

Status and Distribution
of Selected Populations of
Relict Dace (*Relictus solitarius*)
in White Pine County

A Supplemental Document Prepared by:

Richard L. Haskins II

Nevada Department of Conservation and Natural Resources
Division of Wildlife
1375 Mountain City Highway
Elko, NV 89801

1995

STATUS AND DISTRIBUTION OF RELICT DACE
(*Relictus solitarius*)
NEVADA DIVISION OF WILDLIFE
1995

INTRODUCTION

In 1994 the Division of Wildlife conducted an intensive survey to determine the status and distribution of the relict dace within its historic range. Several historical population sites in Steptoe Valley and Spring Valley were not surveyed, two sites could not be located and access was denied to others. Survey activities in 1995 attempted to evaluate these sites as well as other potential sites in Steptoe Valley.

METHODS

Methodologies similar to those used in 1994 were used. The only notable difference is that minnow traps were baited with common dry dog food. The slides and survey forms are on file at the Nevada Division of Wildlife, Ely Field Office.

RESULTS

The existence of two historical relict dace populations was confirmed. The Cordano Ranch site in Steptoe Valley has a healthy population estimated at 3,000 to 5,000 fish and the Keegan Ranch population in Spring Valley was documented as present. In Steptoe Valley six additional spring sites and Duck Creek from Bassett Lake to Cherry Creek were surveyed, with no relict dace found. Access was once again denied to Stonehouse Spring and Spring Creek in Spring Valley, although the presence of relict dace was confirmed.

STEPTOE VALLEY

CORDANO RANCH - T25N R64E S5

Located in north Steptoe Valley on the west side, 12 miles north of the town of Cherry Creek, this ranch is privately owned by Ralph Vance of Wells. Previous NDOW investigators in 1991 and 1994 failed to locate relict dace at this site.

Springs located behind the old ranch house (NE¼ NE¼ sec 5) were visually examined, electroshocked and trapped overnight. No fish were seen or contacted. Habitat in the main spring pond and outflow appeared to be suitable for relict dace.

Relict dace were found in springs marked by a large tree, located approximately 400 yards southeast of the old ranch house (NE¼ SE¼ sec 5). This site consists of five springs which have been tied together and flow into an irrigation system for a native hay meadow. Combined flow of these springs was estimated at 1 cfs with a temperature of 17.1°C. The system is heavily vegetated with *Carex sp.*, *Nasturtium sp.*, *Hippurus sp.*, and heavy mats of filamentous algae.

Fish were visible in the outflow and the spring area. Two traps were set overnight in the spring area, and 45 relict dace were captured. These fish averaged 78mm in total length with a range of 43mm to 100mm. The outflow area was spot shocked and fish observed for some 200 yards, with hundreds of YOY relict dace noted. A 16 fish sample of the relict dace contacted from the outflow averaged 52mm with a range of 22mm to 77mm total length. It was estimated that this system contained several thousand fish, probably in the range of three to five thousand. The number of fish probably fluctuates greatly as the population expands into the outflow area when conditions permit.

Use of this site for livestock and irrigation water has probably gone unchanged for many decades. It was noted that livestock use in the area is probably high at times. The security of this population should be considered high.

UNNAMED SPRINGS - T26N 64E NE¼ S33

These springs are located approximately 1 mile north of the Cordano Ranch and east of the main county road. No fish were noted and a rating of no potential was given for this site.

UNNAMED SPRING - T24N R63E SE¼ SW¼ S1

This spring is located approximately 5 miles north of the Cherry Creek road and 1 mile east of the county road on the west side of Steptoe Valley. There appeared to have been a mill of some sort at this site as foundations and remnants of an old steam engine were evident. No fish were found and a rating of no potential was given for this site.

UNNAMED SPRINGS - T21N R63E SW¼

These springs are located on the west side of Steptoe Valley, approximately 9 miles south of the town of Cherry Creek, and a few hundred yards east of the county road (below Borchert Spring). This site had three springs of significance. Two of these springs appeared to have sufficient flow to support fish, although their potential to support fish was rated as limited. However, no fish were found.

UNNAMED SPRING - T22N R63E NW¼ S36

This spring is located on the west side of Steptoe Valley, approximately 4 miles north of Monte Neva Hot Springs and 0.5 miles east of the county road. No fish were found and it was noted as a "nice spring" with no potential.

COLD SPRING - T21N R63E SE¼ S12

This spring is located on the west side of Steptoe Valley, approximately 1.5 miles north of Monte Neva Hot Springs and 0.75 miles east of the county road. It was noted as a "good spring", with no fish potential. It did support a substantial wet meadow, with a sage grouse brood and mule deer observed.

MONTE NEVA HOT SPRINGS - T21N R63E SW¼ S24

These springs are located on the west side of Steptoe Valley, approximately 15 miles north of Ely. The springs originate on lands owned by a Mr. Bell. Mr. Bell indicated that the water is too hot to support fish near the source as water temperatures are lethal to humans. He indicated that there is a manmade pond on lands owned by a Mr. Assuras of McGill, but there were no fish there to his knowledge. Field surveys of the area found that no water reaches Duck Creek in the bottom of the valley. Recent references to Monte Neva Hot Springs as having a population of relict dace appear to stem from historical references to collections made by J. E. Deacon in 1962 from the slough at Warm Springs. This site is located approximately 1.0 miles away along Duck Creek in the bottom of the valley.

DUCK CREEK AT WARM SPRINGS - T21N R63E S35

That portion of Duck Creek north of the county road crossing and southeast of Monte Neva Hotsprings was intensively surveyed (T21N R63E sections 13, 24, 25 and T21N R64E sections 7, 18, 19, 30). Contact was made with local rancher Joel Twitchell and local resident Mr. Bell, who delineated areas of Duck Creek with permanent water which might hold fish. One section of Duck Creek on the Twitchell property had good water over a distance of several hundred yards with depths of 2-6 feet. Shorter sections of good water were found closer to Warm Springs. These areas recede during drier years. The only fish found were northern pike and common carp. Historical references to relict dace predate the introduction of northern pike into Bassett Lake in 1966. During good water years it may be possible to find relict dace here which wash down from populations located upstream.

DUCK CREEK AT THE OLD SLAUGHTER HOUSE - T20N R64E S7

This site takes its name from the remnants of an old livestock slaughter house. The area one mile north of this site was examined and no water was found. The area south of this site was surveyed for a distance of 2.5 miles. Pockets of water were found beginning 1.0 mile south. Hundreds of small carp were found in areas with suitable water. No other fish were found.

DUCK CREEK EAST OF STEPTOE RANCH - T20N R63E SEC 26, 34, 35

Approximately 3 miles of stream were surveyed, with shallower areas electroshocked and deeper areas trapped. The only fish captured or seen were carp. The channel was noted as 3-6 feet wide and 1-2 feet deep in some areas and 5-6 feet wide and 3-5 feet deep in others. Flows were low and turbid. Livestock use and damage to the channel were noted as high in the area below Steptoe Ranch alfalfa fields.

DUCK CREEK NORTHEAST OF LUSETTI RANCH - T19N R63E SEC 27, 28, 22

Numerous side channels in addition to the main channel were electroshocked. The area sampled was northeast of Lusetti Ranch alfalfa fields. No fish were contacted although suitable habitat was found.

DUCK CREEK BELOW BASSETT LAKE - T19N R63E SEC 27, 35

The main channel immediately below Bassett Lake was sampled. Traps were set at 0.4, 0.6 and 1.1 mile intervals. No fish were captured, however, this area is known to contain northern pike and common carp. Flow in the main channel was noted as good. Some habitat was available in side channels at the 0.6 mile station.

BASSETT LAKE SLOUGH - T18N R63E SEC 12, 2

This area lies between Bassett Lake and Tailings Creek. Three areas were sampled: one 100 yards below the old Kennecott pumphouse, approximately 1.0 miles below the pumphouse, and immediately above Bassett Lake. No fish were trapped. This area was surveyed in 1994 with a Coffelt generator electroshocking system. Common carp, northern pike, brown trout and rainbow trout were found at similar sites. Two relict dace were found in the area immediately below the water control structure at the pumphouse. These fish probably washed downstream from the relict dace population found east of railroad tracks and Tailings Creek in the McGill swimming pool/Dairy Ranch complex. It is doubtful they could persist here in the presence of northern pike and brown trout.

TAILINGS CREEK - T18N R63E SEC 12, and T18N R64E SEC 18, 19

This is a manmade ditch which collects water from springs south of the McGill tailings and from the east side of the Bassett Lake slough. This water was captured at the pumphouse for Kennecott's McGill operation when needed or allowed to flow into the slough and on to Bassett Lake. No fish were captured in trap sets. It was surveyed in 1993 with a Coffelt electroshocking system and found to contain brook trout, rainbow trout, common carp, northern pike and brown trout. No relict dace were found.

SPRING VALLEY

KEEGAN RANCH - T18N R66E SW¼ S1 AND NW¼ S12

Located in north Spring Valley on the west side of the valley, 28 miles north of Hwy 50 on SR 893, this site consists of a large wet meadow with three springs, a pond and associated outflows. According to the landowner, Reed Robinson, there once was a large pond at the site which he stocked with trout. The dike which formed this pond is still evident. Previous NDOW investigators in 1991 and 1994 failed to locate relict dace at this site.

A visual examination of the area revealed extensive habitat, but no fish. A total of four traps were set at various locations around the site. One relict dace, 71mm in length (TL), was captured in a trap set in the outflow of the north spring where it flows through a breach in the old dike. Water flow at this point was estimated at 0.5 cfs with a temperature of 12.1°C. The system was heavily vegetated with *Carex sp.*, *Nasturtium sp.*, *Typha sp.*, and *Scirpus sp.*

There are undoubtedly more fish in the system than were found with the effort expended. Available habitat appears to be stable at this time. The site is used for livestock grazing which appears to be have been minimal in recent years.

