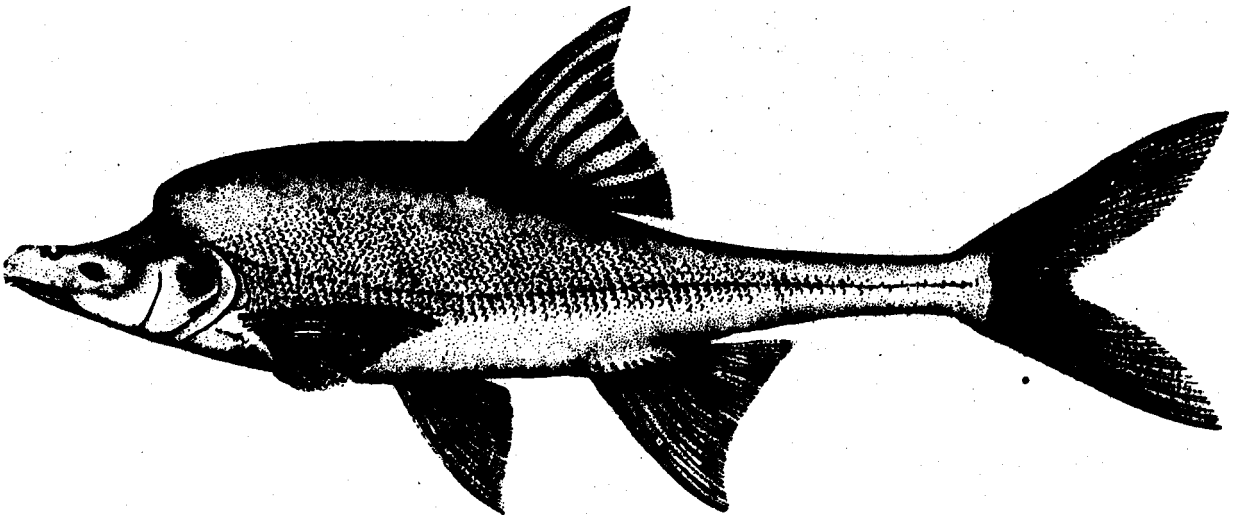
THE HUMPBACK CHUB,

GILA CYPHA

(Excerpted From the Recovery Plan)



U.S. Fish and Wildlife Service
Area Office --Utah-Colorado
1311 Federal Building
125 *S* State Street
Salt Lake City, Utah 84138

INTRODUCTION

General Description

The humpback chub (Gila cypha Miller) is one of North America's most bizarre animals. A prominent nuchal hump, flattened head (concave posteriorly), long fleshy snout, and small eye give it an almost grotesque appearance. Yet, these features combine to provide this minnow with unique adaptations which enable it to survive in one of the world's most severe aquatic ecosystems - the Colorado River.

The humpback chub was one of the last large fish species to be discovered in North America. A specimen caught in the Grand Canyon, and another specimen and a head from unknown localities, formed the basis for describing this unique creature (Miller 1946). Recent publications have more fully described the intraspecific variation of this species (Holden and Stalnaker 1970; Minckley 1973; Suttkus and Clemmer 1977).

The following summary (Minckley 1973) aptly describes the humpback chub:

> "Body streamlined; skull concave on dorsum. Nape abruptly produced at occiput into a truncate, prominent hump, which often projects forward to overhang occiput in large adults. Caudal peduncle thin, somewhat pencil-like but not greatly elongated, its length divided by length of head less than 1.0; head length divided by caudal peduncle less than 5.0. Squamation often incomplete, or scales embedded deeply (especially on hump). Fins large, falcate. Origin of dorsal fin about equidistant between snout and caudal fin base. Dorsal fin rays usually 9, anal fin rays 10 or more. Mouth inferior, overhung by snout. Pharyngeal arch small, its lower ramus short, teeth usually 2, 5-4,2."

