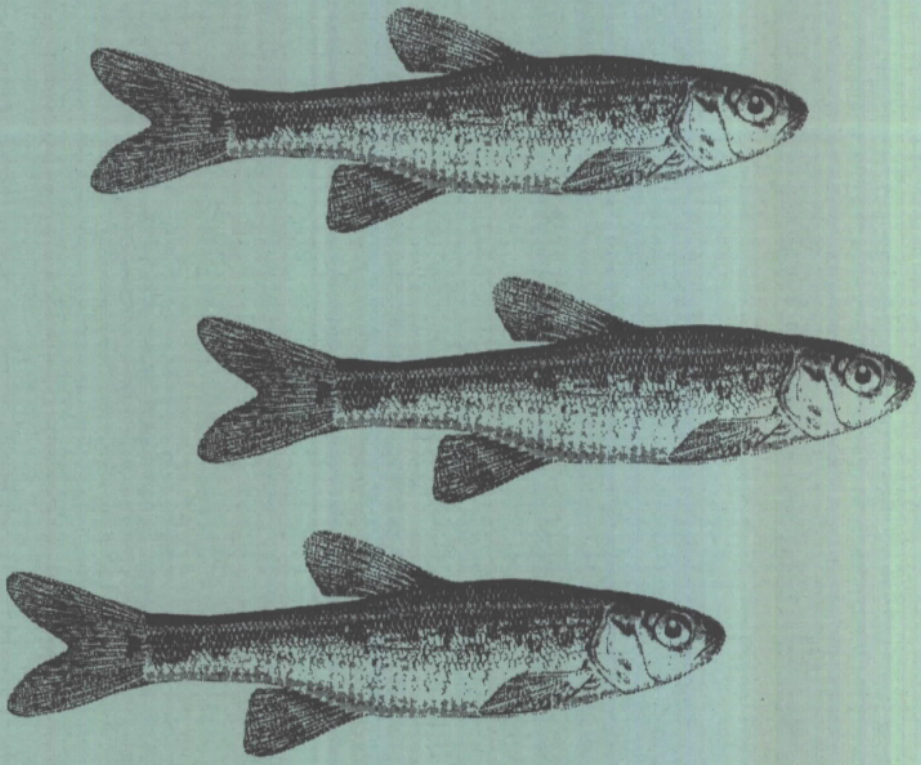
WHITE RIVER SPINEDACE

RECOVERY PLAN



U.S. Fish and Wildlife Service
Region 1
Portland, Oregon

WHITE RIVER SPINEDACE

(*Lepidomeda albivallis*)

RECOVERY PLAN

U.S. Fish and Wildlife Service
Region 1
Portland, Oregon

Approved: MARVIN L. PLENERT
Regional Director
U. S. Fish and Wildlife Service

Date: March 28, 1994

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EXECUTIVE SUMMARY OF THE WHITE RIVER SPINEDACE RECOVERY PLAN

Current Status: The endangered White River spinedace is extant in only one of several historically occupied habitats in northern White River Valley of Nye and White Pine Counties, Nevada. The species persists in Flag Springs, one of three springs designated as critical habitat for this species, but the population was estimated at under 50 individuals in June 1991. Flag Springs is within the State of Nevada's Kirch Wildlife Management Area. The other critical habitats are on private property.

Habitat Requirements and Limiting Factors: White River spinedace life history and habitat requirements are poorly known. Loss of suitable habitat and predation by or competition with nonnative fish species have contributed to species' decline. The Flag Springs population's size and distribution is limited by largemouth bass predation.

Recovery Objective: Reclassification to threatened status.

Recovery Criteria: White River spinedace may be proposed for reclassification to threatened status when a self-sustaining population exists in each of the three designated critical habitats for at least 5 consecutive years and each habitat is secure from all known threats. Delisting criteria cannot be determined at this time.

Actions Needed:

1. Secure, enhance, and maintain the White River spinedace population at Flag Springs.
2. Reestablish and maintain White River spinedace populations in Preston Big Spring and Lund Spring.

Total Estimated Cost of Recovery ($1,000's):

Year	Need 1	Need 2	Total
1994	39	0	39
1995	21	0	21
1996	26	0	26
1997	2	8	10
1998	2	11	13
1999	2	2	4
2000	2	2	4
2001	2	2	4
2002	2	2	4
2003	2	2	4
2004	2	2	4
2005	2	2	4
2006	2	2	4
2007	2	2	4
Totals:	108	37	145

Date of Recovery: Reclassification of the White River spinedace should be initiated in 2007, if recovery criteria are met.

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Part I. INTRODUCTION

A. Brief Overview

White River spinedace (*Lepidomeda albivallis*), listed as a federally endangered species on September 12, 1985 (50 Federal Register 37194), is one of four native fishes known to have historically occupied the stream and spring habitats of northern White River Valley in Nye and White Pine Counties, Nevada. White River spinedace have been extirpated from all but one of several known historic habitats due to habitat modification and nonnative species introductions (Deacon, et al. 1980; Courtenay, et al. 1985; Scoppettone, et al. 1992). The species persists in very low numbers in the northern spring of the Flag Springs complex on the State of Nevada's Wayne E. Kirch Wildlife Management Area at Sunnyside, Nye County, Nevada. Largemouth bass (*Micropterus salmoides*) have essentially eliminated White River spinedace, as well as all other native fish, from all reaches of the Flag Springs complex to which they have gained access.

Immediate action is necessary to prevent the extinction of the White River spinedace. Largemouth bass must be eliminated from the Flag Springs system, and habitat enhancement may be needed to maximize

White River spinedace reproduction and recruitment. Once the Flag Springs population has stabilized, initial recovery efforts should focus on reestablishing White River spinedace populations into historically occupied habitats following rehabilitation of these habitats. Research will be necessary to guide recovery activities because little is currently known about White River spinedace life history and habitat requirements.

When implemented, the tasks recommended in this recovery plan, although specifically addressing the needs of the White River spinedace, should enhance the aquatic ecosystems of northern White River Valley and promote the conservation of all endemic aquatic species supported therein. White River desert sucker (*Catostomus clarki intermedius*), White River speckled dace (*Rhinichthys osculus ssp.*), and Preston White River springfish (*Crenichthys baileyi albivallis*) historically or currently occupy the same habitats as White River spinedace and are all category 2 candidates for possible future listing as threatened or endangered species under the Endangered Species Act of 1973, as amended (Act) (56 Federal Register 58804). The U.S. Fish and Wildlife Service (Service) has information indicating that proposing to list these fishes is possibly appropriate, but substantial data on biological vulnerability and threat(s) are not currently available to support preparation of a proposed rule. Consideration of these candidate species and all other endemic aquatic species during White River spinedace recovery activities could alleviate the need to list these species as threatened or endangered species in the future.

B. Species Description

The Plagopterini tribe of cyprinid fishes includes the monotypic genera *Meda* (spikedace) and *Plagopterus* (woundfin), and the polytypic genus *Lepidomeda* (spinedace) (Table 1). Members of this tribe are distinguished from other cyprinids by: 1) The spinelike character of the pelvic and pectoral fin rays, and the two anterior dorsal fin rays; 2) a membranous connection between the innermost ray of the pelvic fins and the belly; 3) bright silver coloration; and 4) the absence or diminutive development of body scales (Miller and Hubbs 1960). Plagopterin fishes are among the few North American cyprinids that are not known to hybridize with other genera (Hubbs 1955).

