

As with other endemic southwestern fishes (Courtenay and Stauffer 1984; Meffe 1985; Schoenherr 1991), predation by introduced nonnative fishes have caused the decline of the least chub. Largemouth bass, rainbow trout, common carp, and brook trout have been regularly stocked by government agencies and private citizens into least chub habitat (Workman et al. 1979; Sigler and Sigler 1987; Osmundson 1985). Hickman (1989) considered least chub to be "constantly threatened" by the introduction of these gamefish species. However, other nonnative species also prey upon or compete with the least chub, including the mosquitofish (*Gambusia affinis*) and rainwater killifish (*Lucania parva*). Introduction of fishes into least chub habitat probably contributed to the extirpation of least chub outside of Snake Valley, since few least chub are present in spring complexes in Snake Valley where nonnative fishes have been introduced (Osmundson 1985; Shirley, *in litt.* 1989).

Direct, physical habitat loss and habitat degradation also are factors in the decline of the least chub (Holden et al. 1974; Hickman 1989; Crist 1990). In spring complexes that contain least chub, habitat degradation caused by livestock trampling could be a threat although no studies of the impact of livestock on the springs of Snake Valley have been conducted to date.

Recent oil and gas exploration and production activity in the West Desert area may result in increased degradation and/or impacts to least chub habitat. Exploration results in increased road access to sensitive areas while surface activities associated with drilling, including drilling site preparation under water hauling, may impact water quality. Drilling activities also may release drilling fluids into the aquifer or may fracture underground geologic features that are associated with springs.

Water withdrawals also are a potential threat to the least chub. Not only can reduced water supply diminish the amount of least chub habitat, and thus the capacity of an area to support least chub, but lowered levels may cause niche overlaps with other species. These overlaps may increase hybrid introgression and interspecific competition (Crawford 1979; Lamarra 1981). Maintenance of certain water levels is very important to least chub because these levels must be high enough to allow the fish to migrate between springs and surrounding marsh areas as environmental conditions change. Additionally, maintenance of water levels and discharge volumes is

critical in preserving natural sediment transport processes, thereby maintaining underwater habitat configurations and reducing aquatic vegetation encroachment into sensitive spring areas.

Present water withdrawals from surface and underground sources are estimated at 10 percent of the total yearly recharge rate (Van Pelt 1992). These rates do not appear to be threatening to least chub habitat. However, additional proposed wells in the southern part of Snake Valley and surrounding areas could lower the water table, resulting in drying up or lowering the water level in springs and marshes populated by least chub. These springs are dependant on underground water sources that flow from the Deep Creek Mountains to the Snake Valley (M. Barber, Bureau of Land Management (BLM), *in litt.* 1991; Brothers et al. 1993). It is important to note that all surface streams from the Deep Creek Mountains are currently diverted for agricultural use.

Several efforts to reintroduce least chub into historic habitat have been attempted. In 1979, least chub were introduced into a pond near Salt Lake City, Utah. The following year, young least chub were collected, verifying successful reproduction. However, introduction of nonnative fishes, combined with flooding of the pond by the Great Salt Lake, eliminated this successfully reintroduced population. Two other attempts to reintroduce least chub were not successful; the reasons for these failures are not well understood, but competition and/or predation with nonnative fishes offer a partial explanation (Crist 1990). Additional investigations are necessary prior to future reintroduction attempts, including reasons for past successes and failures, and the need to experiment with several reintroduction techniques. Both the UDWR and BLM are working on developing management plans that will address these reintroduction issues (L. Lentsch, UDWR, pers. comm., 1994; R. Fike, BLM, pers. comm., 1994).

Previous Federal Action

The Fish and Wildlife Service (Service) has conducted three status reviews for the least chub and have prepared two status reports. In 1980, the Service reviewed existing information on the least chub and determined that there was insufficient data to warrant its listing as endangered or threatened. On December 30, 1982, the Service classified the fish as a category 2 candidate species (47 FR 58454). After preparation of a 1989 status report, the Service reclassified the least chub as a

category 1 candidate species (54 FR 554; January 6, 1989). The Service continues to evaluate information and data concerning population declines and increasing threats, and has determined that listing the least chub as endangered or threatened is warranted.

Summary of Factors Affecting the Species

Section 4(a)(1) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*), and regulations (50 CFR Part 424) promulgated to implement the listing provisions of the Act set forth the procedures for adding species to the Federal lists. A species may be determined to be an endangered or threatened species due to one or more of the five factors described in section 4(a)(1). These factors and their application to the least chub (*Iotichthys phlegethontis*) are as follows:

A. *The threatened destruction, modification, or curtailment of its habitat or range.* The least chub was once widely distributed within the Bonneville Basin of northwestern Utah and occupied many streams, springs, and ponds. Yarrow and Henshaw found least chub in the Beaver River (Cope and Yarrow 1875). Jordan (1891, cited by Jordan and Evermann 1896) collected least chub from ponds near the mouth of the Provo River. Jordan and Evermann (1896) stated that least chub occurred in "tributaries of Great Salt Lake and Sevier Lake." More recently, least chub were observed in Utah Lake, Beaver River, Parowan Creek, Clear Creek, and the Provo River (reviewed by Sigler and Miller 1963; Hickman 1989). However, least chub have not been collected outside of Snake Valley since 1965 (Hickman 1989).

Least chub populations in Snake Valley are not stable and studies conducted in the past 15 years indicate a steady decline in their distribution and numbers. Workman et al. (1979) collected least chub from 36 sites spread throughout 5 major spring complexes in Snake Valley. A few years later, Osmundson (1985) found least chub in only two of the five complexes. Further surveys have confirmed that least chub has been extirpated from springs on the Bagley Ranch and the Redden Springs Complex (Crist 1990). Recent data suggest that least chub numbers are now declining within the Gandy Salt Marsh and Leland Harris Spring Complex. Personnel from UDWR found least chub only in 3 of 5 springs sampled in the Leland-Harris Complex and 6 of 12 springs in the Gandy Salt Marsh. Some least chub have recently been discovered in Snake Creek, south of Gandy Salt Marsh. However, no studies