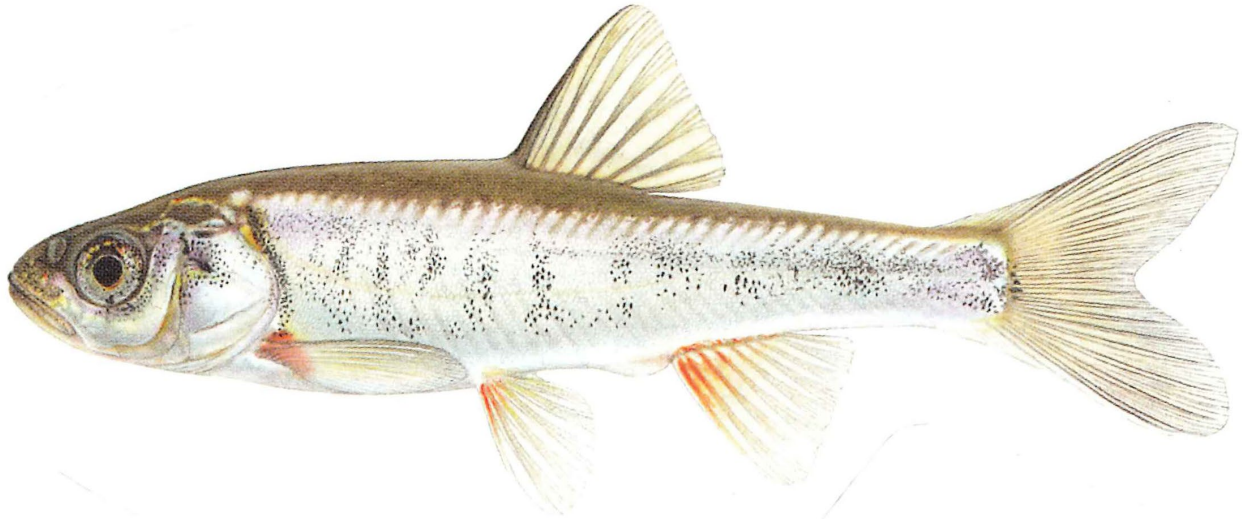


**Big Spring spinedace (*Lepidomeda mollispinis pratensis*)**

**5-Year Review: Summary and Evaluation**



*Illustration by Joseph R. Tomelleri*

**U.S. Fish and Wildlife Service**

**Southern Nevada Fish and Wildlife Office**

**Las Vegas, Nevada**

**June 10, 2021**

## I. GENERAL INFORMATION

### **Purpose of 5-Year Reviews:**

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

### **Species Overview:**

The Big Spring spinedace (*Lepidomeda mollispinis pratensis*) is a small cyprinid fish, which was first collected in 1938. They are a member of Class Actinopterygii, Order Cypriniformes, and Family Cyprinidae. They are also members of the Plagopterini tribe of Cyprinid fish encompassing the Genera *Meda* (spikedace), *Plagopterus* (woundfin), and *Lepidomeda* (spinedace). The Genus *Lepidomeda* includes four species (*L. albivallis*, *L. altivellis*, *L. vitatta* and *L. mollispinis*) and two subspecies (*L. m. mollispinis*, *L. m. pratensis*).

The holotype and paratype specimens of Big Spring spinedace were collected from the outflow of Panaca Big Spring, about 1.6 kilometers (km) northeast of Panaca, Lincoln County, Nevada on July 10, 1938 by Robert R. Miller and Carl L. Hubbs (Figure 1). Due to habitat modification for agriculture, they were extirpated from their historical location and thought extinct by 1959 before they had been taxonomically described (Miller and Hubbs 1960). In 1977, they were re-discovered occupying a plunge pool below a 15-meter high waterfall, herein referred to as Delmue Falls, within the Condor Canyon section of Meadow Valley Wash (Allan 1983 as cited in Service 1994). They currently exist in a single population that stretches approximately 8 km of the Condor Canyon stretch of Meadow Valley Wash (Figure 2).