Spinedace are the most generalized and diverse of the plagopterin genera, and presumably gave rise to the more specialized spikedace and woundfin (Miller and Hubbs 1960; Uyeno and Miller 1973). Spinedace have weakly developed dorsal and pectoral fin spines compared to the strongly developed spines of spikedace and woundfin. Spinedace also possess diminutive scales, whereas spikedace and woundfin are scaleless (Miller and Hubbs 1960).

White River spinedace were described by Miller and Hubbs (1960) following a review of the previous classification of the genus *Lepidomeda*. Two other new spinedace species, one with two subspecies, were also identified and the two previously recognized spinedace species were synonymized into one. White River spinedace differ from other spinedace by: 1) A pharyngeal tooth formula of 5-4 in the main row; 2) typically less than 90 scales in the lateral line; 3) a moderately oblique mouth; 4) a moderately high dorsal fin; and 5) melanophores extending well below the lateral line (Miller and Hubbs

Table 1: Members of the Plagopterini tribe of cyprinid fishes, as described by Miller and Hubbs (1960), with their Federal status and historic distribution.

Common Name, Scientific Name
Status*
Distribution

Spikedace, *Meda fulgida*
Threatened
- Gila River system; Arizona, New Mexico

Woundfin, *Plagopterus argentissimus*
Endangered
- Virgin River system; Utah, Arizona, Nevada
- lower Gila River system; Arizona (extirpated)

Little Colorado spinedace, *Lepidomeda vittata*
Threatened
- headwaters Little Colorado River system; Arizona

Pahranagat spinedace, *Lepidomeda altivelis*
Extinct
- Ash Spring outflow and Upper Pahranagat Lake; Lincoln County, Nevada (extirpated)

White River spinedace, *Lepidomeda albivallis*
Endangered
- Flag Springs; Nye County, Nevada
- Preston Big Spring, Indian Spring, Nicholas Spring, Arnoldson Spring, Cold Spring, Lund Spring, and the upper White River; White Pine County, Nevada (extirpated)

Lower Colorado spinedace, *Lepidomeda mollispinis*

Virgin River spinedace, *Lepidomeda m. mollispinis*
Candidate Category 2
(Petition to list as an endangered species received by the Service in July 1992; 58 Federal Register 14169)
- Virgin River system; Utah, Arizona, Nevada

Big Spring spinedace, *Lepidomeda m. pratensis*
Threatened
- Meadow Valley Wash (Condor Canyon section); Lincoln County, Nevada
- Big Spring outflow; Lincoln County, Nevada (extirpated)

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*as listed in 50 CFR 17.11 and 17.11, August 29, 1992; or 56 Federal Register 58804, November 21, 1991.

1960). White River spinedace are also the largest of the spinedace, commonly attaining a total length over 120 centimeters (Miller and Hubbs 1960).

White River spinedace are the most brightly colored of the four species of *Lepidomeda*. Miller and Hubbs (1960) reported that postnuptial males collected in 1934, were ". . . bright brassy green to olive above, brassy over bright silvery on sides, and silvery white below, splashed with sooty on the sides. Dorsal and caudal fins pale olive-brown to pinkish brown, with the rays often deep-olive and with the rather clear interradial membranes faintly flushed with rosy color; pectorals yellowish with orange-red axils; anal and pelvic fins bright orange-red . . . Lower edge of caudal peduncle with a speckled diffusion of orange-red in adults. Some coppery-red to red on side of face, at upper end of gill opening, on preorbital just behind mouth, and along upper arm of preopercle. Cheeks and opercles with rather strong gilt reflections; the gular membranes watery yellow. Lateral line more strongly gilt than adjacent parts of body. In females the coloration is similar but less intense."

C. Historic Distribution and Current Population Status

All members of the Plagopterini tribe historically occupied highly localized habitats within the Colorado River drainage system of Arizona, New Mexico, Nevada, and Utah. Human manipulation of these habitats and introductions of nonnative fish species, those species not indigenous to the drainage system, further reduced each species' restricted distribution and caused severe population declines (Miller 1961). Within this tribe, one species is extinct and five species or subspecies are federally listed as threatened or endangered

(Table 1). In July 1992, the Service was petitioned to list the remaining subspecies as an endangered species (58 Federal Register 14169).

During late Pleistocene pluvial stages, the White River flowed south approximately 320 kilometers from northern White River Valley and emptied into the Virgin River above its confluence with the Colorado River (Hubbs and Miller 1948). As the pluvial White River system dried due to more xeric climates, native fishes were isolated in remnant springs and disjunct river sections. White River spinedace became restricted to such habitats within northern White River Valley. Complete White River spinedace historical distribution and population status information is unavailable because the aquatic habitats of northern White River Valley were not thoroughly inventoried prior to human modification.

In 1934, the first White River spinedace were collected from the White River, just below the mouth of Ellison Creek (Figure 1). Four years later, White River spinedace were collected from Preston Big Spring and Nicholas Spring (also referred to as Preston Town Spring), Lund Spring, and an unnamed spring system (now referred to as Flag Springs) (Figures 1, 2, 3). In 1941, White River spinedace were collected from an additional unnamed spring (now referred to as Arnoldson Spring) (Figure 2) (Miller and Hubbs 1960). White River spinedace were also observed in Cold Spring, Indian Spring, and in the White River 15 kilometers downstream from Flag Springs below the Adams-McGill Reservoir (Figures 1, 2) (La Rivers 1962; NDOW 1975; Williams and Wilde 1981). Collection records suggests that White River spinedace were common to abundant within these habitats.

