Ichthyologic Assessment of SNWA Water Right Application for Delamar, Dry Lake, and Cave Valley in the White River Flow System

G. Gary Scoppettone
Fishery Biologist, Western Fisheries Research Center
U.S. Geological Survey

Expert Witness Testimony submitted on behalf of
U.S. Fish and Wildlife Service
For the Delamar, Dry Lake, and Cave Valley Protest Hearing
February 2008

EXHIBIT 609

Signature G. Gary Scoppettone

Date 15 November 2007

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Fact Sheet

Native fishes of the White River and Pahranagat valleys (a.k.a Pahranagat Creek) are all endemic and have declined due to habitat alteration and nonnative fish introduction (Deacon 1979, Courtenay et al. 1985, Miller et al. 1989). There were five fishes known from White River; one (White River spinedace, *Lepidomeda albivallis*) which is federally listed as endangered (U.S. Fish and Wildlife Service 1985), and four (Preston White River spingfish, *Crenichthys baileyi albivallis*; Moorman White River springfish, *Crenichthys baileyi thermophilus*; White River desert sucker, *Catostomus clarki intermedius*; White River speckled dace (*Rhinichthys osculus* spp.) considered for listing (U.S. Fish and Wildlife Service 1991). There were six known fishes from the Pahranagat Valley, two (Pahranagat spinedace, *Lepidomeda altivelis*; Pahranagat desert sucker, *Catostomus clarki* ssp.) are now extinct (Minckley and Deacon 1968), three (Pahranagat chub, *Gila jordani;* White River springfish, *Crenichthys baileyi bailyei* and Hiko White River springfish, *Crenichthys bailyi grandis*) are federally listed as endangered (U.S. Fish and Wildlife Service 1998) and one (Pahranagat speckled dace; *Rhinichthys osculus velifer*) was considered for listing (U.S. Fish and Wildlife Service 1991).

White River Valley

Fish Species Status and Distribution

When collected in 1938 the White River spinedace was known from seven warm springs (Miller and Hubbs 1960, La Rivers 1962). By 1991 the White River spinedace had dwindled to one population of less than 50 fish (Scoppettone et al. 2004[b]). The reduction in springs harboring White River spinedace came after several of the larger spring systems were cut short and diverted into pipes, which reduced habitat and eliminated connectivity between spring systems. Other White River fishes declined as well after the fragmentation of habitat. In 1999 Preston White River springfish (*Crenichthys baileyi albivallis*) were extirpated from two of the six spring systems where they had been previously collected (Scoppettone and Rissler 2002). The White River desert sucker (*Catostomus clarki intermedius*) has been extirpated from four spring systems where it co-occurred with spinedace and springfish. At the few locations desert sucker were found they had a localized distribution and were few in number (Scoppettone et al. 2004[b]). In fact, the Lund Town Spring population appeared to be an aging group with no sign of successful reproduction and it is anticipated to be extirpated (personal communication, M. Bridget Nielsen, U.S. Fish and Wildlife Service, Tule Lake, Ca). White River speckled dace (*Rhinichthys osculus* spp.) had been extirpated from at least a couple of spring systems, but was the most widespread of White River Valley fishes.

The Moorman White River springfish (*Crenichthys baileyi thermophilus*) is known from three White River Valley spring systems. Two of the springs were historically connected (Hot Creek and Moon River), but with the diversion of flow for irrigation lost their connectivity. Over the past few decades Hot Creek has been intermittently invaded by largemouth bass (*Micropterus salmoides*) from nearby recreational reservoirs. The invasions led to population crashes (personal communication, Brian Hobbs, Fishery Biologist, Nevada Department of Wildlife)

Interestingly a comprehensive fish survey in the early 1990's revealed a sixth fish believed to be endemic to the White River, a yet to be described sculpin, either a subspecies of *Cottus bairdi* or a species closely related to *Cottus bairdi* (Scoppettone et al. 2004[b]). The new fish was found inhabiting 120 m of a spring system never recorded as previously surveyed.

Life History and Habitat Use

Native fishes of the White River vary in habitat use and life history requirements. White River spinedace are omnivorous but tend toward carnivory. Scoppettone et al. (2004[a]) found aquatic invertebrates to be the predominant food item consumed. White River spinedace were observed feeding on drift items in the water column, accounting for the preponderance of aquatic invertebrates in their gut. In Flag Springs on the KIRCH Nevada State Management Area, reproduction occurs from about April through July. Larval White River spinedace have only been observed within about 400 m of Middle Flag Spring which issues at about 22.7 °C.