### **Methodology Used to Complete This Review:**

This 5-year review was conducted by the Service's Southern Nevada Fish and Wildlife Office. Data for this review were solicited from interested parties through a Federal Register notice announcing this review on January 27, 2020 (85 FR 4692). We also contacted State agencies, Federal agencies, local agencies, and species experts, to request any data or information we should consider in our review. Additionally, we conducted a literature search and a review of information in our files. This review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing.

**Contact Information:**

**Lead Field Office:**

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**Federal Register (FR) Notice Citation Announcing Initiation of This Review:**

85 FR 4692. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews of 66 Species in California and Nevada. Published on January 27, 2020.

**Listing History:**

**Original Listing**

**Species:** Big Spring spinedace (*Lepidomeda mollispinis pratensis*)

**Date listed:** March 28, 1985

**FR Notice:** 50 FR 12298

**Classification:** Threatened

**State Listing**

Big Spring spinedace (*L. m. pratensis*) were listed as Threatened by the state of Nevada on September 25, 1998 (Sec.1, NAC 503.065.1).

**Associated Rulemakings:**

Critical Habitat was designated at the time of listing on March 28, 1985 (50 FR 12298).

**Review History:**

The status of the Big Spring spinedace has not been reviewed since the species was listed in 1985.

**Species' Recovery Priority Number at Start of 5-Year Review:**

The recovery priority number for Big Spring spinedace is 3, based on a 1-18 ranking system (48 FR 43098). This number indicates that the taxon is a subspecies that faces a high likelihood of becoming endangered within the foreseeable future and has a high potential for recovery through proper management practices.

**Recovery Plan or Outline:**

**Name of Plan or Outline:** Big Spring Spinedace Recovery Plan

**Date Issued:** January 20, 1994

## II. REVIEW ANALYSIS

### **Application of the 1996 Distinct Population Segment (DPS) Policy**

The Endangered Species Act defines “species” as including any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate wildlife. The 1996 Policy Regarding the Recognition of Distinct Vertebrate Population Segments under the Endangered Species Act (61 FR 4722, February 7, 1996) clarifies the interpretation of the phrase “distinct population segment” for the purposes of listing, delisting, and reclassifying species. The Big Spring spinedace (*L. m. pratensis*) is not listed as a DPS. There has been no new relevant information regarding the application of the DPS policy to Big Spring spinedace since listing.

### **Information on the Species and its Status**

#### Species Biology and Life History

Little information has been published concerning the life history of Big Spring spinedace; however, a recovery plan was completed in 1994 (Service 1994). Also, a study conducted by the United States Geological Survey (USGS) between June 2008 and January 2011, provided new life history information in regard to distribution, population size, and spawning (Jezorek et al. 2011).

As a member of the Plagopterini tribe of Cyprinid fishes, Big Spring spinedace are distinguished from other Cyprinids by the spine-like character of their pelvic, pectoral, and two anterior dorsal fin rays. They are further distinguished by the presence of a membranous connection between the innermost ray of the pelvic fins and the belly, bright silver coloration and the absent or diminutive body scales (Miller and Hubbs 1960). Big Spring spinedace are generally bright and silvery in color with body length typically less than 80 millimeters. They closely resemble Virgin spinedace (*L. m. mollispinis*) in their overall description. Significant differences include a higher and more pointed dorsal fin, longer pelvic fins, and a smaller, more oblique mouth (Miller and Hubbs 1960). Big Spring spinedace do not have melanophores (pigment cells) below the upper half of the opercle or preopercle and show no pigment on the shoulder girdle directly ahead of the pectoral fin base (Sigler and Sigler 1987).

Big Spring spinedace have been assumed to share the feeding behaviors of the closely related Virgin spinedace. The Virgin spinedace is described as an opportunistic drift-feeder, primarily feeding on insect larvae but eating algae and plant material when insects are scarce (Rinne 1971; Minckley 1973). The feeding preferences of Big Spring spinedace are known only from an unpublished study (Langhorst 1991). Stomach content analysis of 100 individuals revealed a diet of mostly larval mayflies (*ephemeropterans*) and midges (*chironomids*). They were also found to have consumed amphipods (*gammaridae*), caddisflies (*trichopterans*), plant material containing diatoms, algae, and in one individual, a larval speckled dace (*Rhinichthys osculus*). It has been suggested that vegetation, notably watercress, provides important cover for the aquatic insects and invertebrates upon which they feed (Allan 1985 as cited in Service 1994).