Maximum length of humpback chubs is about 45 cm and adults tend to be olivaceous or brownish on the back and silvery on the sides and belly.

Characters which distinguish it from the closely related bonytail chub (2. elegans) and roundtail chub (lc. robusta) include: 1) the prominent nuchal hump with lateral grooves that extend posteriorly along the hump, 2) the flat head with fleshy snout and small eyes, 3) dorsal rays typically 9 and anal rays typically 10 (occasionally 11), 4) a caudal peduncle depth intermediate between those of the bonytail (narrow)

Therefore, the historical distribution of Gila cypha probably included most of the larger, swift-water canyons on the Colorado and Green rivers above Lake Mead, and two Green River tributaries, the Yampa and White rivers.

The absence of reliable data makes it difficult to adequately assess pre-1950 humpback chub abundance. Their abundance in the canyon areas listed above was usually limited, although they were common in one or two particular spots within those areas (Smith 1960; Holden and Stalnaker 1975; Kidd 1977; Seethaler et al. 1976). Occurrence of humpback chub bones in caves used by Indians suggests a fair abundance at one time in the area near Hoover Dam (Miller 1955). However, the general impression is that during historical time, this species may have been uncommon when compared to other endemic fishes.

Present Distribution and Abundance

Available data indicate that several major changes have occurred in humpback chub populations. Humpback chubs were eliminated from the Green River above the mouth of the Yampa River in Colorado, Utah, and Wyoming when Flaming Gorge Dam became operational in 1962 (Vanicek et al. 1970). Humpback chubs were common in fishery samples from Lake Powell soon after closure in the 1960's, but they have not been collected during the last few years (personal communication, Dale Hepworth, Utah Division of Wildlife Resources). The cold tailwaters of Glen Canyon Dam (Lake Powell) have apparently caused major reductions in both distribution and abundance of humpback chubs in Marble and Grand canyons (Minckley 1973; Holden and Stalnaker 1975; Suttkus et al. 1976). Recent researchers in Marble and Grand canyons have found humpback chubs distributed from River Mile 27 to River Mile 108, with a concentration occurring in and near the mouth of the Little Colorado River (Suttkus et al. 1976; personal communication, C. Minckley, Museum of Northern Arizona). C. Minckley (1977) recently recorded humpback chubs 13 km upstream in the Little Colorado River. Due to the recent discovery of humpback chub populations in Desolation Canyon and the Black Rocks area, no population changes have been documented. Recent collections in the White River (Anonymous 1977) and the Colorado

River near Moab, Utah (Taba et al. 1965; Holden and Stalnaker 1975) have failed to find any humpback chubs. Present distribution of the humpback chub includes (Figure 1):

1. The Green River in Desolation and Gray canyons (Holden and Stalnaker 1975; Holden 1977);
2. The Green River in Dinosaur National Monument (Miller 1964; Holden and Stalnaker 1975);
3. The Yampa River in Dinosaur National Monument (Miller 1964; Holden and Stalnaker 1975; Seethaler et al. 1976);
4. The Colorado River between Palisade, Colorado, and Black Rocks near the Colorado-Utah border (Kidd 1977);
5. The Colorado River in Marble and Grand Canyons from River Mile 27 to River Mile 108 (Suttkus et al. 1976; Suttkus and Clemmer 1977) and the Little Colorado River from its mouth to a point 13 km upstream (C. Minckley, personal communication).

Distribution in all the areas listed above is sporadic, with concentrations in very small parts of the canyon areas (Holden 1977; personal communication, C. Minckley, Museum of Northern Arizona).

Reproduction of humpback chubs as evidenced by young-of-the-year or juvenile fish is recorded from Desolation and Gray canyons (Holden and Stalnaker 1975; Holden 1977) and from the Grand Canyon near the Little Colorado River (Suttkus et al. 1976; Suttkus and Clemmer 1977; personal communication, C. Minckley, Museum of Northern Arizona).