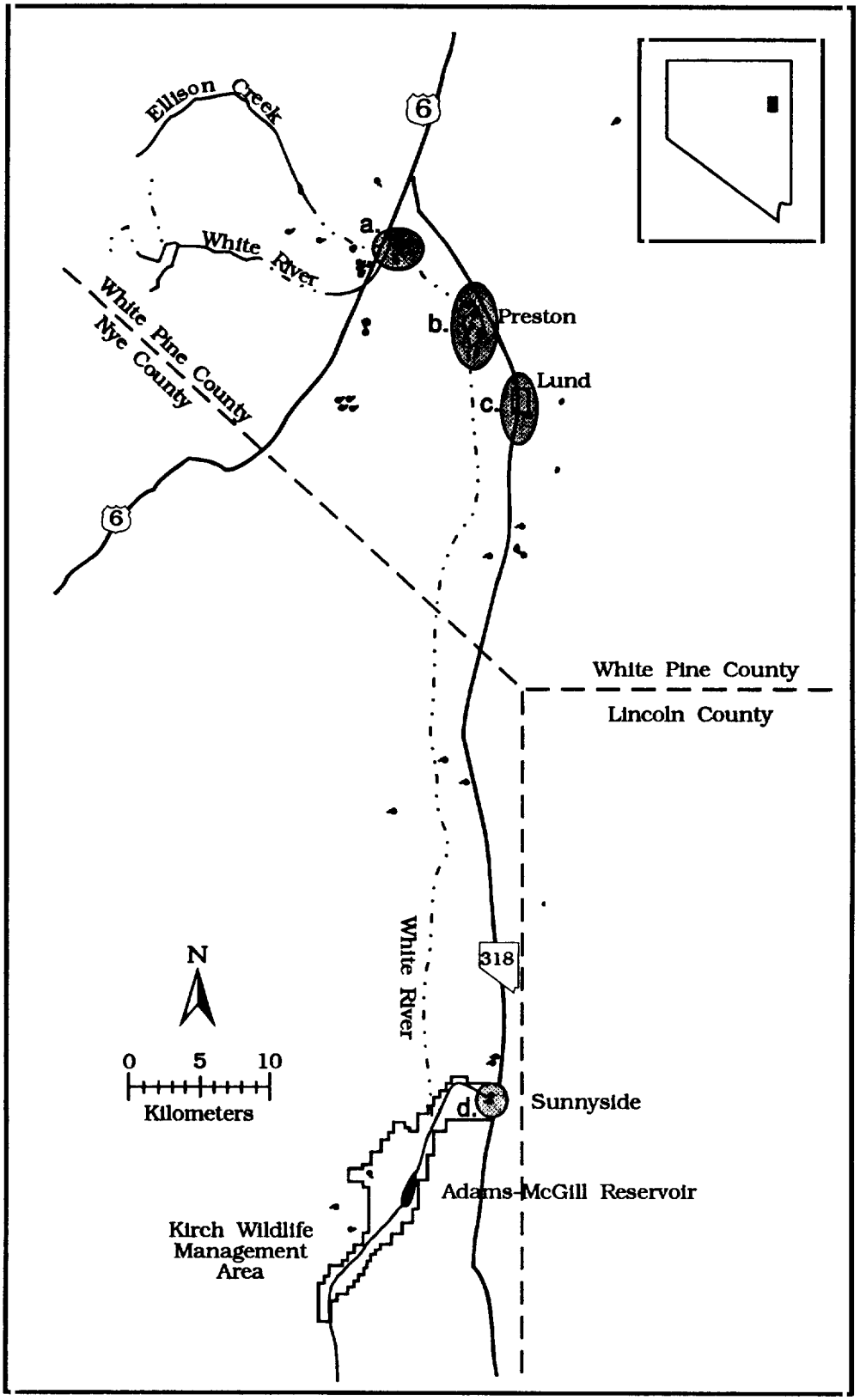

Figure 1. White River spinedace historic distribution, Nye & White Pine Cos., NV: a) White River near its confluence with Ellison Creek; b) Preston Big Spring, Cold Spring, Nicholas Spring and Arnoldson Spring; c) Lund Spring; and d) Flag Springs (modified from Scoppettone, et al. 1992).

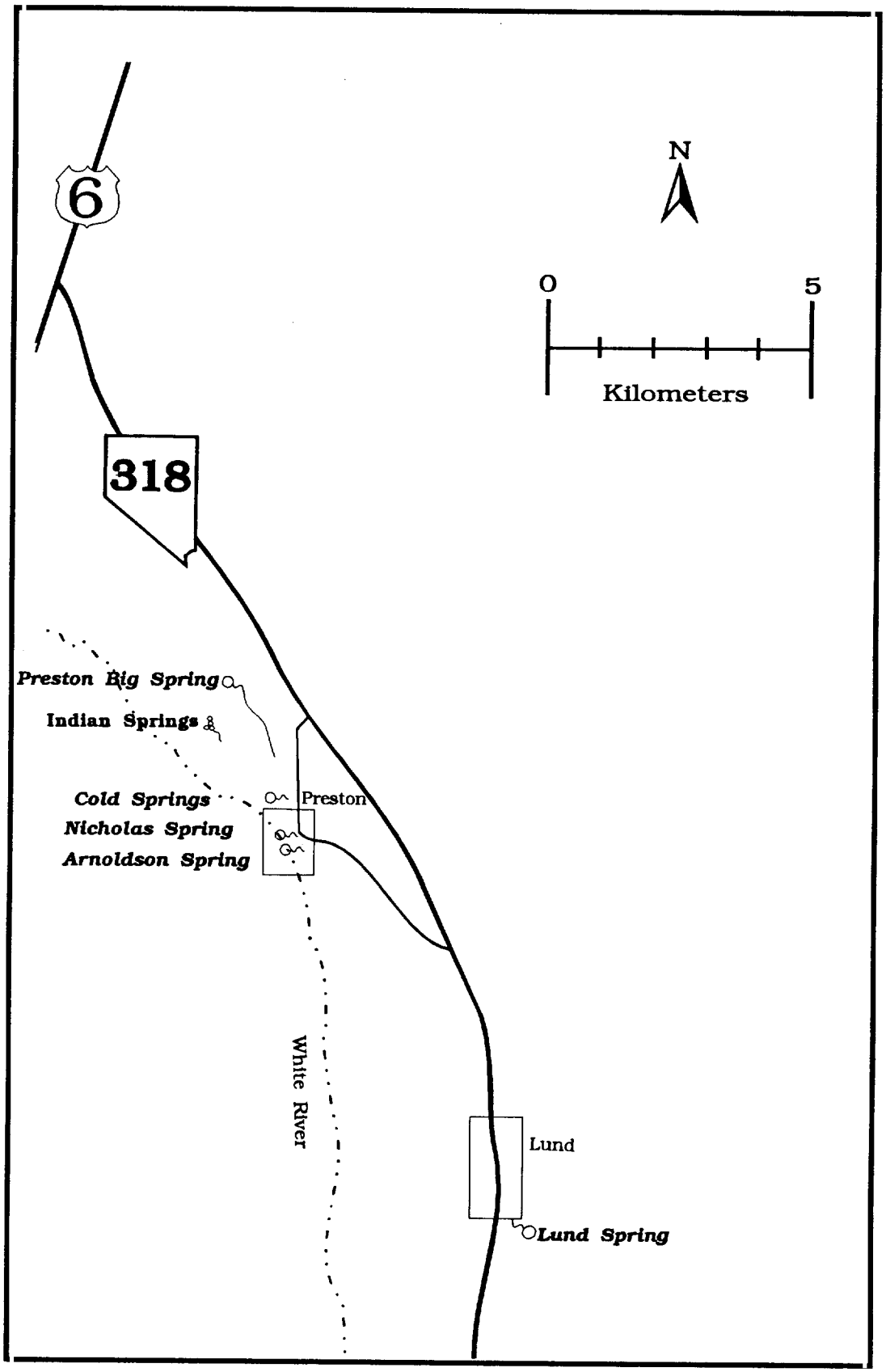

Figure 2. White River spinedace historic habitats in the vicinity of Preston and Lund, White Pine Co., Nevada (modified from Scopettone, et al. 1992).