STONE HOUSE AND SPRING CREEK - NORTH SPRING VALLEY

Contact was made with Hank Vogler, the lessee of the private property associated with these springs. Access was denied based on a perceived concern with such activities by the owner of the

property. Mr. Vogler acknowledged that fish were still present in these springs and that management of these sites had not changed. Security of these sites should be considered high.

RECOMMENDATIONS

Monitor known populations on a scheduled basis.

Continue efforts to survey Stonehouse Spring and Spring Creek populations in north Spring Valley.

1994-95 Status and Distribution of Relict Dace (*Relictus solitarius*)
 (Developed from Stein & Salisbury 1994 and Haskins 1995)

Valley	Site	Location¹	Population Estimate²	Security³	Notes
Ruby Valley	Narcisse 246	T25N R57E sec 2 lot 2	1,883	1	mark-recapture estimate excluding YOY; isolated; good habitat condition
	Narcisse 226	T25N R57E nw¼sw¼ sec2	1,584	2	mark-recapture estimate excluding YOY; potential access to speckled dace; good habitat condition
	Narcisse 220 outflow terminus	T25N R57E sec 2 lot 2	<100	4	limited habitat; direct access to speckled dace; good habitat condition
	Ramiriz 244	T26N R57E sec 34	300 to 500	3	excluding YOY; potential access to speckled dace; good habitat condition
	Cow Camp 236	T27N R58E sec 32	200 to 300	3	recent introduction; isolated; limited habitat
Butte Valley	Atwood Ranch #1	T29N R62E	abundant	2	private ownership; good habitat condition; outflow 1.0 cfs
	Atwood Ranch #2	T29N R62E	abundant	3	private ownership; good habitat condition; limited outflow <0.1cfs
	Atwood Ranch #3	T29N R62E	scarce	4	private ownership; shallow; limited outflow <0.1cfs
	Odgers Creek	T27N R62E	30,888	1	public ownership; improving habitat condition; 7.5 miles of available habitat
	Quilicy Spring	T28N R61E sec 2	abundant	3	public ownership; extremely poor habitat condition; no evidence of reproduction for two years
	Spr. NE of Odgers	T28N R62E sec 16	abundant	3	limited habitat; flow <0.5 cfs; poor habitat condition
Spring Valley	Shoshone Ponds	T13N R65E	1,500	1	Public owned refugium; excellent habitat condition
	Keegan Ranch ⁴	T18N R66E SW¼ sec1 NW¼ sec 12	scarce	4	Few fish encountered; several spring sources; heavily vegetated; stable; livestock grazing; private
	Stone House and Spring Creek ⁴	North Spring Valley	present	2	not surveyed but reported by landowner to be present and secure

Valley	Site	Location ¹	Population Estimate ²	Security ³	Notes
Steptoe Valley	Lusetti Ranch #1 Grass Springs	T19N R63E sec 17	2,500	2	private ownership; stable conditions; 0.75 miles of occupied habitat
	Lusetti Ranch #2	T19N R63E sec 17	300	3	private ownership; pond and ditch; stable habitats
	Steptoe Ranch #1	T19N R63E sec 5	1,000	2	private ownership; very good habitat condition
	Steptoe Ranch #2	T19N R63E sec 5	500	3	private ownership; limited habitat; fair condition
	Georgetown Ranch	T16N R63E	scarce	4	public land; low population; poor water quality
	Dairy Springs	T18N R64E sec 20	10,000	2	private ownership; excellent habitat condition; competing and predatory species
	Cordano Ranch ⁴	T25N R64E sec 5	5,000	2	extensive spring, ditch and pond system; good flow; private ownership
Goshute Valley	Johnson Ranch #1	T26N R66E sec 29	25	4	private ownership; small, isolate population; good habitat condition
	Johnson Ranch #2	T26N R66E sec 29	200	2	private ownership; excellent habitat condition; good reproduction evident
	Johnson Ranch #3	T26N R66E sec 29	100	2	private ownership; excellent habitat condition; enclosure; reproduction evident
	Johnson Ranch #4	T26N R66E sec 29	100	2	private ownership; excellent habitat condition; enclosure
	Johnson Ranch #5	T 26N R66E sec 29	2000	2	private ownership; extensive habitat, springhead, 1 mile of ditch and pond
	Twin Springs	T29N R63E sec 22	abundant	2	private ownership; enclosure; spring diverted for irrigation; excellent reproduction evident

¹ Location - See report for detailed description of location.

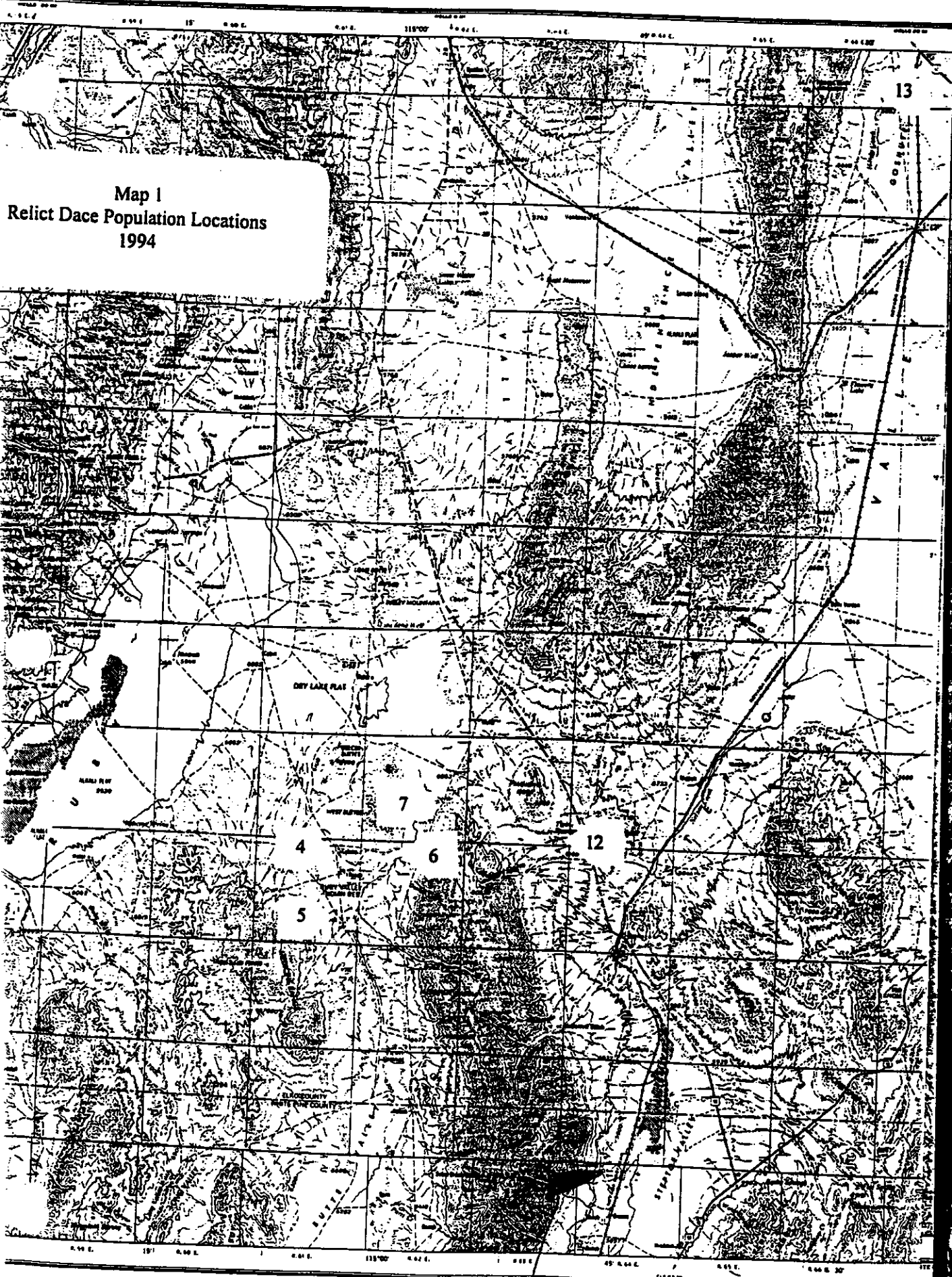
² Population Estimate - Numbers provided if an estimate was made or computed, else subjectively evaluated as abundant, moderate or scarce.

³ Security - A subjective assessment based upon population size, land ownership, habitat extent and condition, and potential threats. Value is from 1 to 5 where 1 is most secure and 5 is least secure.

⁴ Documented in 1995 by Rich Haskins, see associated report, all others documented by Stein & Salisbury, 1994.

