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ICHTHYOLOGICAL NOTES

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RECENT CAPTURE OF A BONYTAIL (*GILA ELEGANS*) AND OBSERVATIONS ON THIS NEARLY EXTINCT CYPRINID FROM THE COLORADO RIVER.—The bonytail (*Gila elegans*) is one of several *Gila* endemic to the Colorado River basin. The aquatic ecosystems of the basin have been profoundly altered by water-development projects, introduction of non-native fishes, poor land-use practices and other activities of technologic man (Miller, 1961; Minckley and Deacon, 1968; Ono et al., 1983). The negative effects of these changes have presumably been especially significant for the bonytail, for it is now near extinction.

Observations of early workers indicate bonytail were formerly widespread and abundant in the large rivers (Jordan, 1891; Jordan and Evermann, 1896; Gilbert and Scofield, 1898). Vanicek and Kramer (1969) collected 67 bonytail (>200 mm TL) from the Green River during 1964–66 and were the last to report appreciable numbers in riverine habitat. During the past several years, fewer than ten presumed bonytail have been captured from the Green (Tyus et al., 1982 and references therein; Paul B. Holden, pers. com.) and about 25 bonytail have been collected from Lake Mohave, a lower Colorado River reservoir in which the few bonytail are large, old and apparently not reproducing (Minckley, 1983; Bozek et al., 1984). Because morphological characters do not clearly distinguish young bonytail from other sympatric *Gila*, reproductive success of Green River bonytail is unknown. We document here the recent capture of a bonytail, describe the capture site and other species that occur there and offer additional observations on the bonytail of the Colorado River basin.

We captured a bonytail on July 17, 1984, from the Black Rocks area of the Colorado River, western Colorado. This 2 km long reach, a major habitat for humpback chub (*G. cypha*), is a narrow, deep-water, turbulent area formed by passage of the river through a relatively erosion-resistant layer of metamorphic rock. The Black Rocks area is unlike the broad, relatively shallow reaches of the nearby Gunnison and Green rivers from which bonytail historically were collected (Jordan, 1891; Jordan and Ev-

ermann, 1896). We photographed the fish (Fig. 1), a mature female with light tubercles on pectoral fins and head and took the following measurements and counts (after Lagler et al., 1977) before releasing it alive: total length, 458 mm; fork length, 418 mm; weight, 560 g; distance between insertion of pectoral and pelvic fins, 86.6 mm; depth of nuchal depression (Smith et al., 1979), 6.7 mm; caudal-peduncle depth, 14.8 mm; caudal-peduncle length, 108.9 mm; head length, 85.8 mm; dorsal-fin base, 53.2 mm; anal-fin base, 55.2 mm; dorsal-fin rays, 10; and anal-fin rays, 10.

These data and the photograph were provided to six ichthyologists who have worked extensively on the taxonomy of *Gila* and each was asked his opinion as to the identity of the fish. Four of five respondents agreed that the fish was a bonytail. The fifth believed the fish was largely bonytail, but that the ventral mouth overhung by the snout indicated the presence of some humpback chub genes. Two respondents mentioned the “Roman nose” or “flat head”—characters that could be interpreted as indicative of the occurrence of humpback chub genes—but the presence of these characters did not affect their identifications. One of these respondents suggested such characters reflect individual variation that is especially pronounced among old fish.

The bonytail was large and probably old. The largest seen by Vanicek and Kramer (1969) was 388 mm TL (estimated on the basis of scale annuli to be 7 yr old). Seven bonytail collected by Bozek et al. (1984) from Lake Mohave were 475–535 mm TL. The largest bonytail seen by Minckley (1973), from another lower Colorado River reservoir (Lake Havasu), was 489 mm TL. Although the age of that fish was not given, marks on otoliths of large bonytail from Lake Mohave suggested these fish might be more than 30 yr old (W. L. Minckley, pers. com.).

Our capture demonstrates that bonytail remain in the upper Colorado River basin, although their scarcity suggests a viable population might not exist. In addition to the bonytail, we collected 602 adult-size (>250 mm TL) *Gila* from the Black Rocks area; on the basis of gross morphologic characters, we tentatively identified 272 as humpback chub, 271 as roundtail chub (*G. robusta*) and 59 as possible intergrades