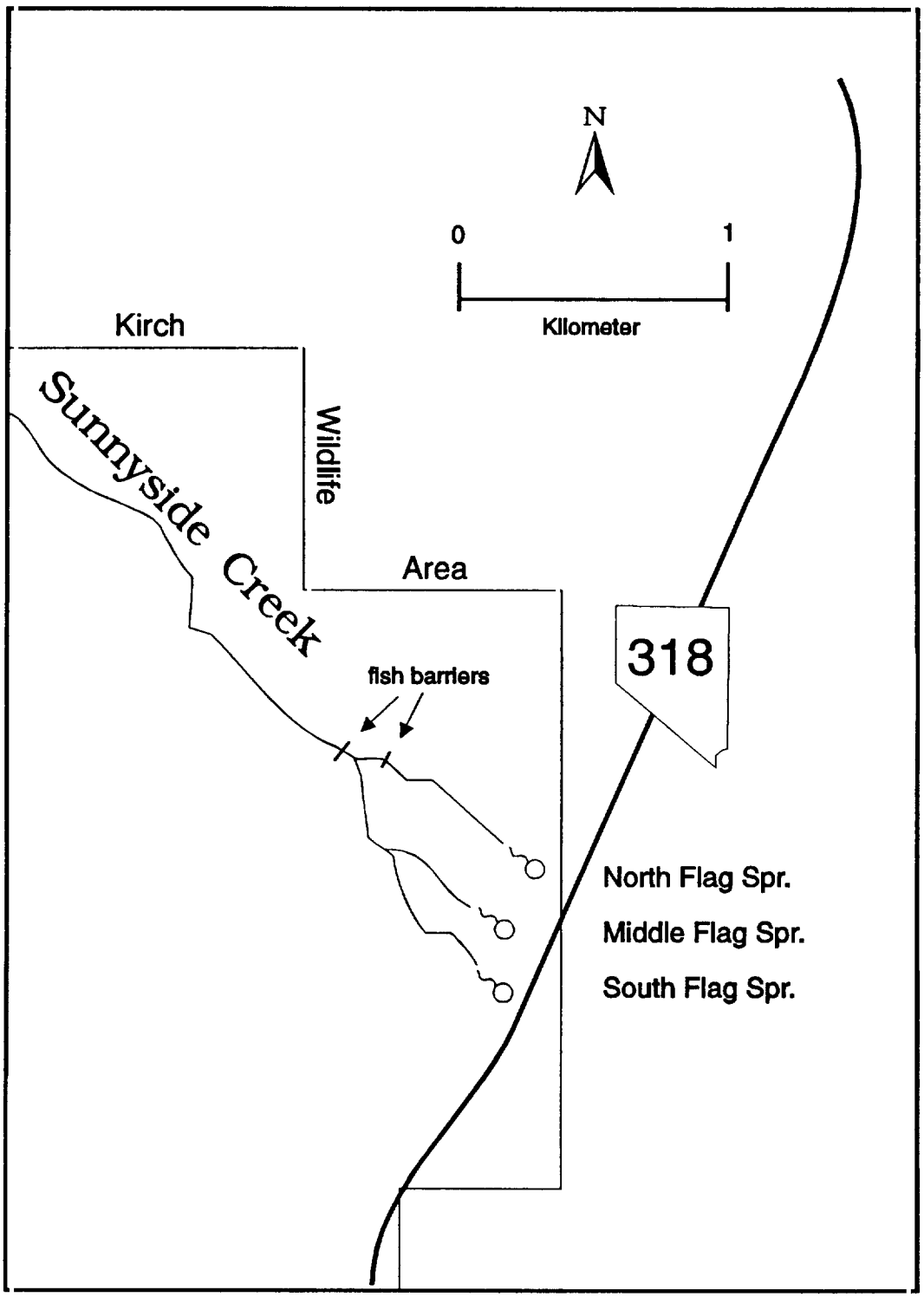

Figure 3. White River spinedace historic habitat at Flag Springs. (modified from Scoppettone, et al. 1992)

There have been two documented translocations of White River spinedace, but no evidence that either release resulted in the establishment of a White River spinedace population. During 1951, White River spinedace were reportedly used as bait fish in the lower Colorado River (Miller 1952). In 1957, Nevada Department of Wildlife (NDOW) personnel collected White River spinedace from the White River below the Adams-McGill reservoir and released them into waters in Railroad Valley, Nevada (La Rivers 1962).

It is difficult to determine when White River spinedace populations began to decline or were eliminated. The population in the headwaters of the White River was probably the first to disappear. In 1934, 429 White River spinedace were collected from the White River, just below the mouth of Ellison Creek near U. S. Highway 6 (Miller and Hubbs 1960). During a 1956 stream survey, only one White River spinedace was observed in the White River above U.S. Highway 6 (Frantz 1956). White River spinedace have not been encountered in the river during recent surveys (NDOW 1984; Courtenay, et al. 1985; Scoppettone, et al. 1992).

White River spinedace were not observed in Preston Big Spring during 1977 and 1980 (Selby 1977; Deacon, et al. 1980). By the mid-1980's, White River spinedace had been confirmed extirpated from Preston Big Spring and Nicholas Spring, and the populations at Lund Spring and Flag Springs were depleted and restricted to small remnants of historic habitats (Courtenay, et al. 1985). The demise of the White River spinedace populations at Arnoldson and Cold Springs is not documented. White River spinedace were last observed in Arnoldson Spring in November 1977 (Selby 1977).

Limited numbers of White River spinedace were collected from Lund Spring and its outflow stream between 1938 and 1986 (Miller and Hubbs 1960; Selby 1977; Allan 1985; Courtenay, et al. 1985; NDOW 1986). In 1987, however, no spinedace were observed during a limited survey of Lund Spring (Withers 1987). The extirpation of the Lund Spring population was confirmed following a thorough inventory conducted during the summer of 1991 (Scoppettone, et al. 1992).

White River spinedace have been collected at Flag Springs since 1938 (Miller and Hubbs 1960; Allan 1985; Courtenay, et al. 1985; Withers 1985, 1986, 1987). Flag Springs is a complex of three springs, oriented north to south, whose outflows combine to form Sunnyside Creek, which is tributary to the White River. In May 1982, 20 White River spinedace were captured from the main spring pool of the northern Flag Spring, and an additional 15 individuals were captured from a small section of stream immediately below the spring pool (Burrell 1982). In 1991, the Flag Springs complex was thoroughly inventoried for White River spinedace, but only 37 individuals were observed. All individuals found were adults and occupied the spring pool of the northern Flag Spring and the stream immediately below this pool. The one remaining population of this endangered fish species was estimated at less than 50 individuals, with no obvious indication of recent recruitment (Scoppettone, et al. 1992).

All habitats historically occupied by White River spinedace also historically supported White River desert sucker, White River speckled dace, and Preston White River springfish, in various combinations and densities (Table 2) (NDOW 1956; Miller and Hubbs 1960; Williams and Wilde 1981; Courtenay, et al. 1985). The relative composition and densities of native fishes within these habitats have shifted over

Table 2: Historic and present distribution of endemic and nonnative fishes in the northern White River Valley (Miller and Hubbs 1960; NDOW 1956; Williams and Wilde 1981; Courtenay, et al. 1985; Scoppettone, et al. 1992)

H - historically present endemic; I - introduced nonnative; P - present in 1991.

	White River @ U.S. 6	Preston Big Spring	Indian Spring	Cold Spring	Nicholas Spring	Arnoldson Spring	Lund Spring	Flag Spring
White River spinedace	H	H	H	H	H	H	H	H,P
Preston White River springfish		H,P	H,P	H	H,P	H,P	H	
White River speckled dace	H,P	H,P	P		H	H,P	H,P	H,P
White River desert sucker	H,P	H			H	H	H,P	H,P
largemouth bass								I,P
guppy			I	I,P	I,P	I,P	I,P	
mosquitofish							I	
trout species	I,P							I
goldfish							I	

time as habitats were physically modified, nonnative fish species introduced, and native fish species extirpated from individual habitats (Courtenay, et al. 1985; Scoppettone, et al. 1992).