ELKO

Map 1
Relict Dace Population Locations
1994

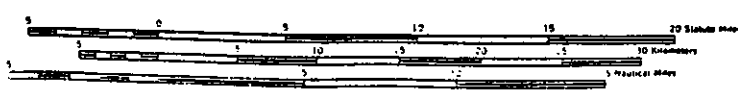


LORDANO RANCH

Map 2
Relict Dace Population Locations
1994

- 11
- 10
- 9
- 8

14



CONTOUR INTERVAL 200 FEET
 1:250,000 SCALE, 1:500,000 SCALE, 1:1,000,000 SCALE

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	Narcisse 226	T25N R57E nw¼sw¼ sec2	1,584	2	
	Narcisse 220 outflow terminus	T25N R57E sec 2 lot 2	<100	4	
	Ramiriz 244	T26N R57E sec 34	300 to 500	3	
	Cow Camp 236	T27N R58E sec 32	200 to 300	3	
Butte Valley	Atwood Ranch #1	T29N R62E	abundant	2	private ownership; good habitat condition; outflow 1.0 cfs private ownership; good habitat condition; limited outflow <0.1cfs private ownership; shallow; limited outflow <0.1cfs public ownership; improving habitat condition; 7.5 miles of available habitat public ownership; extremely poor habitat condition; no evidence of reproduction for two years limited habitat; flow <0.5 cfs; poor habitat condition
	Atwood Ranch #2	T29N R62E	abundant	3	
	Atwood Ranch #3	T29N R62E	scarce	4	
	Odgers Creek	T27N R62E	30,888	1	
	Quilicy Spring	T28N R61E sec 2	abundant	3	
	Spr. NE of Odgers	T28N R62E sec 16	abundant	3	
Spring Valley	Shoshone Ponds	T13N R65E	1,500	1	Public owned refugium; excellent habitat condition Few fish encountered; several spring sources; heavily vegetated; stable; livestock grazing; private not surveyed but reported by landowner to be present and secure
	Keegan Ranch ⁴	T18N R66E SW¼ sec1 NW¼ sec 12	scarce	4	
	Stone House and Spring Creek ⁴	North Spring Valley	present	2	

Valley	Site	Location ¹	Population Estimate ²	Security ³	Notes
Step toe Valley	Lusetti Ranch #1 Grass Springs	T19N R63E sec 17	2,500	2	private ownership; stable conditions; 0.75 miles of occupied habitat
	Lusetti Ranch #2	T19N R63E sec 17	300	3	private ownership; pond and ditch; stable habitats
	Step toe Ranch #1	T19N R63E sec 5	1,000	2	private ownership; very good habitat condition
	Step toe Ranch #2	T19N R63E sec 5	500	3	private ownership; limited habitat; fair condition
	Georgetown Ranch	T16N R63E	scarce	4	public land; low population; poor water quality
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	Cordano Ranch ⁴	T25N R64E sec 5	5,000	2	extensive spring, ditch and pond system; good flow; private ownership
Goshute Valley	Johnson Ranch #1	T26N R66E sec 29	25	4	private ownership; small, isolate population; good habitat condition
	Johnson Ranch #2	T26N R66E sec 29	200	2	private ownership; excellent habitat condition; good reproduction evident
	Johnson Ranch #3	T26N R66E sec 29	100	2	private ownership; excellent habitat condition; exclosure; reproduction evident
	Johnson Ranch #4	T26N R66E sec 29	100	2	private ownership; excellent habitat condition; exclosure
	Johnson Ranch #5	T 26N R66E sec 29	2000	2	private ownership; extensive habitat, springhead, 1 mile of ditch and pond
	Twin Springs	T29N R63E sec 22	abundant	2	private ownership; exclosure; spring diverted for irrigation; excellent reproduction evident

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⁴ Documented in 1995 by Rich Haskins, see associated report, all others documented by Stein & Salisbury, 1994.

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Prepared by:

Jerry R. Stein
Jason Salisbury

Nevada Department of Conservation and Natural Resources
Division of Wildlife
1375 Mountain City Highway
Elko, NV 89801

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TABLE OF CONTENTS

	page
Abstract	5
Introduction	5
Study Area and Historic Documentation	6
Methods	13
Results	15
Discussion and Recommendations	30
Conclusion	33
References	34
Maps	Appendix 1
Summary Table of 1994 Distribution	Appendix 2

LIST OF TABLES

	page
Table 1 Ruby Valley Historic Relict Dace Locations	8
Table 2 Butte Valley Historic Relict Dace Locations	9
Table 3 Steptoe Valley Historic Relict Dace Locations	11
Table 4 Goshute Valley Historic Relict Dace Locations	12
Table 5 Spring Valley Historic Relict Dace Locations	12
Table 6 Substrate Size Classes	14
Table 7 Ruby Lake NWR Survey Location and Results	16
Table 8 Remainder of Ruby Valley Survey Locations and Results	18
Table 9 Ruby Valley Relict Dace Lengths	20
Table 10 Butte Valley Survey Location and Results	20
Table 11 Butte Valley Relict Dace Lengths	22
Table 12 Steptoe Valley Survey Locations and Results	24

List of Tables
(continued)

	page
Table 13	
Steptoe Valley Relict Dace Lengths	25
Table 14	
Goshute Valley Survey Location and Results	26
Table 15	
Goshute Valley Relict Dace Lengths	27
Table 16	
Summary of Water Characteristics	28
Table 17	
Locations and Classification of Introduction Sites . .	29

Abstract - Twenty-four individual populations of relict dace were identified and sampled during the summer of 1994. These populations are located in Ruby, Butte, Steptoe, Goshute, and Spring Valleys, Elko and White Pine Counties, Nevada, and ranged in estimated size from 50 to 30,000 fish. No relict dace were documented in the Franklin River and Lake system or pluvial Lake Gale. Relict dace average fork length and maximum length were recorded at 56 mm and 109 mm respectively in Ruby Valley; 59 mm and 111 mm in Butte Valley; 48 mm and 96 mm in Steptoe Valley; and 44 mm and 70 mm in Goshute Valley. Relict dace were most prevalent in warm water that averaged 18°C. Other physical indices of preferred habitat were an average alkalinity of 12 grains/gallon as calcium carbonate, 7 mg/liter of dissolved oxygen, and a pH of 8.0. Fourteen waters were found to be suitable for introduction or reintroduction of relict dace presently, while another eleven could be introduction sites with minor habitat modifications and/or competitive fishes eradication.

INTRODUCTION

In 1948 the relict dace was characterized by Hubbs and Miller as "a dace species worthy of separation from *Rhinichthys*". Hubbs and Miller in 1972 then described the relict dace as *Relictus solitarius*, the sole member of the genus (Hubbs et al. 1974). Specific meristic characteristics include a terminal mouth, extended caudal peduncle, lack of distinctive horizontal barring, purple to violet iridescent hue through the midline, and midwater swimmer morphology. Currently the relict dace is thought to be a closer relative to *Gila bicolor ssp.* than *Rhinichthys* (Personal communication with Phil Harris, 1994). A meristic key to the species is found in Hubbs, Miller, and Hubbs, Relict Fishes of the Great Basin.

Distribution of the cyprinid is limited to isolated spring systems on both private and public land. Historic habitat consists of four intermountain valleys in northeastern Nevada. A fifth adjacent valley presently supports introduced populations. Respectively these are Ruby, Butte, Steptoe, Goshute, and Spring

Valleys. The four endemic valleys make up a contiguous closed basin system of pluvial lakes: Steptoe, Gale, Waring, and Franklin (Hubbs et al, 1974). The relict dace is the lone endemic fish in this basin.

Behavioral characteristics and life history of the relict dace are still shrouded to a large extent. They are capable of explosive reproductive rates evidenced by high densities in a full Franklin Lake only two years after the lake was completely dry (Personal comm. with Mike Green, 1994). The dace appear to be a vegetative broadcast spawner such as *Rhinichthys* (Personal comm. with Jim Heinrich 1994). Carmichael (1982) found relict dace from Ruby Lake to be highly omnivorous with coenagrionid damselfly nymphs, chironomid subadults, baetid mayfly nymphs and cladocerans as the primary prey.

Concerns over degradation of habitat, exotic introductions, and localized extirpations have caused the relict dace to be considered for listing under the protection of the Endangered Species Act of 1973 as amended. Relict dace are currently a Category 2 taxa, status which indicates that proposing to list is possibly appropriate but for which conclusive data on biological vulnerability and threat currently are not available to support a proposal to list (Federal Register, 1990). The purpose of this project, therefore, is to determine current distribution and abundance, and to make recommendations for future management of relict dace in northeastern Nevada.

STUDY AREA AND HISTORIC DOCUMENTATION

As water receded in the pluvial lakes, relict dace retreated into spring systems throughout the interbasin area. In drought conditions dace are limited to spring heads and the immediate outflows, but in high water years the dace populations explosively reproduce and utilize ancient lake beds which fill with water. Currently this area is in an extended drought cycle and the dace populations are sequestered into spring habitat.

Ruby Valley (pluvial Lake Franklin) - Ruby Valley is located between the Ruby Mountains to the west and the Maverick Springs and Medicine Range to the east. The northern and southern borders of the valley are the East Humboldt Range and the Bald Mountains, respectively. Ruby Valley is divided into the Ruby Lake drainage system in the southern end of the valley and the Franklin River and Lake system in the northern two-thirds of the valley.

Table 1 is a listing of Ruby Valley historic relict dace habitats and abundance as mentioned in literature. Most of the spring systems of Ruby Lake are located on a federal waterfowl refuge (Ruby Lake National Wildlife Refuge) and a proposed land exchange would place the rest of the spring systems under federal control (Personal comm. with Jeff McKay, 1994). The Franklin River system springs are exclusively on private land. These springs, along with mountain runoff, supply Franklin River, which in turn fills Franklin Lake. Franklin River meanders through BLM and private land while the lake is under State and BLM ownership with a small amount of private land on the western shoreline.

Largemouth bass were introduced into Ruby Lake in 1932 or 1933 and there were "no native fish that would serve as a satisfactory forage fish" (Aldous 1962), although Hubbs and Miller found relict dace to be abundant throughout the marsh in 1934. In 1947 Trelease (1948) also was not able to document any native fishes. In 1950 speckled dace and red side shiners from T Creek (MRDS) were introduced into the lake through a cooperative effort between the Nevada Fish and Game Commission and the Ruby Lake National Wildlife Refuge (Lynn 1950). In 1962 threadfin shad from Lake Mead were introduced into the system (King 1962). Only the largemouth bass and speckled dace introductions were successful.

