- Tularosa Basin
- Salt Basin
- Rio Grande
- Rio Mimbres
- Zuni River
- Gila River
- Rio Yaqui Basin
- Wilcox Playa
- Rio Magdalena Basin
- Rio Sonoita Basin
- Little Colorado River
- Mainstream Colorado River
- Virgin River Basin
- Hualapai Lake
- Bill Williams Basin

Status/Trends/Threats (narrative):

Federal (USDI): Endangered, State AZ: Wildlife species of concern (Endangered).
Endemic pupfishes inhabiting insolated springs and streams in the southwestern United States and northern Mexico are being subjected to increasing environmental stress (Naiman 1979). There is limited information regarding threats, however, Naiman (1979) stated that diversion of water for other uses, permanent alteration of habitats, and interspecific competition from introduced species are serious problems. Other threats include predation by large aquatic insects, piscivorous birds, and occasional mammals are sources of population attrition (Minckley 1973).

Distribution (narrative):

Desert pupfish were distributed in the lower Colorado and Gila Rivers, from southern AZ to eastern lower CA, and Sonoyta River of northern Sonora, Mexico (Lee et al 1981).

One morphological form of *Cyprinodon macularius* once was widespread in Arizona, occurring throughout the lower Gila basin, downstream from the mountains, in the lower Colorado River system throughout Arizona, California, and adjacent Mexican states, and to the extreme headwaters of the San Pedro and Santa Cruz rivers (Miller, 1943 from Minckley 1973).

Key Distribution/Abundance/Management Areas:

Panel key distribution/abundance/management areas:

Breeding (narrative)**:**

Spawning occurs in the summer, and males guard small territories of bottom, or of vegetation, over which females deposit their eggs (Koster 1957).

Minckley (1973) described the breeding behavior of the desert pupfish as follows; the male moves alongside, an "S-shape" posture is assumed, with the male wrapping his anal fin around the anal fin or caudal peduncle of the female, and an egg(s) is extruded against the bottom or substrate. The eggs are deposited randomly within the territory of a given male, and in a few days the eggs hatch (Minckley 1973). There is no direct parental care, but the activities of a male on his territory may well serve that purpose (Koster 1957, Minckley 1973). In warm, shallow habitats, where foods are abundant, sexual maturity may be attained in about six weeks (Minckley 1973).

Desert pupfish can tolerate a wide range of environmental conditions, and in the field the desert pupfish was found to reproduce in salinities ranging from that of freshwater to approximately salinity of 70 and to exist at temperatures ranging from 8-39° C (Kinne and Kinne 1962). Eggs are usually laid individually, and average time of hatching was 12 hours at temperatures below 30° C; it was 1-3 hours at temperatures above 30° C (Kinne and Kinne 1962). At higher temperatures, however, a progressive retardation of development was noticeable in salinity of 35 (Kinne and Kinne 1962). At 70% air saturation, upper lethal temperature of incubation lies close to 28° C in 1/2 freshwater and close to 27.5^{o} C in seawater (Kinne and Kinne 1962). Kinne and Kinne (1962) reported that extreme conditions of temperature, salinity, and DO can induce developmental arrest, but such arrest may be reversible if conditions are normalized within hours or a few days: longer periods can cause irreversible damage; they are lethal.

Desert pupfish rarely exceed 40 mm, even as an extremely large adult (Minckley 1991).

Habitat (narrative)**:**

The desert pupfish survives in variety of habitats and typically in habitats with harsh or extreme environmental fluctuations in oxygen, temperature, and salinities, which preclude competitive or predaceous fishes (Lee et al 1981). Desert pupfishes are characteristic of many springs, marshes, and flowing streams, and also occur in backwaters and other complex, lateral habits of large rivers, at least in times past (Minckley 1973). Desert pupfish persist on the delta at present, typically in highly saline pools associated with the inflowing springs and seeps (Minckley 1991).

Key Habitat Components: springs, marshes, stream margins, shallow waters, aquatic vegetation.