D. Critical Habitat

Critical habitat, as defined by section 3 of the Act includes: 1) The specific areas, within the geographical area occupied by a species at the time of its listing under the Act, which contain those physical or biological features essential to the conservation of the species and which may require special management considerations or protection; and 2) specific areas, outside the geographical area occupied by the species at the time it is listed, which are determined to be essential for the conservation of the species.

White River spinedace critical habitat encompasses the following springs and their associated outflows plus surrounding land areas for a distance of 15 meters from these springs and outflows:

1) Preston Big Spring and associated outflow within T. 12 N., R. 61 E., NE¼ sec. 2, White Pine County, Nevada;

2) Lund Spring and associated outflow within T. 11 N., R. 62 E., NE¼ NE¼ sec. 4 and T. 12 N., R. 62 E., S½ SE¼ sec. 33, White Pine County, Nevada; and

3) Flag Springs and associated outflows within T. 7 N., R. 62 E., E¼ NE¼ sec. 32, SW¼ NW¼ sec. 33, Nye County, Nevada (50 Federal Register 37194).

Known constituent elements for all White River spinedace critical habitat include consistent quantities of high quality cool (13° to 21° Centigrade) water in the springs and their outflows, vegetation for cover, and insects and other invertebrates for food (50 Federal Register 37194).

E. Life History and Habitat Requirements

White River spinedace life history and habitat requirements are scantily known. Field investigations conducted on White River spinedace populations have focused on status and distribution, with little or no attention given to the species' life history and habitat requirements. This information should be collected to guide recovery efforts, but activities needed immediately to prevent the extinction of the species should proceed based on best available information.

Due to the limited size and restricted distribution of the remaining White River spinedace population, life history and habitat requirement information may be difficult to collect. Certain life history and habitat information may not be obtainable if mortality of individuals is required. Observations of habitat utilization may not reflect the species true preferences. Initial inferences may need to be drawn

based on comparisons with other better-studied spinedace or other similar species. Caution should be exercised in making direct comparisons. Spring habitats occupied by White River spinedace may be sufficiently distinct from the riverine habitats occupied by other spinedace that White River spinedace requirements may be substantially different. As recovery tasks are implemented and White River spinedace become more plentiful and widely distributed, more detailed research should be conducted to determine the species actual needs and preferences.

White River spinedace collected during the 1930's occupied spring habitats with clear, cool (18° to 22° Centigrade) water. Source pools varied in size from 5 to 27 meters in diameter, with bottoms primarily comprised of gravel and sand, but with some mud. Emergent aquatic vegetation was common and often dense. The current in the spring outflows and the White River was swift to moderate (Miller and Hubbs 1960). In 1980, Preston Big Spring supported 74 species of algae and over 40 taxa of crustaceans and insects (Williams and Williams 1982). Available data on water temperatures, discharge rates, and dissolved oxygen levels of springs historically occupied by White River spinedace indicate relatively similar temperatures among springs, but disparate discharge and dissolved oxygen values (Table 3). Preliminary investigations suggest that White River spinedace may require habitats with appropriate ratios of water volume and temperature to meet their metabolic needs (Scoppettone pers. comm.).

Table 3: Some physical characteristics of springs historically occupied by White River spinedace (Garside and Schilling 1979; Bostic, et al. 1990; Garcia, et al. 1991; Scoppettone, et al. 1992).

Spring	Date	Temperature (°C)	Discharge (m^3/min.)	Dissolved Oxygen (mg/l)
Preston Big	Oct 1966	21	15	
	Mar 1990		14	
	Mar 1991		13	
	Jun 1991	21		3.8
Cold	Nov 1966	21	3	
	Mar 1990		3	
	Mar 1991		2	
	May 1992	23		10.8
Nicholas	Nov 1966	22	4	
	Apr 1990		4	
	Mar 1991		6	
	Jun 1991	22		3.2
Arnoldson	Nov 1966	22	5	
	Apr 1990		6	
	Mar 1991		2	
	Jun 1991	22		3.1
Lund	Mar 1990			
	Mar 1991		17	
	Jun 1991	19		5.9
North Flag	Mar 1990		3	
	Jun 1991	16		9.1
Middle Flag	Mar 1990		1	
	Jun 1991	19		5.8
South Flag	Mar 1990		4	
	Jun 1991	23		5.0

White River spinedace spawning has never been observed, and spawning habitat requirements are unknown. Remnants of spawning tubercles were present on postnuptial males collected in August 1938, suggesting the species spawns during the summer (Miller and Hubbs 1960). This timing correlates with that observed in other spinedace. Virgin River spinedace (*Lepidomeda mollispinis mollispinis*) have been observed spawning in the Santa Clara River of Utah in May and June (Rinne 1971). Little Colorado River spinedace (*Lepidomeda vittata*) juveniles and apparent courtship activity were observed in July 1961 (Miller 1963). Spawning tubercles have been observed on Big Spring spinedace (*Lepidomeda mollispinis pratensis*) from May through August (Langhorst 1991).

White River spinedace food preferences and feeding habits are unknown, although preliminary investigations suggest they drift feed on invertebrates suspended in the water column (Scoppettone, pers. comm.). Virgin River spinedace feed primarily on aquatic insect larvae, but consume algae and other plant material when insects are not available (Rinne 1971, Minckley 1973). Allan (1985) suggested that vegetation, especially watercress, is important in providing habitat for insect and invertebrate foods for Big Spring spinedace.

No information is available regarding specific life history and habitat requirements of the other native fish species which occupy historic White River spinedace habitats, or how these species interact with White River spinedace. This information is necessary prior to reintroduction of White River spinedace into unoccupied historic habitat to determine how the resident native fishes will be affected by the reintroduction of White River spinedace and what influence the

existing community structure may have on the success of the reintroduction.

F. Reasons for Decline and Current Threats

In 1979, the American Fisheries Society (AFS) recognized the White River spinedace as a "threatened" species due to 1) present or threatened destruction, modification, or curtailment of its habitat or range; and 2) other natural or human-made factors affecting its continued existence (hybridization, introduction of exotic or translocated species, predation, competition) (Deacon, et al. 1979). The definition of "threatened" used by AFS is that in the Endangered Species Act of 1973, as amended. Shortly thereafter, Deacon and Williams (1984) noted that White River spinedace were very rare due to the recent extirpation of the Preston Big Spring population. In 1985, the Service determined the White River spinedace to be an endangered species and designated its critical habitat (50 Federal Register 37194) because five populations of this species had been eliminated and the remaining two populations (Lund Spring and Flag Springs) had declined due to habitat destruction from channelization of spring habitats and diversion of water, and introduction of nonnative fishes which compete with and/or prey on White River spinedace. In 1989, the American Fisheries Society reclassified the White River spinedace to "endangered" species status (Williams, et al. 1989).

