Scientific Name: *Gila cypha*
Common Name: Humpback chub
BISON No.: 010114

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: Endangered.
Over the course of the 20th century, the distributional range of the humpback chub had been reduced by more than 70% as a result of anthropogenic activities in the Colorado River (Gorman and Stone 1999). Additional human alterations of the aquatic ecosystem of the Colorado River will occur perhaps most predictably as the result of developments planned to meet the increasing demands for water (Kaeding et. al. 1990). Declines of humpback chub have been attributed to dewatering; mainstem dams and impoundments; altered stream flows, channel morphology, and water quality; and introduction of exotic fishes (**Miller 1961**).
One reason for the decline of humpback chub is high dams with their resultant reservoirs and cold tailwaters that are unsuitable habitat for reproduction (Holden and Stalnaker 1975, Kaeding and Zimmerman 1983, Marsh 1985). Hypolimnetic discharges result in downstream

temperatures in most of these streams that are relatively cool in summer and warm in winter (Kaeding and Zimmerman 1983). Lower tailwater temperatures and the loss of lotic habitat in the reservoir presumably eliminated reproduction by some native fishes and led to their eventual extinction in that region (Kaeding and Zimmerman 1983). Distribution of humpback chub in the mainstem Colorado River in Grand Canyon is limited by cold, hypolimnetic releases from Glen Canyon, low food availability, large number predators, and possibly habitat instability from dam operations (Wasowicz and Valdez 1995). Seasonal dewatering of upstream reaches might have eliminated use of Little Colorado River by species other than those tolerant of its present physiochemical conditions (Kaeding and Zimmerman 1983).

There is evidence of massive hybridization between humpback, bonytail, and roundtail chubs in the area of Glen Canyon Dam near Page, Arizona (Rinne and Minckley 1970, Holden and Stahlnaker 1970). The alteration of the Colorado River environment could have forced bonytails there to spawn in the lower Little Colorado River; some interbreeding might have occurred with humpback chubs before the bonytail stock was eliminated (Kaeding and Zimmerman 1983). Competition from introduced species such as the red shiner that have created more competition for space and food for juvenile fish (Holden and Stalnaker 1975). Nonnative fishes are abundant, and even modest predation rates could result in consumption of substantial numbers of native fishes (Marsh and Douglas 1995). Adult humpback chubs from Little Colorado River sometimes exhibited apparent channel catfish bite marks (Kaeding and Zimmerman 1983). Predatory fishes represent a threat to the humpback chub in the Little Colorado River and may exert a major negative effect on the population there. Our data indicate that on average about 3% of rainbow trout and channel catfish ate an average of 2.3 humpback chubs. If an average meal of 2.3 prey is taken once a week, a predator population of 1,000 would annually consume 3,588 humpback chub. Predation impacts may limit native species populations (Marsh 1997). Disease are also a threat to humpback chubs. Adult humpback chubs collected from the confluence and from the lower Little Colorado River showed acute signs of systemic bacterial infection of *Aeromonas hydrophila* , including abundant petechia and poor physical condition (Kaeding and Zimmerman 1983).

Distribution (narrative)**:**

Archaeological and historic records indicate that the endangered humpback chub (*Gila cypha*) was once distributed throughout the Colorado River and its major tributaries in the Grand Canyon and Green River UT (Marsh 1985, Wasowicz and Valdez 1995). The humpback chub achieves greatest abundance in the lower basin where it utilizes the Little Colorado River for spring reproduction and summer residence (Douglas and Marsh 1992) where mean water temps were about 9° C warmer in the Little Colorado River than in the Colorado River throughout the year (Kaeding and Zimmerman 1983). The population center of humpback chubs in the Grand Canyon is associated with the Little Colorado River where a majority of the Little Colorado River population component spawns (Lee et. al. 1981, Kaeding and Zimmerman 1983, Marsh 1985, Wasowicz and Valdez 1995, Douglas and Marsh 1997). The humpback chub once occurred downstream to just below the present site of Hoover Dam and upstream in the larger portions of the main river (**Sigler and Miller 1963**). At present, the humpback chub is restricted in distribution to tight, canyon-bound reaches of the Grand Canyon and above, and is known from only a few, scattered and sporadic collections (Minckley 1973, Gorman and Stone 1999). Valdez et. al. (1992) reported that ninety-five percent of 1,392 humpback chub captured in the mainstem

Colorado River in Grand Canyon, from Oct. 1990 through June 1992, were found in a 13 km reach between River Mile (RM) 57 and 65, about equidistant upstream and downstream of the confluence with the Little Colorado River (RM 61.3). The humpback chubs are distributed in six concentrated groups along the mainstem Colorado River (Valdez et. al. 1992, Gorman and Stone 1999).