Spawning condition, as evidenced by color changes in the paired fins and tuberculation of the head, was observed in Big Spring spinedace during May of 1990 with no young of the year evident (Langhorst 1991). Similar spawning conditions were observed in a small (~1%) portion of the same population in August of 1990 with many young of the year observed (Langhorst

1991). A more recent PIT tag study showed that tagged Big Spring spinedace made substantial movement into a small tributary, Kill Wash, between the months of March and May in 2008, 2009 (Jezorek et al. 2011). It is believed that this movement may have been related to spawning activity. Additionally, a gravid female Big Spring spinedace was sampled on June 22, 2009, which indicates that spawning may be protracted over a greater period of time (Jezorek et al. 2011). The related Virgin spinedace is known to spawn between April and June when water temperatures are in the range of 13°- 17°C and the photoperiod is greater than 13 hours of daylight per day (Minckley 1973).

### Spatial Distribution

Although thought to be extinct, Big Spring spinedace were re-discovered occupying the plunge pool below Delmue Falls in 1977 (Allan 1983). In 1980, larval spinedace were transplanted from the plunge pool to an area that was 1.5 km upstream and above the falls. Adults were captured there the following year but it is not known if Big Spring spinedace occupied the area upstream of Delmue Falls prior to being transplanted (Allan 1983).

Distribution of the species is restricted to a single population occurring in an approximate 8 km section of the Condor Canyon reach of Meadow Valley Wash northeast of Panaca in Lincoln County, Nevada (Figure 1). Big Spring spinedace no longer occupy the Panaca Big Spring outflow, the area they were first collected, due to habitat modification and the introduction of nonnative species (Figure 2). The upper limit of Big Spring spinedace habitat within Meadow Valley Wash is not currently known as it occurs on private property that has not been fully surveyed. The lower boundary of the habitat is the end of Condor Canyon where the stream flow is insufficient to support spinedace. Near the center of the canyon is Delmue Falls, which prevents fish from moving upstream from the lower limits of the canyon habitat to the upper limits (Figure 3). Therefore, the majority of the Big Spring spinedace population occurs above Delmue Falls with few individuals occurring below (Jezorek et al. 2011).

### Abundance

At the time of the recovery plan in 1994, the overall population was not known, nor could it be confidently estimated using available survey data. The most in depth survey of the population, conducted by USGS in 2008 and 2009, has provided additional data concerning abundance and distribution of Big Spring spinedace within Condor Canyon (Table 1). Population numbers are derived from electrofishing surveys wherein adult fish are PIT tagged and measured before being released. Additionally, Big Spring spinedace have been described by the Nevada Department of Wildlife (NDOW) in survey reports as being relatively abundant within Condor Canyon (NDOW 2001-2020). The greatest concentrations typically occur near the northern boundary of the designated critical habitat with decreasing numbers further downstream.

Table 1. Population estimates ( $\pm$  95% CI), 2008-2009 (Jezorek et al. 2011).

	Big Spring Spinedace	
	Age-0	Age-1 or older
Fall 2008	2,658 (1,166)	2,078 (1,054)
Spring 2009	1,111 (608)	2,267 (992)
Fall 2009	5,539 (3,842)	3,745 (3,807)

### Habitat or Ecosystem

Big Spring spinedace were first observed in the outflow stream and marsh associated with Panaca Big Spring (Figure 1; Miller and Hubbs, 1960). The stream substrate was described as firm to soft clay with some gravel and the water temperature was recorded as 29°C. Aquatic vegetation observed, included watercress (*Rorippa* sp.), pondweed (*Potamogeton* sp.), and bulrushes (*Scirpus* sp.; Miller and Hubbs 1960).

Currently, Big Spring spinedace are found in a single population within an approximate 8 km section of the Condor Canyon, Meadow Valley Wash, Lincoln County, Nevada (Figure 2). The stream itself is typically narrow (less than 2m wide) and shallow (less than 1m deep) with few pools and abundant aquatic and riparian vegetation. Within the current known habitat, surveys conducted by NDOW from 2001-2019 show Big Spring spinedace occupying waters in the temperature range of 9.5°- 21.1°C and dissolved oxygen between 5.76 mg/l and 9.8 mg/l during the April and September survey times. In another study, recorded stream temperatures varied between 9.7° - 28.4°C during July-September 2008 (Jezorek et al. 2011).