White River spinedace habitats have been altered since the mid-1800's, when the first settlers began diverting water from streams and spring outflows for agriculture and ranching purposes (Georgetta 1972). With the exception of Flag Springs, all springs historically

occupied by White River spinedace have all or a significant portion of their outflow streams captured in underground pipes. Originally, Nicholas Spring, and perhaps others, combined with the outflow from Preston Big Spring. During the 1970's, this connection was severed when Nicholas Spring's outflow stream was piped 15 meters from its source (Courtenay, et al. 1985). In 1973, an underground pipe was constructed 1.8 kilometers from Preston Big Spring. This event and frequent use of heavy equipment and copper sulfate to control aquatic vegetation resulted in the extirpation of White River spinedace and White River desert sucker (Deacon, et al. 1980; Courtenay, et al. 1985). The outflow stream from Lund Spring is diverted at the spring pool into three irrigation channels. In June 1983, the largest channel was replaced with an underground pipeline. A small population of White River spinedace persisted in the remaining dirt channels because enough water leaked through the diversion structure to maintain downstream habitat. Improvements to the structure, however, eliminated the leakage and resulted in the eventual extirpation of Lund Spring White River spinedace population. Flag Springs and their outflow streams have been modified over time by various diversions, but are essentially intact. A concrete weir creates the pool at the northern Flag Spring and protects the White River spinedace resident in the pool from largemouth bass.

Nonnative fish species have been implicated in the decline of White River spinedace due to predation and/or competition for available resources (Minckley and Deacon 1968; Williams and Wilde 1981; Courtenay, et al. 1985). Nonnative fish species have been introduced into most habitats historically occupied by White River spinedace (Table 2). Brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), and cutthroat trout

(*Oncorhynchus clarki*) have been released into the upper White River at various times since 1925 (Frantz 1956). NDOW maintains a recreational trout fishery in the upper White River. NDOW released rainbow trout into the Flag Springs complex, but none remain. Largemouth bass have gained access to the Flag Springs outflows from downstream reservoirs, and currently persist in lower gradient areas (Scoppettone, et al. 1992). Guppies (*Poecilia reticulata*), mosquitofish (*Gambusia affinis*), and goldfish (*Carassius auratus*) have been introduced into all springs except Preston Big Spring and Flag Springs.

G. Conservation Efforts

The White River spinedace was listed as an endangered species with critical habitat in 1985 and is fully protected under the provisions of the Act (50 Federal Register 37194). The Service has assigned the White River spinedace a recovery priority of 2C, which means that this species has a high degree of threat and existing conflicts to recovery, but a high recovery potential. The Nevada Board of Wildlife Commissioners recognizes the White River spinedace as a protected species (Nevada Revised Statutes 503.065). Nevada State laws and regulations prohibit taking of State protected species without a valid State collecting permit.

Actions have been undertaken to enhance the status of the White River spinedace population and its habitat at the north Flag Spring. The entire Flag Springs complex and appurtenant water rights are owned by the State of Nevada. In 1986, NDOW installed a fish barrier in Sunnyside Creek, just below the confluence of Flag Springs' outflow streams to prevent nonnative game fishes from moving out of

the downstream reservoirs into White River spinedace habitat (Figure 3). Unfortunately, largemouth bass are present above this barrier. In May 1993, NDOW and the Service installed a temporary fish barrier above the 1986 barrier, in the outflow stream from the northern Flag Spring, and improved the 1986 fish barrier. During the summer of 1993, NDOW and the Service will remove all largemouth bass above each barrier using electroshocking equipment. NDOW and the Service created small pools within the northern Flag Springs outflow to improve the suitability of the habitat for White River spinedace. As largemouth bass are removed from the outflow streams, hopefully White River spinedace will move out of the headwaters pool and into these new pools.

Federal monies have been allocated to NDOW under section 6 of the Act for: 1) A complete status survey of the aquatic habitats of northern White River Valley, 2) investigations of the ecological characteristics and habitat requirements of White River spinedace, and 3) an evaluation of potential habitats for reintroduction. Results of the status survey have been incorporated into this document (Scoppettone, et al. 1992). The remainder of the research is currently being conducted.

The U.S. Forest Service is currently monitoring habitat conditions and NDOW is monitoring fish populations in the upper White River within Forest Service boundaries. This information will be incorporated into various Forest Service management plans when they are updated. The BLM is currently updating all habitat management plans for BLM land within the White River drainage.

Part II. RECOVERY

A. Objective

The objective of the White River Spinedace Recovery Plan is to improve the species' status so that it may be reclassified to threatened status. Because so little information is available on this species, it is not possible to determine delisting criteria at this time. Future revisions of this recovery plan will identify delisting criteria and recommend tasks to accomplish full recovery of this species.

White River spinedace may be considered for reclassification when the following criteria are met: 1) A self-sustaining population exists in each of the three designated critical habitats for at least 5 consecutive years, 2) each critical habitat is secure from all known threats, and 3) all native fish are present in Flag Spring, Preston Big Spring, and Lund Spring that were present historically as identified in Table 2. These criteria are preliminary and may be modified pending completion of research identified as tasks in this recovery plan. Specific information on White River spinedace life history and habitat requirements is necessary to determine the characteristics of a self-sustaining White River spinedace population and the extent of habitat needed to support it. Upon completion of task 1.3.3, the measurable characteristics of a self sustaining population will be defined and the plan objectives expanded as appropriate.

Recovery of White River spinedace will be accomplished with full consideration given to the needs of the White River desert sucker, White River speckled dace, Preston White River springfish, and all

other endemic aquatic species, such that actions taken to improve the status of White River spinedace should also improve the long-term status of the entire aquatic ecosystem.

Prior to implementation of any task recommended in this recovery plan, the lead agency must comply with all applicable provisions of the National Environmental Policy Act and the Endangered Species Act of 1973, as amended.

B. Narrative

1. Enhance, and maintain White River spinedace population at Flag Spring

The immediate survival of White River spinedace depends on minimizing the loss of the remaining individuals and providing adequate habitat to allow the population to expand. Ideally, enhancement of the Flag Springs habitat would be guided by information collected during research efforts. Unfortunately, the extremely low numbers of White River spinedace remaining demand immediate action.

1.1. Eliminate impact of nonnative fishes at Flag Springs

Largemouth bass from downstream reservoirs have migrated into Sunnyside Creek and the Flag Springs outflow streams and are a serious threat to the survival of the few remaining White River spinedace. This nonnative species has effectively eliminated native fishes from those stream reaches it has gained access to. Steps should be taken immediately to remove all largemouth bass already in the system and to prevent ingress of additional fish.

1.1.1. Prevent migration of nonnative fish into the Flag Springs system

A permanent barrier should be constructed to prevent migration of nonnative fish into the Flag Springs system. The location of the permanent barrier should be selected based on the extent of habitat needed to support a self-sustaining population of White River spinedace. Additional habitat outside of designated critical habitat may be needed. Additional temporary barriers may be necessary to provide protection to the remaining White

River spinedace prior to completion of the permanent barrier. All temporary barriers should be removed following construction of the permanent barrier.

Once the site for a fish barrier has been selected, the structure should be designed with special attention given to maintaining the natural hydraulics of the stream course. The structure should not significantly alter the stream characteristics so that habitat values for White River spinedace are maintained and largemouth bass habitat is not inadvertently created. All barrier structures should be able to withstand flash floods.

Construction of fish barriers should be conducted so that short- and long-term impacts to the stream riparian corridor are minimized.

Two fish barriers already exist within the Flag Springs system, one in the northern spring outflow and one in Sunnyside Creek below the confluence of the three springs' outflow streams, the downstream extent of designated critical habitat. These structures, and all additional temporary or permanent barriers constructed, need to be regularly maintained to ensure that they continually function as barriers to upstream migration of largemouth bass.