The genus *Crenichthys* is unique to Nevada, and the White River springfish *Crenichthys baileyi* is represented by five subspecies occurring in thermo springs along the course of what was the Pluvial White River (Williams and Wilde 1981). The White River Valley harbors two of the subspecies, the Preston and Moorman White River springfish. The Preston White River springfish occurs in the coolest of the thermal springs. Water temperature near the spring sources ranges from about 21 to 22° C. The Moorman White River springfish occurs in springs with discharge ranging from 30 to 37° C. Even with the wide difference in spring temperatures both species are thermal-endemic. In these thermal spring systems water cools as it travels downstream (Scoppettone et al. 1992). Springfish tend to inhabitat spring discharge where the water temperature remains warm and does not dramatically fluctuate (La Rivers 1962). The Moapa White River springfish (*C. b. moapae*) is omnivorous (Scoppettone 1993), as are the other subspecies of *C. baileyi* (Williams and Wilde 1981).

Life history patterns of the White River desert sucker have not been studied. Like many of the catostomids of the western United States, desert sucker appear to be long lived (Scoppettone 1988). A dead specimen I found on the bank of the Flag Spring complex was over 12 years of age. The related Gila desert sucker feeds primarily on algae which it scraps from bottom substrate (Minckley 1973). In the White River system we found sucker in water temperatures ranging from about 16 to 21° C.

The relatively broad distribution of speckled dace in White River Valley is testimony to their adaptability. They are omnivorous (Minckley 1973), successfully feeding from the bottom substrate as well as from the water column (personal observation). In the White River Valley we found them in water depths ranging from several centimeters to several meters and water temperature ranging from about 15 to 22°C.

The newly discovered scuplin was found in very cool water (15°C) where it shared the stream with speckled dace. Adult fish were found over sandy gravel, and juveniles over sandy silt. Water depth ranged from about 25 to 60 cm in the upper 120 m of Butterfield Springs.

Pahranagat

Fish Species Status and Distribution

The extinction of the Pahranagat spinedace and Pahranagat desert sucker suggest that they were the Pahranagat species most affected by the change to their environment. Similarly, in a comprehensive fish survey in the early 1990s, the White River spinedace and White River desert sucker were the rarest natives in that system (Scoppettone et al. 2004[b]). The remaining natives of Pahranagat Valley have only limited distribution.

Historically Pahranagat chub (previously referred to as Pahranagat roundtail chub, *Gila robusta jordani*) was widespread throughout Pahranagat Valley, including downstream from Hiko Spring (Tanner 1950), Crystal and Ash springs (La Rivers 1962). Except for two refuge populations it is restricted to about a 4.5 km stream immediately downstream from Ash Spring (Tuttle et al. 1990). Within this 4.5 km reach the number of chub has varied seasonally and yearly. The winter count for chub in 1989 was about 280 fish (Tuttle et al. 1990) but in winter of 2006 the count was only 84 fish (personal communication, Brian Hobbs, Fishery Biologist, Nevada Department of Wildlife).

In 1938 the White River springfish was reported as common in Ash Spring spring-pool to about 12 km downstream (Miller and Hubbs 1960) suggesting the outflow temperature was sufficiently warm to this distance. In 1981 springfish in Ash Spring spring-pool were rare and scarce in Ash Spring outflow (personal communication Don Sada, Desert Research Institute, Reno, NV). White River springfish counts in Ash Spring spring-pool ranged from about 1000 to about 2,700 in the late 1980s (Tuttle et al. 1990). There are no more recent estimates to my knowledge.

Hiko Whiter River springfish occur in Hiko and Crystal springs. The most recent estimate of springfish number for these two systems was for Hiko spring, which was 73 in the summer of 2006, a substantial decline from the over 6,000 estimated in 2000. This decline followed crayfish introduction into the spring (personal communication, Brian Hobbs, Fishery Biologist, Nevada Department of Wildlife). In Crystal Spring Tuttle et al. (1990) had estimates of 265 springfish in summer 1986 and 181 in spring 1987. The latest estimate for Crystal Spring was 437 crayfish in winter 2007.

In recent times Pahranagat speckled dace was the most numerous and wide spread of Pahranagat Valley fishes. In the late 1980s it was found in two isolated spring systems just south of Crystal Spring, throughout much of the outflow including irrigation ditches and return ditches, and along the course of what was the historic Pahranagat River (Tuttle et al. 1990). Two additional populations of speckled dace with relatively robust body conformation were found on L Spring and Cottonwood Spring on the Pahranagat National Wildlife Refuge (PNWR). They were believed to be an unidentified *Rhinichthys*, but subsequently determined to be the same taxa as the Pahranagat speckled dace. The current status of Pahranagat speckled dace is unknown. In recent years there is indication that the speckled dace population has declined. It has not been sighted or collected from springs on the PNWR, in the 4.5 km reach harboring Pahranagat chub, and they now occur in only one spring south of Crystal Spring (personal communication; Brian Hobbs, Fishery Biologist, Nevada Department of Wildlife).