The humpback chub has generally been associated with fast currents and/or deep channels (Holden and Stalnaker 1975; Seethaler et al. 1976; Kidd 1977). Holden (1977) studied preferred habitat of this species in Desolation and Gray canyons in September, 1977. Young-of-the-year and juvenile chubs preferred habitats with little current, a silt substrate, and a depth of 0.3-1.0 m. Adults utilized a variety of areas, usually over a sand substrate, and showed little preference for either depth or velocity. Distributional information stresses the preference for canyon areas that contain deep, fast water, although microhabitat studies indicate that shallower, slower areas within these canyons are used during daily activities.

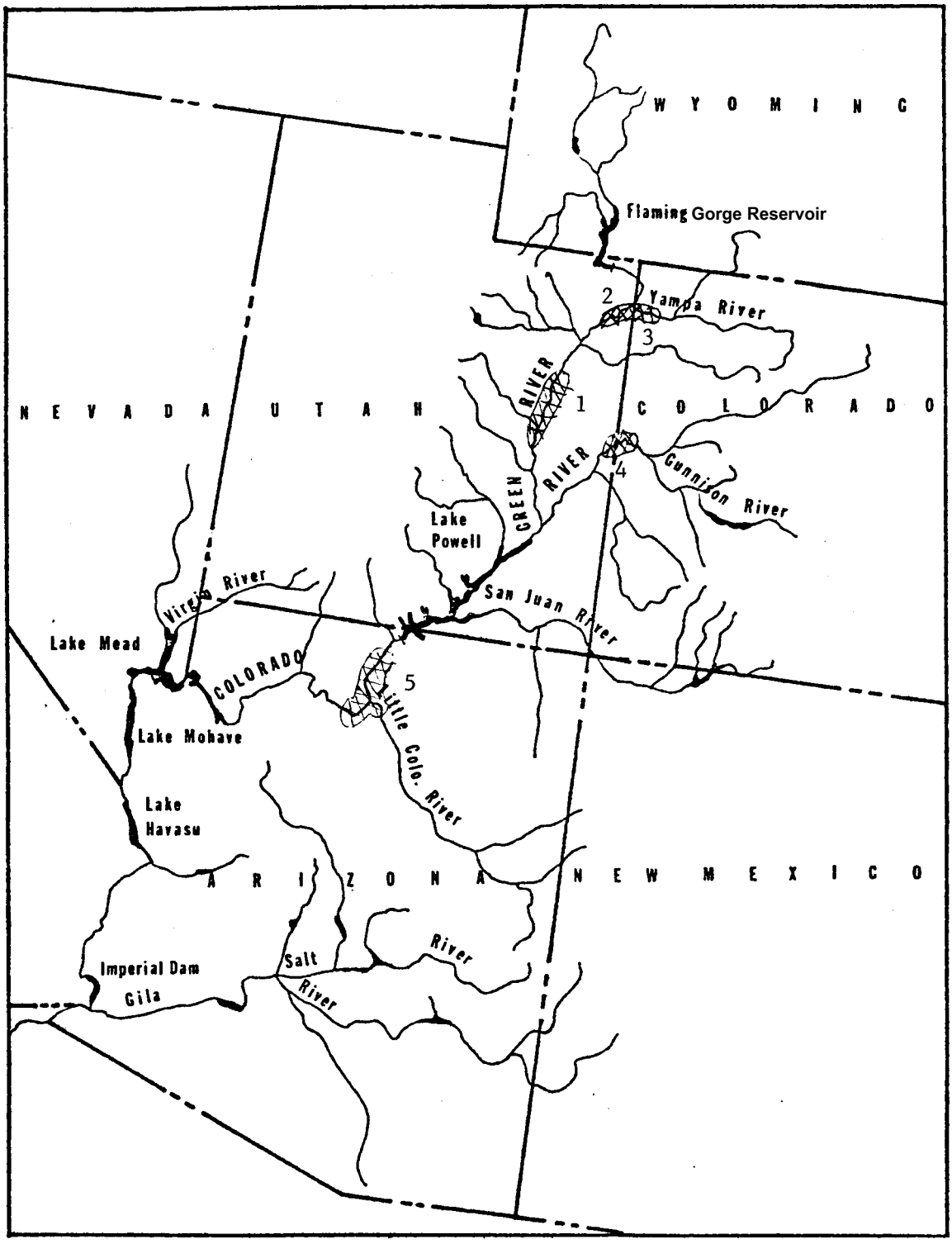


Figure 1. Present distribution (XX) of the humpback chub; (1) The Green River in Desolation and Gray Canyons, (2) The Green River in Dinosaur National Monument, (3) The Yampa River in Dinosaur National Monument, (4) The Colorado River near the Colorado-Utah Border, and (5) The Colorado and Little Colorado rivers in Grand Canyon National Park.

Humpback chubs are relatively common in Desolation-Gray canyons (Holden 1977), in the Little Colorado River (personal communication, C. Minckley, Museum of Northern Arizona), and the Black Rocks area of Colorado (Kidd 1977). The Desolation-Gray canyons area probably contains the largest population, as the other two areas have less suitable habitat. The Little Colorado River is serving as a refugium for the Grand Canyon population from the cold, fluctuating conditions of the Colorado River in that area. Humpback chubs are relatively rare in the Green and Yampa rivers of Dinosaur National Monument where they usually have been taken from one or two rather restricted reaches (Holden and Stalnaker 1975; Seethaler et al. 1976).

Life History

No specific research has been conducted on humpback chub life history except the microhabitat study mentioned previously. Therefore, life-history information must be extrapolated from data on closely related species (bonytail and roundtail chubs) and the occasional observations of field researchers.