Critical habitat has been designated for this species (Figure 2), which encompasses approximately 6.4 km of the Meadow Valley Wash through Condor Canyon (Service 1994). The primary constituent elements described include: (1) clean, permanent, flowing, spring-fed stream habitat with deep pool areas and shallow marshy areas along the shore; and (2) the absence of non-native fishes (50 FR 12298). Occupied habitat is not entirely included within the critical habitat boundary.

### Changes in Taxonomic Classification or Nomenclature

There have been no changes in the species taxonomic classification or nomenclature since its listing.

### Genetics

No significant research has been conducted concerning Big Spring spinedace genetics to date.

### Species-specific Research and/or Grant-supported Activities

The Service provides section 6 funding to the NDOW for Big Spring spinedace. Specifically, the NDOW's responsibilities include:

- Coordinating the Meadow Valley Wash Native Fishes RIT;

- Conducting population monitoring and mechanical nonnative species control for the Condor Canyon population of Big Spring spinedace using electrofishing;
- Providing oversight and technical assistance for habitat restoration actions conducted by partners for Big Spring spinedace in Condor Canyon; and,
- Evaluating potential sites for establishment of a second Big Spring spinedace population.

New research conducted since the 1994 recovery plan include:

- Jezorek, I.G., P.J. Connolly, C.S. Munz, and C. Dixon. 2011. Big Spring spinedace and associated fish populations and habitat conditions in Condor Canyon, Meadow Valley Wash, Nevada: U.S. Geological Survey Open-File Report 2011-1072, 116 p.

## **FIVE-FACTOR ANALYSIS**

The following five-factor analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act. The following summarizes information on threats to the Big Spring spinedace since the species was listed.

### Factor A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

The final listing rule (50 FR 12298) outlined concerns of disruption to the habitat stemming from a reduction or alteration in water flow. The rule listed overgrazing, groundwater pumping, diversion and channelization of the stream, loss of riparian vegetation or a combination of the aforementioned factors as having the potential to lead to the species becoming endangered.

The Big Spring spinedace continues to be vulnerable to changes in its habitat due to human activity or natural agents; however, no current or planned activities requiring action are known at this time and we believe the habitat is likely to remain stable in the short-term.

#### *Grazing*

Streambank erosion resulting from cattle grazing makes effective control of instream vegetation more difficult. Cattle flatten and widen streams, slowing the flow, increasing sediment accumulation and thus improving the habitat for crayfish and aquatic vegetation. They also transport seeds and produce nitrogenous waste, which spurs plant growth in and around the stream.

#### *Habitat Modification*

Habitat modifications have been made which support ongoing agricultural activity within the historical habitat (Figure 1). Renovation of the historical habitat at Panaca Big Spring, as suggested at the time of listing, is not feasible within the foreseeable future. The historical habitat cannot be restored without ceasing the agricultural activity in the immediate vicinity of Panaca Big Spring. The spring is the key water source for agriculture in Panaca, and agriculture is Panaca's key industry.

Historical modifications by the Union Pacific Railroad and others have altered the stream channel significantly within Condor Canyon, which has contributed to the stream's instability. Alterations to Condor Canyon's hydrology may have resulted in the creation of Delmue Falls

(Figure 3, Figure 4) due to the stream head-cutting through the gravel substrate composing its bed material. Future head-cutting resulting from flooding is a possibility that must be considered. Based on this information, we conclude the magnitude of the threat from stochastic events is high and the immediacy to be non-imminent.

#### Factor B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization for commercial purposes was not known to be a factor in the final listing rule (50 FR 12298) and does not appear to be a threat at this time. No commercial use of Big Spring spinedace has occurred since listing nor is it likely to become an issue in the foreseeable future. No commercial interest in the species has arisen to date.

#### Factor C: Disease or Predation

The final listing rule (50 FR 12298) did not list disease as a factor for listing. No new information concerning disease has since been published, and disease is not considered a significant threat at this time.

