

INTRASPECIFIC PREDATION IN ENDANGERED MOHAVE TUI CHUB

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Mohave tui chub (*Siphateles bicolor mohavensis*) is the only native fish in the Mojave River basin of California. Populations declined during the 1930s, due to competition with arroyo chubs (*Gila orcutti*) that were believed to have been introduced into the headwaters of the Mojave River by anglers (Hubbs and Miller 1943). Mohave tui chubs were eliminated from the Mojave River system by the late 1960s, and existed only at Zzyzx Mineral Springs in San Bernardino County (Miller 1968). The Mohave tui chub was federally listed as endangered in 1970 (United States Fish and Wildlife Service 1984). Recovery efforts have included transplants of fish to establish new populations but, despite many attempts, only four populations exist in southern California: one at Lark Seep on the China Lake Naval Weapons Center, one at Camp Cady ponds about 40 km east of Barstow, one at Zzyzx Mineral Springs, and a recently established population at the Lewis Center for Educational Research in Apple Valley (Garron 2006; S. Parmenter, California Department of Fish and Game, personal communication).

At Zzyzx Mineral Springs, Mohave tui chubs inhabit Lake Tuendae, a man-made 0.5 ha pond, and MC Spring, a small spring approximately 2 m across. Lake Tuendae also contains two non-native species, western mosquitofish (*Gambusia affinis*), and Saratoga Springs pupfish (*Cyprinodon nevadensis nevadensis*). MC Spring contains only Mohave tui chub, and is the only natural, non-translocated population of Mohave tui chub. Approximately 500 fish inhabit the spring (S. Parmenter, California Department of Fish and Game, personal communication), and between 2,200 and 3,500 inhabited Lake Tuendae in 2005 (Garron 2006).

As part of a collaborative project between the National Park Service, California Department of Fish and Game, and the Arizona Cooperative Fish and Wildlife Research Unit, we monitored Mohave tui chub in Lake Tuendae for prevalence and intensity of Asian tapeworm (*Bothriocephalus acheilognathi*). For the majority of sampling, we used non-lethal methods to quantify prevalence and intensity of Asian tapeworm (Ward 2007). However, we dissected nine fish ranging in total length (TL) from 61 to 226 mm (mean = 123 mm) on 6 May 2006. Intestinal contents of two dissected chubs included fish remains: a single 60 mm TL fish in the gut of a 195 mm TL chub, and three total fish (50, 55, and 60 mm TL) in the gut of a 226 mm TL chub. Although partially digested, we identified all four of the fish remains as Mohave tui chub based on large body size, body shape, and large scale size,

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characteristics that distinguish them from Saratoga Springs pupfish and western mosquitofish.

Several taxa of tui chub are known to be piscivorous, although invertebrates, aquatic vegetation, and detritus account for the majority of their diets (Bird 1975, Cooper 1978). Vicker (1973) reported a single instance of intraspecific predation in 60 fish examined from Lake Tuendae, a 31 mm TL juvenile chub preyed upon by a 125 mm TL chub. Other stomach contents included algae, aquatic vegetation, and silt. Although we have a limited sample size, three fish in the gut of a single Mohave tui chub suggests these were not incidental prey, and prey were age 1+ fish, not larvae or juveniles. Predation might have occurred in the minnow traps we used to collect chubs, but traps were set for only 2 h and the prey were already partly digested when the traps were retrieved. Small systems, like MC Spring, where food might be a limiting resource, could experience high cannibalism leading to left-skewed age distributions where the gene pool is dominated by relatively few individuals. Although we doubt cannibalism has a major impact on Mohave tui chub in Lake Tuendae, it is yet another factor to be considered when managing endangered species, especially when translocating fishes to initiate new populations.

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