Spawning of roundtail and bonytail chubs appears to occur at river temperatures of approximately 18°C (Vanicek and Kramer 1969; Holden 1973). Due to the close systematic relationship between these species and the humpback chub, it is reasonable to assume that similar temperatures are required by the humpback chub. Paul Holden (personal communication, Logan, Utah) collected a ripe male humpback chub in the lower Yampa River at the same time that roundtail males were ripe there. The specimen had slight breeding tubercles in the dorsum and splashes of orange coloration near the paired fins, similar to that noted in roundtails and bonytails. Size of humpback young in Desolation and Gray canyons in September suggests that spawning occurs in May or June when water temperature first reaches 18°C. Suttkus and Clemmer (1977) stated that spawning of humpback chubs "probably occurs during June and July in the Grand Canyon area."

Growth of young humpbacks, as shown by length/frequency analysis (Holden 1977), indicates that in September, Desolation Canyon young-of-the-year are 30-70 mm and juveniles (age I and II?) are 70-150 mm.

These specimens were somewhat larger than young roundtail chubs found during the same study in the Green River near Jensen, Utah, and are larger than both roundtails and bonytails collected by Vanicek and Kramer (1969) in the Green River of Dinosaur National Monument. Larger young are expected in Desolation Canyon because of the probable earlier spawning time.

The subterminal mouth of the humpback chub suggests bottom feeding (Miller 1946). This assumption has not been tested since no stomach analyses of this species have been made. Humpback chubs have been observed feeding on the surface in Desolation Canyon and several netted at Black Rocks and in Dinosaur National Monument were caught very near the surface (personal communication, P. Holden, Logan, Utah; personal communication, N. Armantrout, BLM, Moab, Utah). This suggests that the humpback is a surface feeder, as is the bonytail chub (Vanicek and Kramer 1969).

Minckley (1973) noted that humpbacks caught below Glen Canyon Dam had fed primarily on planktonic crustaceans which apparently originated in Lake Powell. No food habit studies have been conducted on specimens from more natural environments.