Life History and Habitat Use

There is virtually no information on the life history or habitat requirements of the now extinct Pahranagat spinedace and Pahranagat desert sucker except that they occurred in cooler, faster-moving water (La Rivers 1962). Presumably their life history patterns were similar to the White River spinedace and desert sucker.

The Pahranagat chub is a thermal tolerant species visiting water up to 32°C, but probably requires cooler temperatures to persist. Peak reproduction occurs in late January and mid February in water temperature ranging from 17.0 to 24.5°C. Depths, velocities, and substrate used is reported by Tuttle et al. (1990). Spawners ranged in length from about 100 to 280 mm FL. No food habit studies have been conducted on the species but they have been observed to feed primarily on drift items.

C. b. baileyi and *C.b. grandis* are thermo-endemics, generally remaining in warm water (Williams and Wilde 1981). They are omnivorous, and historically inhabited the spring-pool and spring outflow habitat (Williams and Wilde 1981).

Like the White River speckled dace the Pahranagat speckled dace is a generalist and occupies a wide variety of habits.

Expert Opinion

Reduction in spring discharge to springs providing habitat for native fishes in the White River and Pahranagat valleys threaten the opportunity for species persistence. Projected negative affects will be a reduction in habitat, exacerbation of negative effects of non-native species on native fishes, and reduction of species fitness through reduced fish size.

In thermal spring systems, water cools as it moves down stream. Thermal endemic species require a given temperature range to persist. For example, Moapa dace (*Moapa coriacea*) inhabit water temperatures of 26 to 32°C, but have only been found to reproduce in water temperatures ranging about 30 to 32°C (Scoppettone et al. 1992). Similarly we have observed White River spinedace in water from about 16.5 to 22°C, but have only observed reproduction in relatively constant water temperatures from about 19.5 to 22°C. Reduction of stream flow will cause all flows to cool faster and broaden fluctuations in water temperature, thus reducing spinedace reproductive habitat. The rapid loss of thermal load has the potential to restrict future distribution of the thermal endemic springfish as well.

Reduction in water volume would be expected to reduce foraging efficiency, hence a reduction in fitness, of drift feeding fish such as spinedace and Pahranagat chub. Drift feeding fish tend to position themselves in hydraulic conditions that permit high energy gains (Booker et al. 2004). For efficient feeding there needs to be enough water volume to permit large drift feeders sufficient slow water to conserve energy as they sight drift items adjacent to rapidly moving water transporting drift items. For White River spinedace, a lower water volume in which they now occur, may not be sufficient for their persistence . For example, White River spinedace have been introduced into Indian Spring with a flow of less than $0.01m^2$. Only several spinedace remain from over 100 fish stocked.

The Pahranagat chub, a much larger bodied fish requires an even larger water body to forage effectively on drift. Since its numbers in the last 20 years have remained precariously low, its minimum flow should not be further reduced.

A major threat to endemic fishes of the American West has been nonnative species (Miller et al. 1989). Nonnative species have been particularly successful in replacing natives in disturbed habitat (Moyle and Nichols 1973). The negative effects of non-native species are exacerbated when stream flows are reduced such that species are unable to segregate habitat. For example, Warm springs pupfish (*Cyprinodon nevadensis pectoralis*), in a low water volume spring ($<0.01m^2$), became extinct after the invasion of red swamp crayfish (*Procambaris clarki*). The recent invasion of red swamp crayfish into North Indian and south Scruggs, with similar low flow volumes, was also followed by dramatic decline of Warm Springs pupfish populations (personal observation). Similary, the White River Valley Cold Spring historically harbored four species of native White River Valley Fishes. It has been altered to a shallow spring-pool about 4 m^2 and now harbors only the non-native guppy (*Poecilia reticulata*).

Body size in fishes generally scales to water volume (Smith 1981). Thus lower water volume selects for small, less fecund fish, consequently reducing reproductive potential. For example the largest and most fecund Moapa dace occur in the greatest stream flow (Scoppettone et al. 1992). Reduce reproductive potential reduces the probability of species persistence through environmental change such as assault on egg and fry by invasive species.

In conclusion, alteration and reduction of habitat has already caused unforeseen extinction and endangerment of endemic fishes along the course of the Pluvial White River. Further habitat reduction would be expected to cause more extinctions and loss of Nevada's unique fish fauna.

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