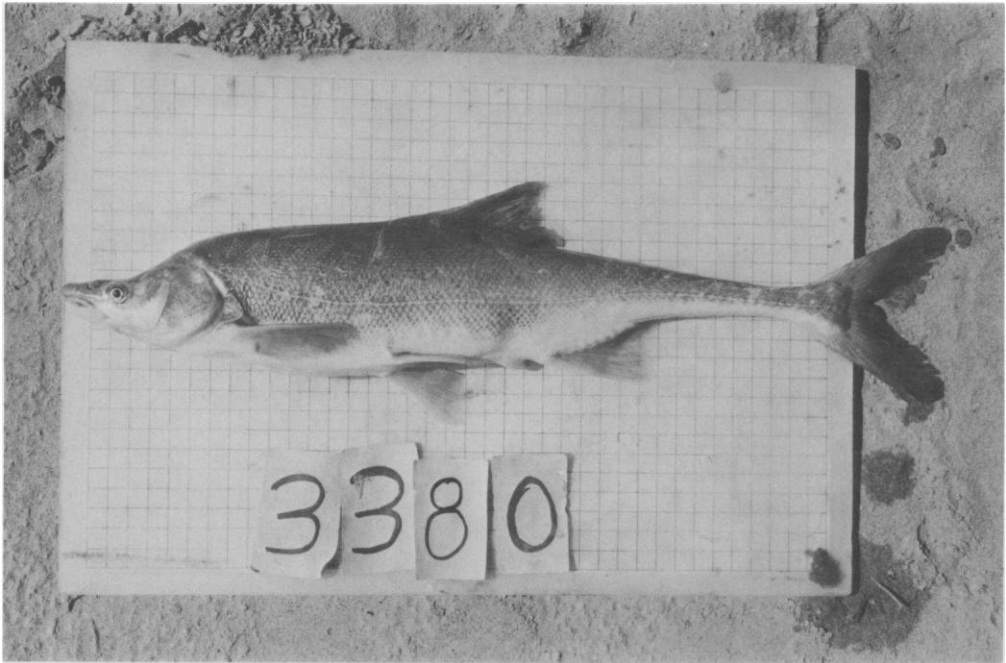


Fig. 1. Bonytail captured from the Black Rocks area of the Colorado River, Mesa County, Colorado, July 17, 1984. The background pattern is a 1 cm grid.

or hybrids of these species. The bonytail was collected in a trammel net that also captured humpback chub and roundtail chub, some of which were in reproductive condition as revealed by the occurrence of expressible ova and milt. The small number of bonytail remaining increases the likelihood that they will interbreed with these more abundant *Gila* (Hubbs, 1955). Recent artificial hybridization experiments showed gene exchange among these *Gila* is possible (Hamman, 1981). Presumed bonytail \times humpback chub intergrades have been reported from Lake Powell—a Colorado River reservoir about 230 km downstream from our study area—and from the Green River (Holden and Stalnaker, 1970).

The decline of bonytail and that of other native southwestern fishes has been attributed to the alteration of discharge and temperature regimes downstream from dams and diversions, conversion of riverine ecosystems to lacustrine ones in the reservoirs upstream, introduction of non-native fishes and altered water quality (Miller, 1961; Minckley and Deacon, 1968). However, aside from the obvious detrimental effect on bonytail of severe dewatering, only that of unseasonably cold, hypolimnetic waters

from dams has been demonstrated. Vanicek and Kramer (1969) studied bonytail in the Green River near its confluence with the Yampa River after the 1962 closure of Flaming Gorge Dam, upstream on the Green. Because age-0 *Gila* were absent, Vanicek and Kramer concluded that bonytail (as well as roundtail chub) did not reproduce in the reach between the dam and the Yampa in 1964 and 1966—years when temperatures were sharply reduced by large, hypolimnetic discharges from the dam (Vanicek et al., 1970). Subsequent work by Hamman (1982) and Marsh (1985) showed survival of bonytail embryos is appreciably reduced by low water temperatures such as those evident below the dam during the Vanicek and Kramer study (and continuing today).

Our observations on the Colorado River indicate the effects of altered temperature regimes alone do not account for the decline of bonytail in the upper basin. Unlike the Green, the Colorado upstream from its confluence with the Green has no large, mainstream dams. Although the Colorado has dams on its tributaries, recent analyses of U.S. Geological Survey records showed dam operation has not reduced Colorado River temperatures in reaches that

formerly might have included bonytail habitat. Water temperatures there are most affected by air temperature; discharge is the fifth most important independent variable affecting water temperature (after air temperature, solar radiation, wind speed and cloud cover, respectively) (Bob Green, Regional Hydrologist, U.S. Fish and Wildlife Service, Denver, Colorado, pers. com.). Nonetheless, bonytail are very rare in these areas. The same holds true for the lower Green, where temperatures are not affected by operation of Flaming Gorge Dam but where a viable bonytail population no longer occurs. Factors other than alteration of temperature regimes must have eliminated bonytail from these river reaches. This same conclusion was reached by Marsh (1985) for some reaches of the lower Colorado. Operation of upstream dams has reduced seasonal-high discharges and increased seasonal-low discharges in these reaches, but it seems unlikely that a species like bonytail—which evolved under the wide variety of discharge conditions characteristic of the seasonally dynamic Colorado River system—would have been affected directly by such moderation of discharge regimes. These river reaches have been successfully colonized by several introduced species (Tyus et al., 1982); perhaps these species or synergic effects of these species and the altered discharge regimes have had important effects on bonytail.

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