The final listing rule (50 FR 12298) identified the introduction of invasive fish as a serious threat. The introduction of the Mosquitofish (*Gambusia affinis*) into Panaca Big Spring contributed to Big Spring spinedace extirpation at that locality. At present, mosquitofish and rainbow trout are found within Big Spring spinedace habitat, raising concerns of predation and competition. Rainbow trout are only present below Delmue Falls and have not been documented above it. As evidenced by a single study on the related Little Colorado River spinedace, predation by rainbow trout could be high in areas that the species overlap (Blinn et al. 1993).

Possibly of greater concern is the presence of signal crayfish (*Pacifasticus leniusculus*) throughout Big Spring spinedace habitat. Once established, the crayfish population has proven difficult to remove from the stream system. Crayfish are omnivores, which can alter habitat and directly predate on eggs and larval fish (Dorn and Wojak 1994).

#### Factor D: Inadequacy of Existing Regulatory Mechanisms

##### *National Environmental Policy Act (NEPA)*

NEPA (42 U.S.C. 4371 *et seq.*) provides some protection for listed species that may be affected by activities undertaken, authorized, or funded by Federal agencies. Prior to implementation of such project with a Federal nexus, NEPA requires the agency to analyze the project for potential impacts to the human environment, including natural resources. In cases where that analysis reveals significant environmental effects, the Federal agency must propose mitigation alternatives that would offset those effects (40 C.F.R. 1502.16). These mitigations usually provide some protection for listed species. However, NEPA does not require that adverse impacts be fully mitigated, only that impacts be assessed and the analysis disclosed to the public.

##### *Clean Water Act*

Under section 404, the U.S. Army Corps of Engineers (ACOE) regulates the discharge of fill material into waters of the United States, which include navigable and isolated waters, headwaters, and adjacent wetlands (33 U.S.C. 1344). In general, the term “wetland” refers to

areas meeting the ACOE criteria of hydric soils, hydrology (either sufficient annual flooding or water on the soil surface), and hydrophytic vegetation (plants specifically adapted for growing in wetlands). Any action with the potential to impact waters of the United States must be reviewed under the Clean Water Act, NEPA, and the Act. These reviews require consideration of impacts to listed species and their habitats, and recommendations for mitigation of significant impacts.

The ACOE interprets “the waters of the United States” expansively to include not only traditional navigable waters and wetlands, but also other defined waters that are adjacent or hydrologically connected to traditional navigable waters. However, On April 21, 2020, the U.S. Environmental Protection Agency and the Department of the Army published the Navigable Waters Protection Rule in the Federal Register (85 FR 22250) that finalized a revised definition of “waters of the United States” under the Clean Water Act. The overall effect of the new rule on loss of isolated wetlands, such as vernal pool habitat, is not known at this time.

### *Endangered Species Act (Act)*

The Act is the primary Federal law providing protection for these species. The Service’s responsibilities include administering the Act, including sections 7, 9, and 10 that address take. Since listing, the Service has analyzed the potential effects of Federal projects under section 7(a)(2), which requires Federal agencies to consult with the Service prior to authorizing, funding, or carrying out activities that may affect listed species. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 CFR 402.02). A non-jeopardy opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of listed species associated with a project.

Section 9 prohibits the taking of any federally listed endangered or threatened species. Section 3(18) defines “take” to mean “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct”. Service regulations (50 CFR 17.3) define “harm” to include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harassment is defined by the Service as an intentional or negligent action that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns that include, but are not limited to, breeding, feeding, or sheltering. The Act provides for civil and criminal penalties for the unlawful taking of listed species. Incidental take refers to taking of listed species that result from, but is not the purpose of, carrying out an otherwise lawful activity by a Federal agency or applicant (50 CFR 402.02). For projects without a Federal nexus that would likely result in incidental take of listed species, the Service may issue incidental take permits to non-Federal applicants pursuant to section 10(a)(1)(B). To qualify for an incidental take permit, applicants must develop, fund, and implement a Service-approved Habitat Conservation Plan that details measures to minimize and mitigate the project’s adverse impacts to listed species.