TABLE 1 - Ruby Valley historic relict dace locations, documentation, and relative abundance (if any). "Present" refers to a population of relict dace but no abundances given.

Location/Legal Description	Hubbs & Miller ¹	Lewis ¹	Hardy ²	Vigg ³	Heinrich ⁴	Miscellaneous Documentation
Gravel Pit Pond T26N, R57E, S12	Abundant *	1967 Present				
Pothole Spring T27N, R58E, S19	1934 Abundant*				1991 Not Found	
Diving Bd Pond T27N, R58E, S18,19	Abundant*	1967 Present			1984 Yes 1991 None	1981 Carmichael ⁵ 1983 NDOW ⁴
Cave Cr. Slough T27N, R58E	1934 Abundant*		1979 Present		1991 Not Found	
Shantytown Slough T26N, R57E, S1	Abundant*	1967 Present				
Cow Camp Spring T27N, R58E, S31 SE1/4	Abundant*				1991 Not Found	1983 NDOW ⁴ <i>R. osculus</i>
Ramiriz Springs T26N, R57E, S34	Abundant*				1991 Not Found	1980 Refuge ⁴ 1981 Carmichael ⁵
Narcise Springs T25N, R57E, S2	Abundant*		1979 Present	1980 Present	1991,1993 Present	1981 Carmichael ⁵
North East Spr T27N, R58E,	Abundant*	1965 Present		1980 Present	1993 Present	1980 NDOW ⁴
Minnie Spring T27N, R58E, S10	Abundant*				1991 Not Found	
Dace Bay T25N, R57E, S1	Abundant*			1980 Present	1991 Dry	1981 Carmichael ⁵
Franklin River T29N, R58E			1979 Present	1980 Present	1993 Present	1980 Masinton ⁶ Present
Woodward Creek T25N, R57E, S12	Abundant*	1967 Present			1991 Sp Dace	

1. Hubbs et al. 1974 2. Hardy 1980 3. Vigg 1982 4. Heinrich 1991
5. Carmichael et al 1982 6. Masinton 1991

* In 1934 Hubbs & Miller found relict dace to be abundant throughout Ruby Lake and associated springs. At Cave Creek Slough and Pothole Spring collections were taken.

Butte Valley (pluvial Lake Franklin/Lake Gale) - A small rise to the north of the Medicine Range is the lowest point separating Ruby and Butte Valleys. Butte Valley is bordered on the west by the West Buttes, the Medicine Range, and the Butte Mountains. The Cherry Creek Mountains and the Egan Range comprise the eastern border. To the north, Valley Mountain separates Butte Valley from Clover Valley. The southern border is where the Egan Range and the Butte Mountains coalesce. The southern two-thirds of the valley is very arid and has no suitable dace habitat.

TABLE 2 - Butte Valley historic relict dace locations, documentation, and relative abundance (if any). "Present" refers to a population of relict dace but no abundances given.

Location/Legal Description	Hubbs & Miller ¹	Hardy ²	Masinton ³	Vigg ⁴	Heinrich ⁵	Miscellaneous Documentation
Atwood Ranch T29N, R62E	1938, 42 Present	1979 Fair Numbers		1980 Present		1962 Deacon ¹
Quilicy/Delker Spring T28N, R61E, S2	1934 Present	1979 Fair Numbers	1980 Present	1980 Present	1991-92 Abundant	
Odggers Creek T27-28N, R61E S62	1942 Present	1979 Fair Numbers	1980 Present	1980 Not Found	1991-92 Abundant	
Stratton/Paris Ranch T26N, R62E, S16	1942 Abundant	1979 Not Found				1962 Deacon ¹
Wright Spring T26N, R62E	1942 Present	1979 Not Found				
Owens Ranch Springs T26N, R62E	1942 Common					

1. Hubbs et al 1974 2. Hardy 1979 3. Masinton 1991 4. Vigg 1983
5. Heinrich 1991,1992

Table 2 is an historical listing of Butte Valley relict dace sites. The Stratton Ranch, Wright Springs, and Owens Springs are located in the pluvial Lake Gale drainage. Pluvial Lake Franklin extends into the north section of Butte Valley and is separated from Lake Gale drainage by a small rise just north of the White Pine/Elko County line. Springs in north Butte Valley are found on both private and public lands, while springs and outflows in Lake Gale are found only on private lands.

Steptoe Valley (pluvial Lake Steptoe) - The Cherry Creek Mountains and the Egan Range are the western edge, and the Schell Creek Mountains comprise the eastern border of Steptoe Valley. The southern border is where the Schell Creek Mountains meet the Egan Range. The northern border of Steptoe Valley is around the Currie Hills but is somewhat nondescript since Steptoe Valley is continuous with Goshute Valley. Steptoe Valley is the longest contiguous valley found in Nevada.

Similar to the Franklin Lake system, spring heads are exclusively on private land and in high water years fill the bed of ancient Lake Steptoe (Duck Creek Slough). In Ely springs are on city property, and in McGill springs are found on the Kennecott Mining Company properties.

TABLE 3 - Steptoe Valley historic relict dace locations, documentation and relative abundance (if any). "Present" refers to a population of relict dace but no abundance given.

Location/Legal Description	Hubbs & Miller ¹	Hardy ²	Vigg ³	Heinrich ⁴	Miscellaneous Documentation
Steptoe Ranch T19N, R63E, S5	1938 Present	1979 Present	1980 Present		Deacon 1962 ¹
Lusetti Ranch T19N, R63E, S20		1979 Present	1980 Rare	1991 Not Found	Deacon 1962 ¹ McLelland 1977 ⁵
Georgetown Ranch T16N, R63E, S2	1938 Present			1992 Present	
Dairy Ranch Springs T18N, R64E, S20	1938 Present	1979 Rare		1991 None 1992 Yes	
Ruth Pond T16N, R62E		1979 Present			Lockard 1965 ¹
3C Rch./Steptoe Cr. T15N, R64E	1938, 1969 Abundant			1992 Chubs	Behnke/Dodge ¹ 1972, Abundant
Cardano Ranch T25N, R64E, S5	1938 Present	1979 Present	1980 Present	1991 Not Found	
Monte Neva Hot Spr. T21N, R63E, S25					Deacon 1962 ¹

1. Hubbs et al 1974

2. Hardy 1979

3. Vigg 1983

4. Heinrich 1992

5. McLelland et al. 1977

Goshute Valley (pluvial Lake Waring) - Contiguous with Steptoe Valley to the south, Goshute Valley is bordered on the west by the Pequop Mountains and Spruce Mountain. The eastern border of Goshute Valley is the Goshute Mountains and the Toana Range. The southern border is the vague juncture with Steptoe Valley at the Currie Hills. Murdock Mountain which marks the northern boundary of the valley also marks the northern range of relict dace habitat.

Springs in Goshute Valley which have historically contained dace are entirely on private lands. Most spring outflows are used for agricultural and livestock purposes. Table 4 lists historical documentation of relict dace in Goshute Valley.

TABLE 4 - Goshute Valley historic relict dace locations, documentation and relative abundance (if any). "Present" refers to a population of relict dace but no abundance given.

Location/Legal Description	Hubbs & Miller ¹	Hardy ²	Vigg ³	Heinrich ⁴	Miscellaneous Documentation
Johnson Ranch T36N, R66E, S29	1942 Abundant	1979 No Access			
Twin Springs T29N, R63E	1938 Present	1979 Present	1980 Present	1992 Abundant	
Currie Pond T27-28N, R64E	1938 Present			1992 No Water	

1. Hubbs et al. 1974 2. Hardy 1979 3. Vigg 1983 4. Heinrich 1992

Spring Valley (pluvial Lake Spring) - Spring Valley is the lone valley with introduced relict dace and lies to the east of the Schell Creek Mountains and the Fortification Range. The eastern border of the valley is the Snake Range and Antelope Range. Spring Valley is contained to the north by the joining of the Schell Creek and the Antelope Mountains and to the south by the Wilson Creek Mountains.

TABLE 5 - Spring Valley historic relict dace locations, documentation, and relative abundance (if any). "Present" refers to a population of relict dace but has no abundance given.

Location/Legal Description	Hubbs & Miller ¹	Hardy ²	Heinrich ³	Miscellaneous Documentation
Spring Valley Cr. T23N, R66E, S31		1979 Present	1992 Present	Deacon 1964 ¹
Stone House Springs T22N, R66E, S17	1938, 1959 Present	1979 Present	1992 Abundant	
Keegan Ranch T18N, R66E, S12	1959 Present	1979 Present	1992, Not locatable	
Shoshone Ponds T13N, R65E		1979 Present		1977 NDOW/BLM/UNLV Introduction ⁴

1. Hubbs et al. 1974 2. Hardy 1979 3. Heinrich 1992 4. McLelland 1977

METHODS

Documented sites, springs, and other bodies of water throughout the historic range were visited to verify the presence or absence of relict dace populations and suitable habitat. Seventy-seven sites were inventoried for existing populations of relict dace or possible introduction sites. Access to survey sites on private land was accomplished by personally obtaining permission from the local owner/manager at the location.

The inventory procedures took several steps. Site legal description (township, range, section, county, elevation) was identified using USGS 7.5 minute, 15 minute, and 1:100,000 maps. The water location was also noted by name (if known) and surrounding terrain/features to determine a precise location for future resurvey efforts. A physical description of the site was recorded with emphasis placed on the size and unique characteristics of the water.