1.1.2. Develop nonnative species eradication plan

Largemouth bass must be removed from the Flag Spring system to prevent the extinction of the White River spinedace. Eradication methods selected must fully consider direct and indirect effects on the entire aquatic ecosystem. Interim plans

should be developed to address immediate removal of largemouth bass above the existing temporary barriers.

1.1.3. Implement nonnative species eradication plan

Largemouth bass should be immediately removed from the stream reaches above the existing fish barriers. This will protect the remaining White River spinedace and to allow these fish to recolonize suitable habitat within all three outflow streams and a portion of Sunnyside Creek. As additional temporary barriers and the permanent barrier are constructed eradication efforts should proceed to remove largemouth bass from above each new structure.

1.2. Establish White River spinedace refugia population

To prevent the extinction of White River spinedace, it may be necessary to remove all or a portion of the remaining population to a refugia location. This activity should be undertaken only as a last resort, when all other efforts to maintain the species in Flag Springs have not improved the species status, the population is declining, and only intervention will prevent extinction.

1.2.1. Prepare emergency refugia plan

An emergency refugia plan should be developed to identify criteria to determine when White River spinedace should be removed from the wild and what percent of the population should be removed from the wild. The criteria should consider the risk of possible loss of fish translocated due to stress and disease. The plan should identify the need to select a secure refugia site and to obtain advance funding authorization for construction and maintenance of the refugia. The plan should

establish guidelines for collection, transport, care, and eventual return of White River spinedace to the wild.

1.2.2. Implement emergency refugia plan

Portions of the refugia plan should be implemented before the decision to remove White River spinedace from the wild is made. The refugia site should be selected, facilities constructed, arrangements for care of the fish made, and all necessary funding and permits obtained so that no delays will be incurred.

1.3. Optimize White River spinedace habitat at Flag Springs

Once largemouth bass, the most immediate threat to White River spinedace, are removed from the Flag Springs system, efforts should be undertaken to enhance the habitat to maximize its White River spinedace carrying capacity. Research will be necessary to determine the ecological parameters of preferred White River spinedace habitat, identify existing limiting factors at Flag Springs, and guide management activities. This information will also be necessary to guide rehabilitation activities at the other two White River spinedace critical habitats prior to reestablishment of populations, and to assess the potential impacts of future proposed actions on the species.

1.3.1. Determine White River spinedace life history and habitat requirements

Data specific to White River spinedace habitat and feeding requirements, reproductive behavior, and demographic parameters, such as reproductive rates, age structure, and population growth rates, need to be acquired. Because the Flag

Springs population is presently so limited, both in numbers and distribution, initial information may need to be postulated from other spinedace species. As recovery tasks are implemented and the Flag Springs population stabilizes, the information previously collected should be verified.

1.3.2. Determine species interactions

Caution should be exercised to avoid implementing management actions which benefit White River spinedace at the expense of any other cohabiting native species. Determination of life history and habitat requirements of White River desert sucker, White River speckled dace, and Preston White River springfish may be necessary to identify possible conflicts. Behavioral observations may be necessary to determine the influence of interspecific interactions on community structure and its implications to the reestablishment of White River spinedace populations. Removal and/or control of nonnative species, without detrimental effects to native fish populations, will be facilitated by an understanding of the life history and habitat requirements of the nonnative species, and interactions between native and nonnative species.

1.3.3. Conduct population viability analysis

A population viability analysis should be conducted to estimate the parameters of a self-sustaining White River spinedace population and the size of habitat necessary to maintain such a population. Initial emphasis should be to obtain this information to guide recovery efforts at Flag Springs, but similar information will be necessary for recovery activities at Preston Big Spring and Lund Spring.

1.3.4. Develop habitat management plan for Flag Springs

A habitat management plan should be developed for the Flag Springs system which would identify the habitat improvements necessary to improve general conditions for White River spinedace and management strategies necessary to maintain optimum habitat conditions in the long-term. The plan should be based on the most recent data available on White River spinedace, be flexible enough to be modified as new data are acquired, and consider the effects of management activities on all endemic species.

1.3.5. Implement habitat management plan for Flag Springs

Once the management plan has been developed, it should be implemented.

1.4. Monitor White River spinedace population at Flag Springs

The stability and health of White River spinedace population at Flag Springs can only be assessed by regular monitoring to determine population size, age-class structure, and distribution. Regular monitoring will also provide information on the effect of habitat improvements on the White River spinedace populations and the occurrence and abundance of coexisting native and nonnative species. Habitat quality and quantity should also be evaluated regularly. Information collected during monitoring can identify potential problems in a timely manner, guide management activities, and permit an analysis of the effectiveness of recovery programs. Ultimately, this information will be utilized to determine whether or not recovery has been accomplished.

1.4.1. Develop population monitoring plan

A population monitoring plan should be developed which identifies the information to be collected, monitoring techniques, time-frames, etc.

1.4.2. Implement population monitoring plan

Once the population monitoring plan has been developed, it should be implemented.

2. Reestablish and maintain White River spinedace populations in Preston Big Spring and Lund Spring

Recovery objectives require the maintenance of self-sustaining populations of White River spinedace within designated critical habitat. Considerable effort will be required to reestablish White River spinedace in Preston Big Spring and Lund Spring because these habitats have been severely modified.

2.1. Protect habitat at Preston Big Springs and Lund Spring

Prior to initiation of recovery activities, the cooperation of private landowners within the Preston/Lund area must be obtained. Currently these two areas are designated as critical habitat. The Preston and Lund Irrigation Companies hold the water rights to Preston Big Spring and Lund Spring, while various individuals own the property actually surrounding each spring. Conservation agreements should be negotiated with individual landowners as well as the irrigation companies to allow for habitat restoration, including maintenance of adequate stream flows; long-term habitat protection; and access for management activities. Restoration of White River spinedace habitat at Preston Big Spring and Lund Spring may require modification of irrigation water delivery

systems. Private land parcels and appurtenant water rights may also be acquired in fee title from willing sellers.

2.2. Develop habitat rehabilitation plans for Preston Big Spring and Lund Spring

Habitat rehabilitation plans should be developed for Preston Big Spring and Lund Spring. Historical and existing habitat conditions at these two springs should be determined. The plans should identify the extent and character of habitat necessary to support a self-sustaining population of White River spinedace, improvements necessary to restore it to suitable habitat, and management strategies necessary to maintain optimum habitat conditions in the long-term. The plan should be based on the most recent data available on White River spinedace, be flexible enough to be modified as new data are acquired, and consider the effects of management activities on all endemic species.

2.3. Implement habitat rehabilitation plans

Once the habitat rehabilitation plans are developed, they should be implemented.