Reasons for Decline

The major reason for decline of humpback chub populations has been the operation of Flaming Gorge and Glen Canyon dams, and perhaps Hoover Dam. Impoundments and cold tailwaters created by these dams have eliminated humpback chub populations from significant portions of prior habitat (Vanicek et al. 1970; Holden and Stalnaker 1975; Suttkus et al. 1976; Suttkus and Clemmer 1977; Smith et al. 1978). The fish eradication program on the Green River prior to closing Flaming Gorge Dam probably adversely affected humpback chub populations in Dinosaur National Monument (Miller 1963, 1964), although pre-eradication studies were not conducted in this area and, therefore, no objective data are available to support this assumption.

Desolation Canyon and Black Rocks populations have not been known sufficiently long for population changes to be documented. It seems reasonable to assume that reduced flows far below the cold, fluctuating

tailwaters of dams may be adversely affecting humpback chub habitat, as is suspected for other rare fish (Colorado squawfish, bonytail chub; Joseph et al. 1977). Such reductions may have altered river hydraulic performance to a point where humpback chub habitat, especially that needed for spawning and rearing, has been reduced or altered significantly, and therefore reproductive success has been lowered.

Another potential reason for decline is competition and/or predation by exotic species. A large number of exotic species has been introduced into the Colorado basin and, therefore, may have added to the demise of the humpback chub (Miller 1961; Holden et al. 1974).

Another reason for decline may be hybridization (Minckley 1973; Holden et al. 1974). The relatively frequent occurrence of probable hybrids in relation to the number of good humpback chubs in recent collections suggests a gradual "swamping" of the genetic stock (Holden and Stalnaker 1970, 1975; Holden 1977). Some authors have suggested the hybridization is caused by habitat modification, especially that resulting from dams in the 1960s (Minckley 1973; Johnson 1976). Other authors (Holden et al. 1974) have suggested that the hybridization occurred before major alteration. Regardless, hybridization in small, isolated populations may well cause the demise of such populations, or at least the loss of pure genetic stock. Recent alterations in the upper basin, and proposed alterations, especially flow depletions, may increase the hybridization potential and therefore speed the demise of the humpback chub.

Literature Cited

Anonymous. 1977. Final environmental baseline report. White River Shale Project, VTN Colorado Inc., Denver.

Bosley, C. E. 1960. Pre-impoundment study of the Flaming Gorge Reservoir. Wyoming Game and Fish Comm., Cheyenne. Fish Tech. Rep. No. 9 81 pp.

Holden, P. B. 1973. Distribution, abundance and life history of the fishes of the Upper Colorado River basin. Ph.D. dissertation, Utah State Univ., Logan. 59 pp.

Holden, P. B. 1977. A study of the habitat use and movement of the rare fishes in the Green River from Jensen to Green River, Utah, August and September, 1977. BIO/WEST Project Report 13-1; Logan Utah.

Holden, P. B., W. White, G. Somerville, D. Duff, R. Gervais, S. Gloss. Threatened fishes of Utah. Utah Acad. Sci., Arts, Lett., Proc. 51(2):46-65.

Holden, P. B. and C. B. Stalnaker. 1970. Systematic studies of the cyprinid genus Gila, in the upper Colorado River basin. Copeia 1970(3):409-420.

Holden, P. B. and C. B. Stalnaker. 1975. Distribution and abundance of mainstream fishes of the middle and upper Colorado River basin, 1967-1973. Trans. Am. Fish. Soc. 104(2):217-231.

Johnson, J. E. 1976. Status of endangered and threatened fish species in Colorado. U. S. Dept. Int., Bur. Land Man., Tech. Note 280. 21pp + appendix.

Joseph, T. W., J. A. Sinning, R. J. Behnke, and P. B. Holden. 1977. An evaluation of the status, life history, and habitat requirements of endangered and threatened fishes of the upper Colorado River system. Western Energy and Land Use Team, Ft. Collins, Colo. 183 pp.