### *Federal Land Policy and Management Act of 1976 (FLPMA)*

The Bureau of Land Management is required to incorporate Federal, State, and local input into their management decisions through Federal law. The FLPMA (Public Law 94-579, 43 U.S.C.

1701) was written “to establish public land policy; to establish guidelines for its administration; to provide for the management, protection, development and enhancement of the public lands; and for other purposes”. Section 102(f) of the FLPMA states that “the Secretary [of the Interior] shall allow an opportunity for public involvement and by regulation shall establish procedures...to give Federal, State, and local governments and the public, adequate notice and opportunity to comment upon and participate in the formulation of plans and programs relating to the management of the public lands”. Therefore, through management plans, the Bureau of Land Management is responsible for including input from Federal, State, and local governments and the public. Additionally, Section 102(c) of the FLPMA states that the Secretary shall “give priority to the designation and protection of areas of critical environmental concern” in the development of plans for public lands. Although the Bureau of Land Management has a multiple-use mandate under the FLPMA which allows for grazing, mining, off-road vehicle use, etc., the Bureau of Land Management also has the ability under the FLPMA to establish and implement special management areas such as Areas of Critical Environmental Concern, wilderness, research areas, etc., that can reduce or eliminate actions that adversely affect species of concern (including listed species).

#### *The Lacey Act*

The Lacey Act (P.L. 97-79), as amended in 16 U.S.C. 3371, makes unlawful the import, export, or transport of any wild animals whether alive or dead taken in violation of any United States or Indian tribal law, treaty, or regulation, as well as the trade of any of these items acquired through violations of foreign law. The Lacey Act further makes unlawful the selling, receiving, acquisition or purchasing of any wild animal, alive or dead. The designation of “wild animal” includes parts, products, eggs, or offspring.

#### *Nevada State Protection*

The State of Nevada classifies the Big Spring spinedace as a protected species under Nevada Administrative Code §§ 503.065. State regulations providing protection for Pahrump poolfish are described below.

Under Nevada Administrative Code §§ 503.050, 503.065, 503.067, 503.075, 503.080, 503.090, 503.103, and 503.104 (Nevada Revised Statutes §§ 501.105, 501.110, 501.181, and 503.650), a species may be designated as protected, threatened, endangered, or sensitive. The State statutes and regulations aimed at protecting wildlife and plant species, respectively, are administered by the NDOW and the Nevada Division of Forestry, under the Department of Conservation and Natural Resources. Capturing, removing, or destroying animals and plants on the State’s fully protected list is prohibited for wildlife under Nevada Administrative Code §§ 503.093 and 503.094 (Nevada Revised Statutes §§ 501.105 and 501.181) and for plants under Nevada Administrative Code §§ 527.250 to 527.460 (Nevada Revised Statutes §§ 527.050 and 527.300), unless a special permit has been obtained from the NDOW or Nevada Division of Forestry.

#### Factor E: Other Natural or Manmade Factors Affecting Its Continued Existence

##### *Invasive and nonnative vegetation*

The overgrowth of instream vegetation such as cattails and bulrush has been shown to encourage crayfish populations (Jezorek et al. 2011). In disturbed and altered habitats, cattails and bulrush can become monotypic stands that degrade and alter instream habitat. The nonnative and invasive salt cedar (*tamarisk ssp.*) is present along portions of Condor Canyon and should be controlled. Salt cedar tends to crowd out native riparian vegetation and establish itself as a monoculture.

### *Recreation*

Recreational impacts within Condor Canyon appear minimal and consist of OHV use and camping. The canyon is accessed by vehicles at two points: 1) North entrance, which requires landowner permission; and 2) South entrance, which requires a 4-wheel drive vehicle or OHV to navigate the dirt road through the canyon and becomes impassable to trucks approximately one mile below Delmue Falls.

### *Stochastic Events*

Since the species habitat is limited, it is susceptible to catastrophic events, which could adversely modify its current habitat conditions. Small populations have an inherent risk of extirpation due to stochastic events. Fire and flooding are natural events that occur within Big Spring spinedace habitat, they are exacerbated by manmade factors such as weeds, unnatural ignition of fires, and altered hydrology. The geographic isolation of small populations also increases the chance of extirpation of metapopulation segments due to stochastic events. For example, an event that affects a small isolated stream such as Condor Canyon has a greater chance of extirpating a population within a stream than a similar event that occurs in a larger, more complex habitat supporting a greater number of individuals.