2.4. Develop White River spinedace reintroduction plan

A reintroduction plan should be developed to ensure that reintroduction of White River spinedace is adequately planned and properly implemented. The American Fisheries Society's "Guidelines for Introductions of Threatened and Endangered Fishes" (Williams, et al. 1988) provides a summary of issues to address. The plan should identify the source of White River spinedace for reintroduction, the number of fish needed to establish a new population, as well as methods of transport and

release. If the Flag Springs population is to serve as the source of fish, the plan should identify the number of White River spinedace that can be removed from Flag Springs at any one time without adversely affecting the population. If the fish are to be produced through a captive propagation program, the Service's most recent guidelines on captive propagation of threatened and endangered fishes should be adhered to. Selection of fish to release and timing of the release should take into consideration reproduction potential and natural mortality factors. The White River spinedace selected to provide transplant stocks should be free of undesirable parasites and diseases. Mortality of transplanted fishes has been attributed to the activation of latent infections or parasite infestations due to handling and other stress-related factors. Measures should be taken to prevent spread of undesirable diseases and parasites. The reintroduction plan should include guidelines for managing the genetics of each White River spinedace population, including Flag Springs. Several releases may be necessary to establish each population. Positive evidence of population establishment may not be realized for several years.

2.5. Implement reintroduction plan

Once the reintroduction plan has been completed and the habitat has been adequately restored, reintroduction of White River spinedace should proceed.

2.6. Monitor reintroduced White River spinedace populations

The success of efforts to reestablish White River spinedace in Preston Big Spring and Lund Spring can only be evaluated by regular monitoring to determine population size, age-class structure, and distribution. Regular monitoring will also provide

information on the occurrence and abundance of coexisting native and nonnative species. Habitat quality and quantity should also be evaluated regularly. Information collected during monitoring can identify potential problems in a timely manner, guide management activities, and permit an analysis of the effectiveness of recovery programs. Ultimately, this information will be utilized to determine whether or not recovery has been accomplished.

2.6.1. Develop population monitoring plan

A population monitoring plan should be developed which identifies the information to be collected, monitoring techniques, time-frames, etc.

2.6.2. Implement population monitoring plan

Once the population monitoring plan has been developed, it should be implemented.

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Part III. IMPLEMENTATION SCHEDULE

This implementation schedule outlines recommended actions and estimated costs associated with the recovery of White River spinedace. It is a guide for meeting the objective discussed in Part II of this recovery plan. This schedule indicates task priorities, numbers, and descriptions; duration of each task; responsible agencies; and estimated costs. These actions, when accomplished, should bring about the recovery of White River spinedace and protect its habitat. Estimated monetary needs for all parties involved in recovery are identified and, therefore, this schedule reflects the total estimated financial requirements for the recovery of this species.

In the implementation schedule, tasks are arranged in priority order. The assigned priorities are defined as follows:

Priority 1 - An action that *must* be undertaken to prevent extinction or to prevent White River spinedace from declining irreversibly in the *foreseeable* future.

Priority 2 - An action that *must* be undertaken to prevent a significant decline in White River spinedace population distribution or size, or habitat quality, or some other significant negative impact short of extinction.

Priority 3 - All other actions necessary to meet the recovery objective.

The following abbreviations are used in the implementation schedule:

Task Duration

Cont. = The action will be implemented continually once begun.

Ongoing = The action is currently being implemented and will continue until no longer necessary for recovery.

Responsible Party

* = Lead Agency

FWS-ES = U.S. Fish and Wildlife Service, Division of Ecological Services, Region 1, Portland, Oregon

FWS-RES = U.S. Fish and Wildlife Service, Seattle National Fisheries Research Center, Reno, Nevada

NDOW = Nevada Department of Wildlife

Total Cost = Projected cost of task from start to finish.

TBD = To Be Determined at a later date

IMPLEMENTATION SCHEDULE FOR THE WHITE RIVER SPINEDACE RECOVERY PLAN (First 5 years)

Priority Number	Task Number	Task Description	Task Duration (Years)	Responsible Party	Total Cost	Cost Estimates ($1,000) FY 1994	FY 1995	FY 1996	FY 1997	FY 1998
1	1.1.1.	Prevent migration of nonnative fishes into the flag springs system	1	NDOW* FWS–ES	9 2	5 2	1	1	1	1
1	1.1.2.	Develop nonnative eradication plan	1	NDOW* FWS–ES	2 1	2 1				
1	1.1.3.	Implement nonnative eradication plan	TBD	NDOW*	TBD					
1	1.2.1.	Prepare emergency refugia plan	1	FWS–ES* NDOW	2 1	2 1				
1	1.2.2.	Implement emergency refugia plan	TBD	FWS–ES* NDOW	TBD TBD					
1	1.3.1.	Determine life history and habitat requirements	3	FWS–RES* NDOW	36 6	12 2	12 2	12 2		
1	1.3.2.	Determine species interactions	3	FWS–RES* NDOW	12 3	4 1	4 1	4 1		
1	1.3.3.	Conduct population viability analysis	1	FWS–RES*	5			5		
1	1.3.4.	Develop habitat management plan	1	NDOW*	2	2				

IMPLEMENTATION SCHEDULE FOR THE WHITE RIVER SPINEDACE RECOVERY PLAN (First 5 years)

Priority Number	Task Number	Task Description	Task Duration (Years)	Responsible Party	Total Cost	Cost Estimates ($1,000) FY 1994	FY 1995	FY 1996	FY 1997	FY 1998
				FWS–ES	1	1				
1	1.3.5.	Implement habitat management plan	TBD	NDOW	TBD					
1	1.4.1.	Develop population monitoring plan	1	NDOW*	2	2				
				FWS–ES	1	1				
1	1.4.2.	Implement population monitoring plan	Cont.	NDOW*	5	1	1	1	1	1
		Cost Need 1 Subtotals: (Secure, enhance, and maintain extant population at Flag Springs)			90	39	21	26	2	2
2	2.1.	Protect habitat at Preston Big Spring and Lund Spring	TBD	FWS–ES* NDOW	TBD					
2	2.2.	Develop habitat rehabilitation plans	2	FWS–ES*	6				3	3
				NDOW	2				1	1
2	2.3.	Implement habitat rehabilitation	TBD	FWS–ES*	TBD					

IMPLEMENTATION SCHEDULE FOR THE WHITE RIVER SPINEDACE RECOVERY PLAN (First 5 years)

Priority Number	Task Number	Task Description	Task Duration (Years)	Responsible Party	Total Cost	Cost Estimates ($1,000) FY 1994	FY 1995	FY 1996	FY 1997	FY 1998
		plans		NDOW						
2	2.4.	Develop reintroduction plan	1	NDOW*	6				3	3
				FWS-ES	2				1	1
2	2.5.	Implement reintroduction plan	TBD	NDOW*	TBD					
				FWS-ES						
2	2.6.1.	Develop population monitoring plan for reestablished populations	1	NDOW*	2					2
				FWS-ES	1					1
2	2.6.2.	Implement population monitoring plan	Cont.	NDOW*	0					
		Cost Need 2 Subtotals: (Reestablish and maintain populations in Preston Big and Lund Springs)			19	0	0	0	8	11
				Total Costs:	109	39	21	26	10	13

Part IV. APPENDIX

A. Review of the Technical/Agency Review Draft of the White River Spinedace Recovery Plan

The Technical/Agency Review Draft of the White River Spinedace Recovery plan was made available to the public for comment as required by the 1988 amendments to the Endangered Species Act of 1973, as amended. The public comment period was announced in the Federal Register on October 5, 1992, and closed on December 4, 1992. The Service solicited comments on the document from the individuals and/or agencies identified below. During the 60-day comment period, the Service received 11 response letters from individuals denoted with an asterisk (*) on the list below. The comments provided in these letters were considered in preparation of this final recovery plan, and incorporated as appropriate.

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