Pictures of the site were taken with 35mm slides. If the site was a spring, the picture was taken from above (and including) the head toward the direction of the outflow. On streams, upstream and/or downstream pictures were taken at the survey station. In addition to site pictures, individual pictures of dace, habitat, and other points of interest were taken. Slides were labeled by the following: DS (dace survey) - 94 (year) - 00 (roll number) - 00 (picture number), and then a brief written description of the slide. Example: DS-94-02-23, spring & outflow. The slides and survey forms can be found in the files of the Region II Nevada Division of Wildlife, 1375 Mountain City Highway, Elko Nevada.

Fish populations at each site were inventoried using electroshocking, dipnetting, and trapping. These methods were used singly or in aggregate depending upon the habitat type and time available. The electroshocker used was a Dirigo model 750 backpack shocker using direct current set at a frequency of 100 cycles and voltage of 80 volts. Dipnets used had an opening of 10" X 18", 1/4" nylon mesh, and 4' wooden handle. Traps used were unbaited standard 6" X 18" minnow traps with 1/4" screen and a 1" funnel opening at both ends. The population estimating technique of mark-recapture was used only on key populations. Relict dace populations which were not estimated by mark-recapture were visually estimated. The methods used to estimate populations were recorded along with the species found.

Relict dace were identified by their distinct meristic features mentioned in the introduction. The important differences between the relict and speckled dace are the position of mouth and distinctive coloration. Relict dace have a terminal mouth, and speckled dace have a semisubterminal mouth. Relict dace appear to be "blotchy" with no distinctive horizontal banding, while speckled dace have distinct melanistic horizontal bands running the entire length of the fish (Eddy et al 1989). All dace in Ruby Valley with speckled dace characteristics were called *Rhinichthys*, even if they may have been hybrids.

Macroinvertebrates were qualitatively sampled by dipnetting and looking in vegetative material and in/under substrate. The following abundance ratings were subjectively used to describe invertebrate numbers: abundant, common, occasional, and rare. The same rating system is used to quantify plant species of aquatic, riparian, and upland vegetation communities.

Bottom types were classified as percentages and are described in Table 6 (Helm et al. 1985). Turbidity was described as clear, cloudy, murky, or muddy. Bank stability was described and an estimate was made of percent stable bank materials. Forage utilization on the riparian area was also estimated and recorded as a percentage of use: 0-5%, 6-20%, 21-40%, 41-60%, 61-80%, 81-100% (adapted from USFS literature 1989).

Air (shaded) and water temperatures were taken and recorded with the time. A location was given for water temperatures if more than one was taken, eg. spring head and outflow. If feasible the flows were measured by the transect-float method and translated into cubic feet per second (cfs).

TABLE 6 - Substrate size classes

Bottom Type	Substrate Size (mm)	Substrate Size (in)
Organic	Detritus	
Silt	0.004- 0.062	
Sand	0.062- 2.000	
Gravel	2.000- 64.000	0.08-2.50
Rubble	64.000- 256.000	2.50- 10.00
Boulder	256.000+	10.00+
Bedrock	Continuous Hardrock	
Other	Miscellaneous	

Water chemistry was analyzed at the inventory sites through the use of a HACH kit (model AL-36B). Alkalinity (as calcium carbonate in grains/gallon), pH, dissolved oxygen (milligrams/liter), and carbon dioxide (milligrams/liter) were recorded.

Complete notes were taken at each site regarding a variety of subjects including water usage, land use and ownership, management perspectives, potential predators, and fish condition.

RESULTS

Twenty-four separate populations of relict dace were found during the survey period 20 June 1994 to 26 August 1994. The location of existing relict dace populations are labeled on maps found in the appendix. Several other populations may exist on private lands not surveyed. Some of these unsurveyed areas have historic accounts of relict dace, but landowner permission to access private lands was denied and surveys could not be conducted.

Ruby Valley - The Ruby Lake National Wildlife Refuge was extensively surveyed for the presence of relict dace. The refuge has over two hundred springs and seeps, but only a fraction of these are suitable for supporting dace populations. Table 7 lists sites inventoried and the results. In the past, springs on Ruby Lake National Wildlife Refuge have been surveyed, marked with witness posts and numbered stakes, and mapped. Many of the spring heads have been developed in the past, however, none of these developed springs, currently support relict dace.

The spring heads which have not been developed range in size from less than a meter to 15 meters in diameter. Sedge is encroaching the perimeter of most springs and macrophytes fill up to 75% of the water volume of the springheads. Outflows are typically choked with watercress, sedge, and baltic rush which makes actual water flow hard to locate until several spring drainages coalesce.

TABLE 7 - Listing of Ruby Lake relict dace survey locations and results.

Survey Location	RMR	Results
Narcisse	246	relict dace
Narcisse	226	relict dace
Narcisse	220t	relict dace
Ramiriz	244	relict dace
Cow Camp	236	relict dace
Dace Spring	154	speckled dace
North County Line Pond	168	speckled dace
Banana Pond	168	speckled dace
		trout
	177	speckled dace
	178	speckled dace
	181	speckled dace
	194	speckled dace
combined outflow	196-199	speckled dace
combined outflow	213-214	speckled dace
combined outflow	213-219	speckled dace
Narcisse	220	speckled dace
Narcisse	221	speckled dace
Narcisse	227	speckled dace
Narcisse	253	speckled dace
	245	speckled dace
	252b	speckled dace
Gravel Pit outflow	252b	speckled dace
	175	no fish
Ramiriz	203	no fish
Narcisse	215	no fish
Narcisse	252a	no fish
	212	no fish
	242a	no fish
	188	no fish
	116	no fish
	117	no fish
	207b	no fish
	152	no fish
	156	no fish
	151	no fish
	153	no fish
	145	no fish
	118	no fish
	166	no fish
	161	no fish
	102	no fish
	134	no fish
	127	no fish
	167	no fish
	163	no fish

In the Narcisse area, three springs currently have relict dace populations. RMR-246 has the largest population of any on the refuge. This spring is a natural spring head which is fifteen meters in diameter and is not connected to other springs in the Narcisse Springs complex. The outflow is choked with sedge and hardstem bulrush. Speckled dace have not yet invaded this habitat. Using the Peterson method (Ricker 1985) of mark-recapture for estimating the population size, 1,883 (± 342) adult fish (at least 30mm in length) were found to be in the spring head. Fish less than 30mm, considered to be young-of-year, were not included in the estimate as they could not be sampled with 1/4" screen minnow traps.

The second largest population of relict dace at the Narcisse Spring complex was found in spring RMR-226. Unlike RMR-246, this spring is connected to other springs in the Narcisse complex, and several of these and the associated outflows contain speckled dace. This spring has much more macrophytic growth than RMR-246 and is slightly smaller in diameter. A population estimate was also made on this population by using the same technique. The population was estimated at 1584 fish.

A third population of relict dace was found at what appeared to be an alternate terminus of spring number 220. Of the three populations found at Narcisse, this is the smallest and the one most in jeopardy. The habitat is shallow and full of macrophytes and hardstem bulrush. Dipnetting resulted in the capture of 5 fish and trapping resulted in no captures. Due to the habitat size, the population is estimated to be well under 100 fish. The largest specimen captured was 38mm. Spring number 220 also has a population of speckled dace which apparently invaded through the main outflow and have not yet been able to pass through the thick vegetation leading to the alternate terminus. The main outflow and the alternate terminus are separated by 25 meters of a channel choked with aquatic vegetation.

Another population of relict dace on the refuge was found in a single springhead in the Ramiriz Springs complex. The Ramiriz complex is a system of more than thirty springs located one mile north of the Narcisse complex. Relict dace were found in one spring near the lake bed. The spring is marked by Refuge marker number 244 and is surrounded by hardstem bullrush. Sixty-four dace were captured an overnight trap set. Several other springs and outflows in the system contained speckled dace. The outflow from spring 244 is present but stagnant, and is closely connected to a channel that speckled dace have apparently used in the past to invade springheads in the surrounding areas.

Cow Camp Pond was the last spring on the refuge found to contain relict dace. This spring is a considerable distance from the main marsh with no flow connecting to the marsh. The spring has a significant amount of macrophytes and algae present with very little open water. Only two fish were captured here by two traps set overnight. These fish or their progenitor were reintroduced in the recent past (Personal communication with Jim Heinrich, 1994).

Relict dace were not found anywhere else in Ruby Valley. Table 8 lists sites off of the refuge which were surveyed or where survey attempts were made. Two spring systems were found on the Fort Ruby Ranch south of the refuge. One was at the airport and the other at the pony express station. Both of these systems feed Dace Bay on the

TABLE 8 - Listing and results of Ruby Valley relict dace survey locations which are not on the Ruby Lake NWR.

Survey Location	Results
Fort Ruby Ranch	
Pony Express Pond	speckled dace
Woodward's Creek	speckled dace
Willows Pond	1m bass
Airport Pond	1m bass
Airport Springs	speckled dace
Franklin River	dry
Franklin Lake	dry
7H Ranch	no fish
UX Ranch	dry
Gardner Ranch	no access
Duval Ranch springs	no fish
Dahl Ranch springs	no fish
Wolverton Spring	no fish

Refuge. The springs at the pony express station feed Woodward's Creek which has two impoundments. During the summer of 1994 the springs were dry but the impoundments contained water. Speckled dace were found in the section of Woodward's Creek connecting the two impoundments. Speckled dace were also found in the upper impoundment (Pony Express

Pond). The lower body of water (Willow Pond) contained only largemouth bass. A culvert prevents fish movement from Woodward's Creek up to Pony Express Pond, indicating that speckled dace may have been introduced here. Crayfish were also found in this system, also the likely result of an introduction.