Breeding Season:

- January
- February
- March
- April
- May
- June
- July
- August
- September
- October
- November
- December

Panel breeding season comments:

Aquatic Habitats:

Large Scale:

- Rivers
- Streams
- Springs
- Spring runs
- Lakes
- Ponds
- Sinkholes
- Cienegas
- Unknown
- Variable

Small Scale:

- Runs
- Riffles
- Pools
- Open Water
- Shorelines

Panel comments on aquatic habitats:

Important Habitat Features (Water characteristics):

Current

- Fast (> 75 cm/sec)
- Intermediate (10-75 cm/sec)
- Slow (< 10 cm/sec)
- None
- Unknown
- Variable

Gradient

- High gradient (>1%)
- Intermediate Gradient (0.25-1%)
- Low Gradient (<0.25%)
- None
- Unknown
- Variable

Water Depth

- Very Deep (> 1 m)
- Deep (0.25-1 m)
- Intermediate (0.1-0.25 m)
- Shallow (< 0.1 m)
- Unknown
- Variable

Panel comments on water characteristics:

Important Habitat Features (Water Chemistry)

Temperature (general)
- Cold Water (4-15°C)
- Cool Water (10-21°C)
- Warm Water (15-27°C)
- Unknown
- Variable

Turbidity
- High
- Intermediate
- Low
- Unknown
- Variable

Conductivity
- Very High (> 2000 µS/cm)
- High (750-2000 µS/cm)
- Intermediate (250-750 µS/cm)
- Low (< 250 µS/cm)
- Unknown
- Variable

Panel comments on water chemistry:

Important Habitat Features (Structural elements):

Substrate
- Bedrock
- Silt/Clay
- Detritus
- Sand
- Gravel
- Cobble
- Boulders
- Unknown
- Variable

Cover
- Rocks, boulders
- Undercut banks
- Woody debris
- Aquatic vegetation
- Rootwads
- Not important
- Overhanging vegetation
- Unknown
- Variable

Panel comments on structural elements:

Diet (narrative)**:**

Desert pupfish are omnivorous feeders (Naiman 1979), and travel in schools and do much of their feeding from the bottom mud of from the vegetation (Koster 1957). Feeding on exogenous material occurs after a few hours to a day after the eggs hatch the young desert pupfish begin to feed on small animals and plants (Minckley 1973). Naiman (1979), in his study, categorically separated food materials into algae, vascular plants, inorganic detritus, organic detritus, and animals. Animals comprised 56.5% of the gut volume, algae occupied 33.2% (Naiman 1979). A large proportion of the animal diet was chrionmid larvae, dipteran pupae, and lepidopteran larvae. Algae ingested by desert pupfish appeared to be viable, even if taken from the hindgut (Naiman 1979). Algae ingested by pupfish appeared to be viable, even if taken from the hindgut (Naiman 1979). Naiman (1979) reported that food habits appeared to have been dictated by environmental constraints upon the food supply.

Diet category (list):

- Planktivore
- Herbivore
- Insectivore
- Piscivore (Fish)
- Omnivore
- Detritivore

Grazing Effects (narrative):

Similar to topminnow, the species would be vulnerable to grazing effects in the form of trampling and removal of vegetation and bottom materials causing reduction of oxygen and possible elevation of water temperatures.

Panel limiting habitat component relative to grazing and comments:
Panel assessment: Is this species a priority for selecting a grazing strategy? Throughout the species' distribution in New Mexico and Arizona YES NO UNKNOWN In key management area(s) YES NO UNKNOWN

Principle Mechanisms Through Which Grazing Impacts This Species (list):

May be Revised

- Alteration of bank structures
- Alteration of substrate
- Alteration of water regimes
- Altered stream channel characteristics
- Altered aquatic vegetation composition
- Altered bank vegetation structure
- Change in food availability
- Change in water temperature
- Change in water quality
- Habitat fragmentation
- Increased turbidity
- Other biotic factors
- Parasites or pathogens
- Population genetic structure loss
- Range improvements
- Trampling, scratching
- Unknown

Panel causal mechanisms comments:

Authors

- **Draft:** Magaña, H.A. and Rinne, J.N.
- **GP 2001:**
- **GP 2002:**
- **Revision:**

Bibliography:

Koster, W.J. 1957. Guide to the fishes of New Mexico. University of New Mexico Press, Albuquerque, NM.

Kinne, O. and Kinne, E.M. 1962. Rates of development in embryos of Cyprinodont fish exposed to different temperature-salinity-oxygen combinations. Canadian journal of zoology 40: 231-253.

Lee, D. S., Gilbert C. R., Hocutt C. H., Jenkins R. E., Callister D. E., and Stauffer J. R. 1981. Atlas of North American Freshwater Fishes: North Carolina, North Carolina State Museum of Natural History, 1981, c1980.

Minckley, W.L. 1973. Fishes of Arizona. Arizona Game and Fish Department, Phoenix. 293 pp.

Minckley, W.L. 1991. Native fishes of arid lands: A dwindling resource of the desert southwest. USDA Forest Service. General Technical Report RM-GTR-206. pp 18.

Naiman, R.J. 1979. Preliminary food studies of *Cyprinodon macularius* and *Cyprinodon nevadensis* (Cyprinodontidae). The Southwestern Naturalist 24 (3): 538-541.