## **III. RECOVERY CRITERIA**

Recovery plans provide guidance to the Service, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, overall, the threats have been minimized sufficiently, and the species is robust enough, to downlist or delist the species. In other cases, new recovery approaches and/or opportunities unknown at the time the recovery plan was finalized may be more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

The Big Spring spinedace Recovery Plan states, “Big Spring spinedace may be proposed for delisting when a self-sustaining population exists in Meadow Valley Wash at Condor Canyon for at least 5 consecutive years and its habitat is secured from all known threats.” The plan further suggests restoration of the historical habitat between Condor Canyon and Panaca Big Spring and the establishment of at least one self-sustaining refugium population. By definition, a “self-sustaining population” would be a population of relatively stable or increasing numbers of individuals, with several age classes represented.

In addition to a self-sustaining population being established for at least five years, recovery criteria require that the habitat be “secured from all known threats.” The threats identified at the time of listing (see Five Factor Analysis section), which continue to cause concern include:

- 1) Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range;
- 2) Disease or Predation; and
- 3) Other Natural or Manmade Factors Affecting Its Continued Existence.

#### **IV. SYNTHESIS**

The status of the Big Spring spinedace has neither significantly improved nor degraded since the time of its listing. Many aspects of its life history remain unknown and warrant further investigation though progress has been made. Recent USGS surveys have provided improved data concerning the distribution, population size, spawning, and age and growth of Big Spring spinedace (Jezorek et al. 2011). The recovery criteria set forth in the Big Spring spinedace Recovery Plan have not been met and cannot be properly met without further efforts. We have not established a clear population trend, and we have not established refugia, leaving only one geographically limited population of the species that is still subject to a number of threats, in particular, habitat degradation from human activities, predation from nonnative fishes and crayfish, and stochastic events. The historical habitat is privately owned and currently used for agriculture, it is unlikely that this site will be available for restoration within the foreseeable future.

After reviewing the best available scientific information, we conclude that Big Spring spinedace (*Lepidomeda mollispinis pratensis*) remains a threatened species. The evaluation of threats affecting the species under the factors in 4(a)(1) of the Act and analysis of the status of the species in our 1985 listing determination remains an accurate reflection of the species’ current status.

#### **V. RECOMMENDATIONS FOR FUTURE ACTIONS**

Over the next 5 years, focus should be on collecting population trend information, planning for the establishment of a secondary population, assessing effects from nonnative aquatic species (e.g. signal crayfish, rainbow trout), and improving habitat below Delmue Falls within Condor Canyon.

Population monitoring should continue to occur at established sites. These monitoring efforts should be implemented by NDOW with assistance from the Service and others. If funding allows, conducting a more robust sampling, such as those developed by USGS may be worth considering (Jezorek et al. 2011).

The instability and potential for catastrophic loss of habitat warrants the establishment of a second population. Since Big Spring spinedace are a federally listed species, there are regulatory as well as biological considerations that must be met before establishing a population. To aid in the selection of a transplant site, we should identify and collect baseline information that can be compared to occupied habitat in Condor Canyon. Specifically, we should compare habitat characteristics at potential sites with those of the habitat above Delmue Falls. As for regulatory considerations, a decision should be made whether to pursue a safe harbor agreement or try to identify areas for the establishment of a 10j population (e.g., non-essential, experimental).

Additionally, efforts should be made to identify research needs for Big Spring spinedace. This information can be used to guide the establishment of successful refugia for the species. Potential research needs may include: 1) life history; 2) food web dynamics; and 3) predator-prey relationships between Big Spring spinedace and nonnative species (i.e., signal crayfish, rainbow trout).

Field Supervisor, Fish and Wildlife Service

Approve/Date \_\_\_\_\_

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Figure 1. Panaca Big Spring and historical habitat.



Figure 2. Current distribution of Big Spring spinedace.



Figure 3. Delmue Falls viewed from top NW bank.



Figure 4. Looking downstream from above Delmue Falls on NW bank.