Key Distribution/Abundance/Management Areas:

Panel key distribution/abundance/management areas:

Breeding (narrative)**:**

Very little is known of the biology of the humpback chub, mainly because of the difficulties in collecting in its presumed habitat (Minckley 1973). The onset of female and male maturity occurred at lengths of about 250 to 300 mm (Kaeding and Zimmerman 1983). Gorman and Stone (1999) reported that spawning commences in late March and peaks in mid-April, and wanes by mid-May. Kaeding et. al. (1990) reported capturing female humpback chubs with expressible ova between late June and late July. Kaeding et. al. (1990) stated that humpback chubs spawned when river discharge was near its seasonal high or was receding, and when river temperatures were 14-24° C.

Breeding habitat varies with researchers reporting spawning habitat consisting of boulder and sand substrate, submerged cobble and gravel bars, and shorelines composed of large angular boulders. Ripe males aggregated in areas of complex habitat structure with high angular variation in bottom profiles and were associated with deposits of clean gravel, and spawning involves contact with gravel substrates, where semi-adhesive eggs are deposited and fertilized (Gorman and Stone 1999). There is evidence that humpback chub spawn during receding spring and early high flows that originate as snowmelt runoff from western Rocky Mountains (**Valdez & Clemmer 1982**). Gorman and Stone (1999) reported that nearly 80% of all ripe-spawning fish were captured during night sampling, suggesting that most spawning activity occurs during crepuscular and nocturnal periods. When water temperature was maintained at 16-17° C incubation time was about 167-266 hours; hatching success was 62% and 91% of embryos that hatched became feeding larvae (Kaeding and Zimmerman 1983). The percentage of humpback chub hatch was dependent on temperature with greatest success at 20° C (Kaeding and Zimmerman 1983). Kaeding et. al. (1983) reported that humpback chubs are a long-lived species since two recaptured fish had been tagged in 1979, three in 1980, and three in 1981 indicating that humpback chubs live longer than 10 years, however, Minckley (1973) suggested that the humpback chub lives a relatively long time, perhaps longer than 30 years.

Habitat (narrative)**:**

Humpback chubs live in swift, turbulent habitats of the Colorado River (Rinne 1970). Humpback chubs are often in deep, swift areas, but also common in canyon-shaped pools or along deep, ledge-shaped reaches with moderate current (Lee et. al. 1981, Kaeding et. al. 1990). The humpback chub is found in whitewater, where it lives in deep eddies associated with large

boulders, indentations in canyon walls, or other protecting obstructions (Minckley 1991). Holden and Stalnaker (1975) found that most specimens that were taken were from eddies adjacent to fast currents, in 1969 only 61 were taken, in 1970 only was taken with increased effort suggesting a decrease in abundance had occurred. Gorman and Seales (1995) gave an in depth description of humpback chub habitat. During the day, subadult (> 150 mm TL) and adult humpback chub (> 210 mm TL) used habitats 80 to > 300 cm depth, very slow to slow currents (0.02-0.3 m/s) associated with areas containing a mix of sand, cobble, and small and large boulder substrates, used near-benthic vertical positions (> =80% depth) and associated with areas with a mix of low and high vertical structure and cover. At night, subadult and adult humpback chuub showed a shift in habitat use to include more shallow (<100 cm) open areas with less vertical structure and cover, fewer large substrates, slow currents (0.10-0.30 m/s) and midwater vertical positions. Juvenile humpback chubs (100-150 mm) were restricted to more shallow areas (80-200 cm) and used midwater to near benthic vertical positions and did not show a strong nocturnal shift in habitat use. Young of hte year humpback chub were largely restricted to shallow (< 150 cm deep) near shore (< 600 cm) areas with slow currents, a mixture of fine, cobble, and small boulder substrates, moderate cover and vertical structure and cover. Ripe-spawning fish used areas closer to emergent edges as indicated by reduced mean lateral position, and used areas containing greater frequency of gravel substrate and greater structural complexity (Gorman and Stone 1999).
Key Habitat Components: Swift current, moderate to large rivers.

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)**:**

All chubs are principally carnivorous as adults, feeding upon aquatic invertebrates and sometimes other smaller fishes. Smaller individuals often feed on aquatic plants, usually algae (Rinne and Minckley 1970). (Minckley 1973) found that specimens that were taken from below Glen Canyon Dam had fed mostly on planktonic crustaceans and algae that must have been carried into the river from upstream reservoir. The amphipod, *Gammarus lacustris*, chironomids, simuliids, terrestrial invertebrates, and the green alga, *Cladophora glomerata* dominated stomach contents (Leifried and Valdez 1995, Dresser and Hoffnagle 1997).

Diet category (list):

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

Grazing Effects (narrative):

No specific information related to grazing effects and humpback chubs. Similar to the other big river fishes grazing has little direct effect on this species due to limited distribution in the Grand Canyon where grazing is absent.

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

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