The spring system at the airport is made up of a series of 30 to 40 springheads which drain into an impoundment. This pond is located by the airport, contains largemouth bass, and had no outflow in July of 1994. Speckled dace were found in only one of the springheads, about 200 meters south of the airport building. The remaining springheads in the system show signs of having been covered with wooden planks in the past. This was probably done in an effort to prevent cattle from falling into or getting stuck and drowning in the spring. Apparently the spring heads were covered sufficiently to prevent sunlight and subsequent photosynthesis, ultimately eliminating any native fish populations. The one springhead which contains speckled dace is only one meter in diameter and was likely left uncovered. Many of these springs have the potential of being introduction sites for relict dace.

Franklin Lake and River was dry in July, 1994, however, several ranches along the western edge of the valley were surveyed for relict dace. No populations were found. In the north end of the valley, springs were surveyed on the Duval Ranch and Forest Service land; no dace were found here either.

Table 9 is a listing of a average size (fork length) of relict dace captured in Ruby Valley.

TABLE 9 - Average sizes and standard deviations of fish from Ruby Valley relict dace locations.

Location Spring #	Average size (FL) (mm) Standard deviation	Size Range
RMR-226	64.64 ± 9.71 N=50	<30-110
RMR-246	61.22 ± 18.66 N=49	38-102
RMR-220T	34.00 ± 3.74 N=4	29-38
RMR-244	49.42 ± 7.52 N=62	<30-75
RMR-236	59.50 ± 7.78 N=2	54-65
Totals	56.6± 14.8 N=171	<30-110

Minimum and maximum sizes may only be incidental notes, not from lengths used to figure average and standard deviations. All sizes are in millimeters (FL). <30 refers to young-of-year present.

Butte Valley - Six populations of relict dace were found in Butte Valley during the summer of 1994. Sites which were inventoried

TABLE 10 - Sites and results of dace inventory in Butte Valley.

Survey Location	Results
Atwood Ranch Spring #1	relict dace
Atwood Ranch Spring #2	relict dace
Atwood Ranch Spring #3	relict dace
Quilicy Spring	relict dace
Odgers Creek	relict dace
Stratton Ranch	carp
Wright Spring	dry
Owens Ranch Springs	no fish
Spring NE of Odgers	relict dace

are listed in Table 10. The populations in pluvial Lake Gale appear to be extirpated and the relict dace found are located in the pluvial Lake Franklin section of the valley. The largest population of relict dace is in Odgers Creek. A survey of Odgers Creek by the Department of Wildlife in 1980 found an average of 55.6 fish/100 feet over 7.5 miles of habitat, or an estimated 22,057 fish. The average size of the fish was 58 mm (FL).

During July of 1994 six sites were electroshocked along the creek in 100 foot sections. An average of 39 relict dace was captured at each site. The capture rate was estimated to be 50% due to the large amounts of escape cover in the form of aquatic macrophytes and sedge. The average of 39 fish/100 feet over 7.5 miles of stream assigns the stream a population of 15,444 fish. Expanding to consider the 50% catch ratio results in an estimate of 30,888 fish in the stream, comparable to the 1980 estimates.

In 1984 the BLM installed several large cattle exclosures on Odgers Creek. One exclosure covers 80 acres and the other 60 acres of riparian habitat. The exclosures protect the stream banks damaged by ungulates in the past, and a riparian community with sedge as the dominant plant species has returned. There is evidence such as new meanders forming that the stream is still undergoing morphological changes in these areas. As this process continues, pools will become more common. Now, however, glides are most common. Outside of the exclosures, stream banks were compacted and hummocked and had reached forage utilization in excess of 50% at the time of the survey. Siltation from cattle and horse use outside is still impacting the exclosed habitat.

Quilici Spring to the northwest of Odgers Creek also has a population of relict dace. In high water years this spring may feed Odgers Creek but currently it is several miles away with no apparent outflow. A single overnight trap captured 174 relict dace. The fish are located in a pool 25 meters below the spring head with no water connection. Ungulates have removed all vegetation from the banks and the water is very turbid due to heavy livestock concentrations.

Northeast of Odgers Creek, at the southeast base of an alluvial fan coming off the Cherry Creek Range is another system of springs. In Tables 10 and 11 these are referred to as the springs NE of Odgers. Relict dace are found in only one of these springs, and here only where flowing water was present. Maximum water depth is less than 15 mm and the whole area is heavily hummocked from livestock use. Like Quilici

Spring, this spring may feed Odgers Creek in high water years, but currently waterflow dissipates quickly. Thirty-seven relict dace were captured by electroshocking.

Four other springs in this general area were found to be devoid of fish populations. Also, springs on the north side of the alluvial fan were without fish.

The northernmost populations of relict dace in Butte Valley occur on the McCall Ranch, formally called the Atwood, Murphy or Dolan Ranch. Three populations were located in separate springheads. The water is

TABLE 11 - Average size and standard deviations of fish from Butte Valley relict dace locations.

Location	Average Size (FL) (mm) Standard Deviation	Size Range
Atwood #1	54.98 ± 15.59 N=47	27-82
Atwood #2	54.00 ± 12.18 N=27	34-85
Atwood #3	39.00 ± 3.61 N=3	36-43
Quilici Spr.	59.89 ± 8.96 N=174	49-90
Odgers Creek	63.56 ± 15.19 N=234	30-111
Spring NE of Odgers	36.11 ± 11.62 N=37	23-53
Totals	58.98 ± 12.69 N=522	23-111

All sizes are in millimeters (FL).

fairly warm and the dace seem to flourish in two of the three springheads. Dace were captured by electroshocking the outflow of two of the springs (springs #1 & #3 in Table 11) and by trapping the spring head of the third (spring #2 in Table 11).

Dace on the McCall Ranch inhabit spring heads and up to 800 meters of outflows. The two populations (#1 and #2) that seem to be most viable are located in springs due west of the ranch house. Forty-seven relict dace were captured by electroshocking the spring outflow closest to the ranch house which has an outflow of around 1 cfs. Twenty-seven dace were captured in the next spring due east by trapping for only one hour. This spring had only a slight outflow of less than 0.1 cfs.

A third population at the McCall Ranch is located 100 meters south of the ranch house along the Butte Valley road. Only three fish were captured here by electroshocking. The springhead is less than 25 cm deep with no aquatic vegetation, however, vegetation is abundant in the outflow where the flow is less than 0.1 cfs. Vegetation along a fence line creates a pool on the downward slope where several dace were observed seeking refuge under the cutbank of the springhead. Of the three populations on the ranch, this is the population which may be most tenuous.

The Stratton Ranch, Owens Springs, and Wright Springs are located in the section of Butte Valley which occupies pluvial Lake Gale. No dace were found in these areas, but habitat conditions and water chemistry were documented to assess their potential as future relict dace introduction sites.

Steptoe Valley - Six populations of relict dace were found in Steptoe Valley during the summer of 1994. There are two distinct populations of dace at the Lusetti Ranch and two at the Steptoe Ranch. Also, relict dace were found at the Georgetown Ranch (Murray Creek) and at the Dairy Springs complex below the McGill swimming pool. Table 12 is a listing of the results of surveyed water in Steptoe Valley.

The Lusetti Ranch relict dace populations are located in what is also named the Grass Springs complex. These springs have been divided into three separate irrigation systems; relict dace live in the collection ditches of two of these systems. In the first or northern most collection channel, there is 1200 meters of habitat. Macrophytes fill 1/4 of the water volume and the bottom is comprised mostly of sand and silt with small amounts of gravel mixed in. Several areas were dipnetted and 18 dace were captured. Balostomatidae beetles were common in this location. The relict dace are fairly abundant here and the total population is estimated to be several thousand fish.

TABLE 12 - Sites and results of dace inventory in Steptoe Valley.

Survey location	Results
Steptoe Ranch #1	relict dace
Steptoe Ranch #2	relict dace
Steptoe Ranch ponds	l.m. bass
Lusetti Ranch #1	relict dace
Lusetti Ranch #2	relict dace
Lusetti Ranch #3	no fish
Lusetti Ranch #4	no fish
Lusetti Ranch pond	carp
Georgetown Ranch	relict dace
Dairy Ranch springs	relict dace
	poecilids
	goldfish
	l.m.bass
Lakawana Hot Spr.	poecilids
	goldfish
Ruth pond	dry
3C Ranch	no fish
Steptoe Cr.	dry
Cardono Ranch	no fish
Monte Neva Hot Spr.	no access
Duck Creek Slough	no fish
Elbow & Collar Spr.	goldfish
Flat Spring	no fish
Lookout Spring	chubs

The second population of relict dace on the Lusetti Ranch is found 1,600 meters south of the first site and 800 meters north of the ranch house. This habitat is more limited, though there is a spring pond at the north end of the collection ditch which provides very stable habitat and is not subjected to drawdowns as is the rest of the ditch. Eighteen dace were captured here by dipnetting and electroshocking. The population is estimated at 300 fish.

The Steptoe Ranch relict dace populations are located in the vicinity of the ranch headquarters. North of the ranch house there is a series of springs forming a collection ditch with two ponds. This system contains largemouth bass and is diverted to agricultural uses several miles north of the ranch house. Below the collection ditch ponds, however, there are several springs that form a small channel from which eleven relict dace were captured by electroshocking. The channel and stream are in very good habitat condition and dace are abundant

TABLE 13 - Average size* and standard deviations of fish from Steptoe Valley Relict dace locations.