Kidd, G. 1977. An investigation of endangered and threatened fish species in the upper Colorado River as related to Bureau of Reclamation projects. Final Report to Bur. of Reclamation, Grand Junction, Colo. 44 pp.

Miller, R. R. 1946. Gila cypha, a remarkable new species of cyprinid fish from the Colorado River in Grand Canyon, Arizona. J. Wash. Acad. Sci. 36(12):409-415.

Miller, R. R. 1955. Fish remains from archaeological sites in the lower Colorado River basin, Arizona. Mich. Acad. Sci., Arts, Lett., Pap. 40:125-136.

Miller, R. R. 1961. Man and the changing fish fauna of the American Southwest. Mich. Acad. Sci., Arts, Lett., Pap. 46:365-404.

Miller, R. R. 1963. Is our native underwater life worth saving? Nat. Parks Mag. 37:4-9.

Miller, R. R. 1964. Fishes of Dinosaur. Naturalist 15(2):24-29.

Minckley, C. O. 1977. A preliminary survey of the fish of the Little Colorado River from Blue Spring to the vicinity of Big Canyon, Coconino County, Arizona. Rept. to Off. End Spp. Region II. U. S. Fish and Wild. Serv. 8 pp.

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

Minckley, W. L. 1976. Appendix 8: Fishes. Page 379 In, E. W. Haury. The Hohokam, Desert Farmers and Craftsmen. Univ. Arizona Press. Tucson.

Olsen, S. J. 1976. Appendix 7: Micro-vertebrates. Page 378 In E. W. Haury. The Hohokam, Desert Farmers and Craftsmen. Univ. Arizona Press, Tucson.

Seethaler, K. H., C. W. McAda, and R. S. Wydoski. 1976. Endangered and threatened fish in the Yampa and Green rivers of Dinosaur National Monument. Utah Coop. Fish Unit, Utah State Univ., Logan.

Sigler, W. F. and R. R. Miller. 1963. Fishes of Utah. Utah State Dept. of Fish and Game, Salt Lake City. 203 pp.

Smith, G. R. 1960. Annotated list of fishes of the Flaming Gorge Reservoir basin, 1959. Pages 163-168 In R. M. Woodbury (ed.). Ecological studies of the flora and fauna of Flaming Gorge Reservoir basin, Utah and Wyoming. Univ. Utah, Dept. Anthropol., Anthropol. Paper No. 48, Upper Colorado Basin Ser. No. 3

Smith, G. R., R. R. Miller, and W. D. Sable. 1978. Species relationships among fishes of the genus Gila in the upper Colorado River drainage. Proc. 1st Conf. Sci. Res. in Nat. Parks, Nat. Park Serv., U. S. Dept. Int., Washington, D. C. (in press).

Suttkus, R. D., G. H. Clemmer, C. Jones, and C. R. Shoop. 1976. Survey of fishes, mammals and herpetofauna of the Colorado River in Grand Canyon. Grand Canyon Nat. Park, Colo. River Res. Series, Contr. No. 34. 30 pp + appendices.

Suttkus, R. D. and G. H. Clemmer. 1977. The humpback chub, Gila cypha, in the Grand Canyon area of the Colorado River. Occas. Pap. Tulane Univ. Mus. Nat. Hist. 1:1-30.

Taba, S. S., J. R. Murphy, and H. H. Frost. 1965. Notes on the fishes of the Colorado River near Moab, Utah. Utah Acad. Sci., Arts, Lett., Proc. 42(2):280-283.

Vanicek, C. D. and R. H. Kramer. 1969. Life history of the Colorado squawfish, Ptychocheilus lucius, and the Colorado chub, Gila robusta, in the Green River in Dinosaur National Monument, 1964-1966. Trans. Am. Fish. Soc. 98(2):193-208.

Vanicek, C. D., R. H. Kramer, and D. R. Franklin. 1970. Distribution of Green River fishes in Utah and Colorado following closure of Flaming Gorge Dam. Southwest. Nat. 14(3):297-315.