have been conducted to determine the distribution, abundance, or status of this Snake Creek population (L. Lentsch, pers. comm., 1993). Service biologists believe that the numbers of least chub at Snake Creek are insufficient to reverse this downward trend in its numbers.

Habitat loss and degradation have been indicated as major causes of the least chub's decline (Holden et al. 1974; Hickman 1989; Crist 1990). Although no studies have been made of the springs in Snake Valley, numerous other reports link livestock trampling and grazing with fish habitat degradation in streams and springs (Duff 1977; May and Somes 1981; Taylor et al. 1989; Bowen and Beauchamp 1992). The springs in the Snake Valley that are occupied by least chub are not protected from livestock. The BLM has one fenced exclosure in the Gandy Salt Marsh Complex and is considering a second exclosure to protect other springs (R. Fike, BLM, pers. comm., 1993). Crist and Holden (1990) and Lamarra

(1981) indicated that water levels are important to least chub life history. The Las Vegas Valley Water District has requested a permit to drill a series of wells in the southern part of Snake Valley and surrounding areas (M. Barber, in litt. 1991). This could lower the water table significantly in Snake Valley, possibly drying up or lowering the water level in springs and marshes populated by least chub. These springs are totally dependent on underground water sources which flow from the Deep Creek Mountains to the west of Snake Valley. Other forms of water use within Snake Valley pose a minimal threat to least chub habitat at this time, and water withdrawals from surface and underground sources are estimated at 10 percent of the total yearly recharge rate (Van Pelt 1992).

B. Overutilization for commercial, recreational, scientific, or educational purposes. Some specimens have been collected for scientific and educational purposes (Sigler and Workman 1975; Workman et al. 1979; Crawford 1979; Osmundson 1985). However, no commercial or recreational uses for the least chub are known to exist. Overutilization for commercial or scientific purposes does not pose a threat to least chub.

C. *Disease or predation*. Disease or incidence of parasitism presently are not major factors affecting the least chub. Workman et al. (1979) found a single parasite called blackspot (the metacercariae of the digenetic trematode) infesting the least chub. Black spot (*Neascus cuticola*) produces small, black-pigmented nodules on the

skin, trunk musculature, and fins of fishes and is frequently encountered in the least chub, Utah chub (*Gila atraria*), and speckled dace (*Rhinichthyes osculus*). Workman et al. (1979) reported black spot infection rates for the least chub as 1–23 nodules per fish, and that the infection rate varied from area to area and with season (highest in late summer and lowest in winter). Despite this moderate infestation rate, all least chubs examined appeared robust and in good condition. This parasite is apparently restricted to certain spring and pond areas.

Predation by nonnative fishes has been a major factor in the decline and extirpation of desert fishes in southwestern North America (Schoenherr 1981; Meffe 1985; Minckley et al. 1991). Hickman (1989) considered least chub to be "constantly threatened" by the introduction of nonnative species. Surveys of spring complexes indicate that where nonnative fishes were introduced, few if any least chub remain (Osmundson 1985; Shirley, in litt. 1989). Introduced game fishes which include largemouth bass, rainbow trout, common carp, and brook trout, are predators on least chub, and these species have been regularly stocked in least chub habitat (Workman et al. 1979; Sigler and Sigler 1987; Osmundson 1985; Crist 1990), no doubt contributing to the endangerment of least chub. In addition to game fish, other nonnative fishes also have been released into least chub habitat. Two fishes, the mosquitofish (Gambusia affinis) and rainwater killifish (Luciana parva), have similar diets to the least chub and are considered potential competitors. The mosquitofish poses a direct threat to the least chub because of its known aggressive predation on eggs and young of other fishes. Mosquitofish have been implicated in the decline of other desert fishes (Schoenherr 1981; Meffe 1985).

Osmundson (1985) and Sigler and Sigler (1987) also indicated that frogs, ducks, gulls, herons and egrets also are potential predators on least chub. Under normal circumstances, predation from these sources probably would not injure healthy populations of least chub. However, the effect of predation from the above combined sources could cause further depletion of already fragile populations.

D. The inadequacy of existing regulatory mechanisms. Although the State of Utah lists the least chub as a protected species, the Service believes that the present level of protection afforded by the State is not sufficient. The State does not allow taking of the species without permits, but it does not protect or control actions which cause harm to the species or its habitat. The continued introduction of nonnative predators into least chub habitat and adjacent areas is difficult to control, and the State's protection does not address this issue.

The BLM has designated the Gandy Salt Marsh as an "Area of Critical Environmental Concern (ACEC)." This ACEC is inadequate in protecting the least chub because it does not prevent taking of the species. The establishment of an ACEC requires a management system which integrates the protection of riparian areas without infringement on "traditional permitted uses" (Van Pelt 1990). Accordingly, the Gandy Salt marsh ACEC does not prevent livestock gracing in and around least chub habitat and it does not extend over the fish's entire habitat. Finally, the ACEC is a BLM oil and gas leasing category 4, which normally closes the area to leasing. However, a clause was written into the BLM's Resource Management Plan which allows the District Manager to exempt the category 4 protections and to lease ACEC lands.

E. Other natural or manmade factors affecting its continued existence. Declines in native desert fishes in the Southwest has been associated with the introduction and proliferation of nonnative fishes. These nonnative fishes have, in some documented instances, extirpated small desert fishes by direct competition and predation (Schoenherr 1981; Meffe 1985; Minckley et al. 1991). The existence of small desert cyprinids, including the least chub, is presumably the result of a lack of other small competitors (Smith 1981; Minckley et al. 1991).

Least chub coexist with other native fishes, which include the Utah chub and speckled dace. However, the tiny and reclusive least chub competes poorly with nonnative species such as mosquitofish and rainwater killifish. The mosquitofish, rainbow trout, and largemouth bass are considered to be direct predators (Sigler and Workman 1975; Crawford 1979; Sigler and Sigler 1987). Least chub do not build nests or protect their eggs. Instead, they lay their eggs upon vegetation where they and the newly hatched larvae are vulnerable to predation (Crawford 1979).

Hybrid introgression between least chub and the Utah chub and speckled dace have been reported (Sigler and Sigler 1987). Reproductive isolating mechanisms have apparently broken down in some areas due to habitat alteration and degradation. This has resulted in overlaps of reproductive niches and breakdowns in behavior due to overcrowding (Crawford 1978;