Location	Average Size (FL) (mm) Standard Deviation	Size Range
Lusetti #1	52.11 ± 18.47 N=28	27-96
Lusetti #2	45.67 ± 5.41 N=18	32-53
Steptoe #1	42.18 ± 6.74 N=11	35-57
Steptoe #2	22.00 ± 2.83 N=2	20-24
Georgetown	48.06 ± 15.22 N=16	27-79
Dairy Spr.	54.67 ± 8.50 N=3	46-63
Totals	47.8 ± 14.5 N=78	20-96

*All sizes given are in millimeters (FL).

throughout the system. The water flows through a system of corrals and ends in a small pond 200 meters to the east. At this point, the stream loses its gravel bottom and turns silty and stagnant.

The second population of relict dace at the Steptoe Ranch is more confined. An estimated 500 relict dace inhabit 50 meters of the tailwaters of the piped outflow of a small spring located near the ranch house. In high water years, fish may populate a small pond 400 meters away, but the pond was dry during the survey period.

Georgetown Ranch Springs or Murray Creek in the town of Ely has a very limited relict dace population. Electrochocking resulted in the

capture of one fish. Overnight trapping with 3 traps produced an additional 2 fish. Siltation is heavy and the stream is very turbid.

Dairy Springs has a healthy relict dace population from immediately below the McGill swimming pool to the confluence with the Tailings Ditch at the pump house. Guppies and other poecilids are abundant below the swimming pool for 800 meters. Goldfish and largemouth bass were also found in the system, but were rare. There are several ponds throughout the system supporting a variety of fish species, but the last segment is channelized and harbors only relict dace. The relict dace population is estimated to be in excess of 10,000 fish.

Goshute Valley - Six separate populations of relict dace were found at two locations in Goshute Valley. The survey results are reported in Table 14 and fish sizes in Table 15. Five populations were found on the Johnson Ranch at the north end of the valley. Four of these are in springs found near the ranch house on the valley floor. Similar to the springs on the Fort Ruby Ranch, this is a system of thirty plus springs that shows signs of having been altered in the past to keep cattle from falling in. Four spring heads which were fenced off instead of covered because of their larger size (3+ meters in diameter) contained relict dace. The remaining springs showed signs of having been dredged or covered with wood and had no dace populations present. These springheads were sampled by electroshocking and have estimated populations of 50 to 200 fish each.

TABLE 14- Sites and results of dace inventory Goshute Valley.

Survey Location	Results
Johnson Ranch #1-#5	relict dace
Twin Springs	relict dace
Currie Pond	dry
McDermitt Creek	rainbow trout

The fifth population at the Johnson Ranch occurs at the main spring in the ranch yard. Water from this spring can be diverted three separate ways, depending upon the need. When the area was surveyed, the water was being diverted north along a low gradient ditch to a holding pond 1.6 km away. Relict dace are found throughout the system. In the fall the water is diverted to the south via a ditch which was dry at

TABLE 15- Average size* and standard deviations of fish from Goshute Valley relict locations.

Location	Average size (FL) (mm) Standard deviation	Size Range
Johnson #1	33.00 ± 0.00 N=1	33
Johnson #2	63.00 ± 21.06 N=6	27-92
Johnson #3	53.14 ± 9.39 N=7	43-71
Johnson #4	35.38 ± 9.20 N=8	24-55
Johnson #5	50.67 ± 9.46 N=18	35-70
Twin Spr.	37.17 ± 9.91 N=30	18-61
Totals	44.2 ± 13.9 N=70	18-92

*All sizes are in millimeters.

the time of the survey. The dace population is currently estimated to be several thousand fish but is probably variable depending upon water use.

Twin Springs or Phalen Creek located north of the town of Currie appears to support a stable relict dace population. Water from this spring system is diverted for agricultural use 400 meters downstream of the source. This is a small springhead choked with debris and shows signs of recent dredging. Young-of-year fish less than 20 millimeters were abundant in the shallows.

Spring Valley - Access was not obtained to survey Stone House or Spring Creek populations, and the Keegan Ranch population could not be located. The only dace population surveyed was at the Shoshone Ponds.

Relict dace were found to be abundant in the southern most of three ponds. This is a developed pond four meters in diameter with a continual inflow from an artesian well. Past estimates indicate a population of around 1500 fish. Relict dace were introduced here in 1977 with fish taken from the Grass Springs complex on the Lusetti Ranch (McLelland 1977). The other ponds in the area contain the endangered Parumph killifish.

Water Chemistry

Table 13 documents average chemical and physical characteristics of the survey sites which contained relict dace.

TABLE 13 - Water characteristics for relict dace population sites.

Valley (sites)	Alkalinity gr/gallon as CaCO ₃	Dissolved Oxygen mg/liter	CO ₂ mg/liter	Temperature °C	pH
Ruby (5)	10.80 ± 1.10	10.80 ± 6.06	16.00 ± 2.99	16.62 ± 2.99	8.70 ± 0.45
Butte (6)	13.75 ± 2.93	6.37 ± 3.85	17.50 ± 5.00	21.53 ± 0.35	8.08 ± 0.49
Steptoe (6)	12.17 ± 1.83	6.67 ± 0.51	19.17 ± 6.65	20.79 ± 1.58	8.08 ± 0.38
Goshute (6)	11.33 ± 1.21	5.16 ± 0.41	20.00 ± 3.16	17.31 ± 2.73	7.50 ± 0.32
Totals (23) Range	12.07 ± 2.13 9-19	7.10 ± 3.80 2-21	18.59 ± 6.07 5-35	18.20 ± 3.19 12-25	8.06 ± 0.57 7.0-9.0

Chemical analysis of Shoshone Ponds in Spring Valley revealed alkalinity of 5 grains per gallon as calcium carbonate, dissolved oxygen as 7 mg/liter, carbon dioxide at 10 mg/liter, and pH of 8.

Introduction Sites

Listed in Table 17 are potential introduction or reintroduction sites which were classified into three levels: I, II, and III. Level I introduction sites need no habitat modifications or fish eradications prior to receiving fish. Level II sites require either habitat modifications or eradication of existing species. Level III sites

require both habitat modifications and eradication of existing species prior to dace introduction. The most obvious habitat modification required is the creation of barriers to prevent competitive or hybridizing fish species from invading the habitat.

TABLE 17 - Locations and classifications of potential relict dace introduction sites.

Valley	Level	Location
RUBY	I	RMR-175 RMR-116, NE of Collection Ditch. Ramiriz, RMR-203 RMR-212 RMR-207B, By RMR-207 RMR-152 RMR-151 RMR-161 RMR-156, By county line
	II	RMR-117, NE of Collection Ditch RMR-167, Below Banana Pond Airport Pond & springs on Fort Ruby Ranch Pony Express Pond on Fort Ruby Ranch Willows Pond on Fort Ruby Ranch
	III	RMR-168, spring below Banana Pond RMR-194 Narcisse, RMR-220 Narcisse, RMR-221 RMR-245
BUTTE	I	Owens Springs
STEPTOE	I	Lusetti #3 Lusetti #4 Flat Springs
	II	Lookout Springs
GOSHUTE	I	4 Springs Below the Johnson Ranch

General Comments

In Ruby Valley, only springs on the valley floor close to the lake bed elevation contained relict dace. Springs 5-20 feet higher on surrounding benches supported no relict dace, although many of these springs contained speckled dace. The temperature of these upland springs was 10°C to 12°C, and the only aquatic plant in many of these cold water springs was watercress.

Macroinvertebrates associated with relict dace were freshwater shrimp (cladocerans), leeches (and other annelids), diptera (including chironomids), zygoptera and other odenate larvae, adult and larval coleopterans (including ditiscidae), belostomatidae, mites (hydracarina), notonectidae, corixidae, gastropods, trichoptera, and baetid mayflies. Large cladocerans were rare in waters which contained relict dace.

Algae, sedge (carex), baltic rush, hardstem bulrush, watercress, cattails, duck weed, and various macrophytes comprise the aquatic vegetation found in surveyed sites containing relict dace. Colder waters contained larger amounts of watercress and duck weed, while the warmer waters contained large amounts of macrophytes, hardstem bulrush, and cattails. Sedge was abundant in many systems, lining spring and stream edges creating escape habitat and pools at survey sites. Ungulate use reduced the amount of sedge in many instances.

DISCUSSION AND RECOMMENDATIONS

Ruby Valley - Relict dace populations in Ruby Valley have undergone severe declines since Hubbs and Miller first visited the valley in 1934 (from Table 1). Dace in the Franklin River system migrate in high water years and populate a slough at the north end of the valley on the Duval Ranch (personnel communication with Rich Haskins, 1994). Departmental sight records indicate that during high water years relict dace also populate Franklin Lake in the southern portion of the valley. The origin of fish inhabiting Franklin Lake is not currently known, but it is assumed that there are remnant populations in springheads on private holdings that expand to fill these ephemeral habitats. The private land thought to contain these springs is the Gardner Ranch, which was not surveyed in 1994.

The relict dace from the Ruby Lake portion of Ruby Valley are restricted to five springs along the western edge of the lake. Of these five populations, three are stable and the other two are tenuous. In order to secure local relict dace populations, dace can be reintroduced into several of the Level I habitats classified in Table 17. Also, if the proposed Fort Ruby Ranch land exchange is realized, the spring systems found there can be developed into a relict dace sanctuary.

Historic rationale for subspeciation were found to be questionable by this study. The populations from Ruby Valley were considered unique to those of other valleys because of fish average size. Ruby Valley dace were considered diminutive in comparison to other relict dace (Hubbs et al. 1972), and as such were proposed for subspeciation. Previous records of maximum relict dace length from Ruby Valley was 70 mm. Data from this study, however, revealed several fish over 100 mm and the average fish length was 56.6 mm. This average length is not significantly different than fish from proximal valleys.

RECOMENDATIONS:

To establish at least 5 additional populations in Ruby Valley.

To monitor the existing populations at Ruby Lake National Wildlife Refuge.

To locate the springs in the Franklin River system which contain relict dace and determine status.

To survey Franklin Lake when water returns.

To consider eradication of speckled dace which are in close proximity to existing relict dace populations and thereby threaten hybridization.

Butte Valley - Relict dace captured from Quilici Spring indicate that there has been no reproduction for at least two years as no dace smaller than 49 mm were captured. This is probably due in part to the severely degraded habitat conditions caused by cattle and horse trampling of the springhead. An enclosure is needed around this spring.

Dace populations from the pluvial Lake Gale section of the valley appear to be extirpated, and the only apparent introduction site is the Owens Springs complex.

RECOMENDATIONS:

To exclose Quilici Spring.

To continue to monitor the rehabilitation of riparian habitat within the exclosures on Odgers Creek.

To consider the introduction of relict dace into the Owens Springs complex.

To monitor known populations on a scheduled basis.

Steptoe Valley - Dace in this valley have been heavily impacted since the turn of the century (Hubbs et al. 1974). Survey results indicate loss of the Cordono Ranch and the 3C Ranch populations of relict dace. Existing relict dace populations appear to be secure.

RECOMENDATIONS:

To introduce dace into two locations on the Lusetti Ranch.

To introduce dace into Flat Spring northeast of Lages Station.

To survey the Monte Neva Hot Springs.

To monitor the existing populations on a scheduled basis.

Goshute Valley - Relict dace populations in this valley are limited to two locations and six populations. The populations on the Johnson Ranch could be augmented by introducing dace to an additional four springheads below the ranch house.

RECOMENDATIONS:

To consider the introduction of relict dace into four springheads below the ranch house on the Johnson Ranch.

Monitor the known populations on a scheduled basis.

Spring Valley - Introduced populations of relict dace reportedly exist in four locations. The only population which was surveyed, Shoshone Ponds, is in excellent condition. Access may be gained to the Vogler properties (Stone House and Spring Creek) in the future.

RECOMENDATIONS:

To monitor relict dace populations in conjunction with the Parumph killifish at the Shoshone Ponds.

To locate and survey the populations on the Keegan Ranch.

To attempt to gain access to and survey the Vogler properties for relict dace populations.

CONCLUSION

The current relict dace populations found in northeastern Nevada have been significantly depleted from original numbers found in the 1930's. However, existing populations appear to be stabilized and secure at current locations and levels. The diversity of occupied habitats with such a wide geographic distribution provides relative assurance of the species' persistence. Resolute monitoring at scheduled intervals could track status and trend of these populations. This, coupled with the introduction of dace into the other suitable habitats should insure the perpetuation of the species.

REFERENCES

1. Aldous, C. 1962. Nevada Fish and Game Commission, Investigating Report 23.
2. Carmichael, R.W. 1983. Food habits and distribution of relict dace at Ruby Marsh, Nevada. Technical Paper, Oregon Agricultural experiment Station.
3. Eddy, S. 1969. The Freshwater Fishes. Dubuque, Iowa 73.
4. Green, M.R., Nevada Division of Wildlife. Personnel Communication. Conversation on 7 June 1994.
5. Federal Register 1990. Endangered and threatened wildlife and plants; review of plant taxa for listing as endangered or threatened species; notice of review. Department of the Interior IV:2.
6. Forest Service - Intermountain Region Fisheries and Wildlife Management 1989. Fisheries habitat surveys handbook 13.
7. Hardy, T. 1979. The inter-basin area report - 1979. University of Nevada at Las Vegas 9-10, Las Vegas.
8. Harris, P., Oregon State University PhD Candidate. Telephone conversation on 9 November 1994.
9. Heinrich, J. 1991. Field trip report. Nevada Department of Wildlife, Las Vegas.
10. Heinrich, J. 1992. Field trip report. Nevada Department of Wildlife, Las Vegas.
11. Heinrich, J. 1993. Field trip report. Nevada Department of Wildlife, Las Vegas.
12. Helm, et al. 1985. Glossary of stream habitat terms. American Fisheries Society, Western Division 29.
13. Hubbs, C.L., R.R. Miller, and L.C. Hubbs 1974. Hydrogeographic history and relict fishes of the north-central Great Basin. Memoirs of the California Academy of Sciences 7:259.

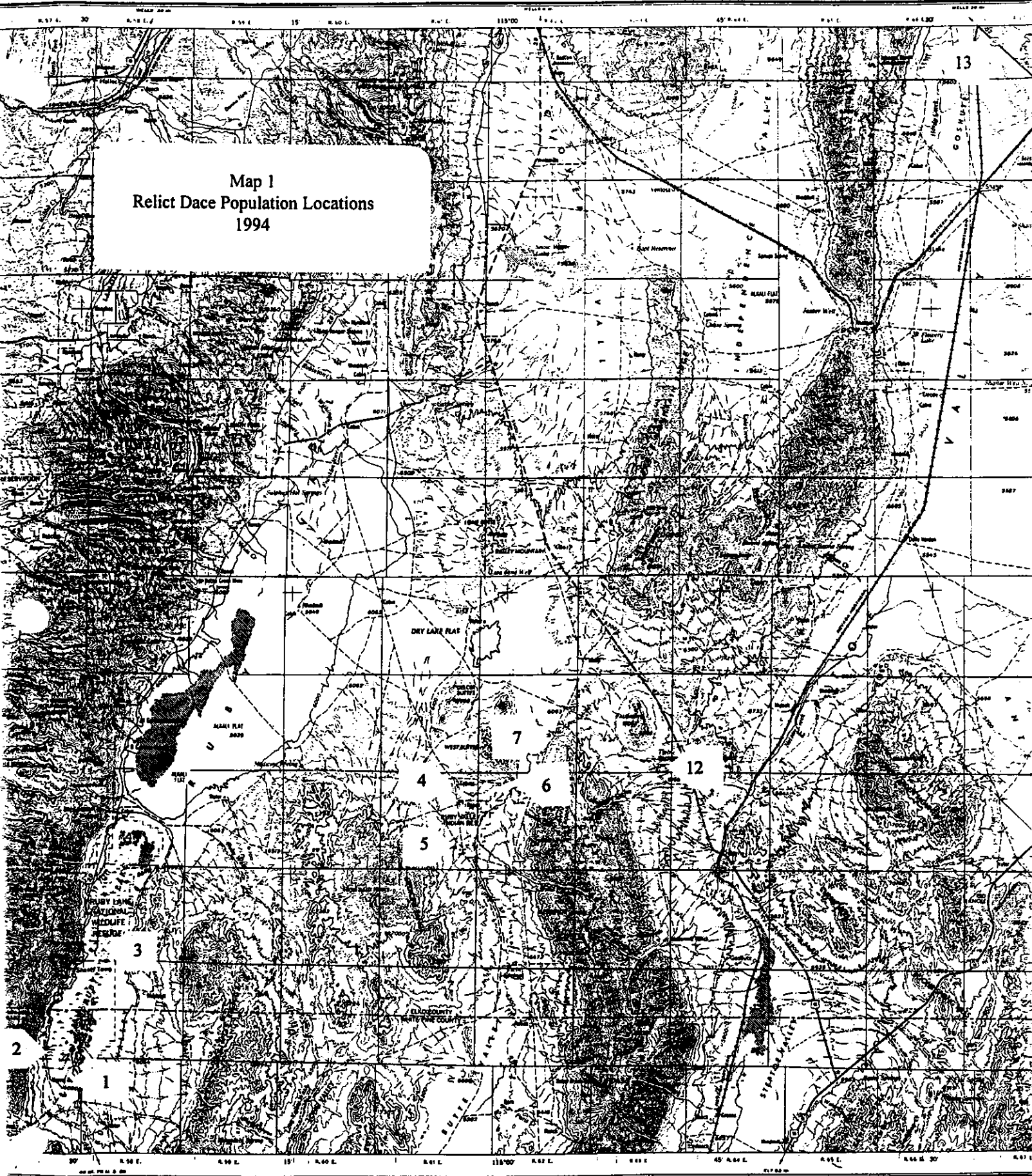
14. King, D. 1962. Fish stocking receipt. Nevada Fish and Game Commission.
15. Masington, R.L. 1981. Status report on relict (Steptoe) dace within Elko District, Currie Planning Unit, Bureau of Land Management.
16. McLelland, L. 1977. Field trip report. Nevada Fish and Game Commission, Ely.
17. Vigg, S. 1982. Ecology of the Nevada relict dace, RELICTUS SOLITARIOUS (Hubbs and Miller) with a selected bibliography on Great Basin Desert Fishes. Bioresources Center Desert Research Institute 4, Reno.
18. Lynn, O. 1950. Fish stocking receipt. Nevada Fish and Game Commission.
19. Trelease, T. J. 1948. Report of field survey and investigations of the fisheries resources of the Ruby Lakes, Nevada. Nevada Fish and Game Commission, Investigating Report 12, Reno.
- 20 Ricker, W.E., 1975. Computation and interpretation of biological statistics of fish populations, Nanaimo, B.C., page 75.

APPENDIX 1
MAPS

Location	Number on the Maps
Narcisse Springs	1
Ramiriz Springs	2
Cow Camp Spring	3
Quilici Spring	4
Odgers Creek	5
Spring NE of Odgers Creek	6
Atwood Ranch	7
Georgetown Ranch	8
Dairy Springs Ranch	9
Lusetti Ranch	10
Steptoe Ranch	11
Twin Springs (Phalen Creek)	12
Johnson Ranch	13
Shoshone Ponds	14

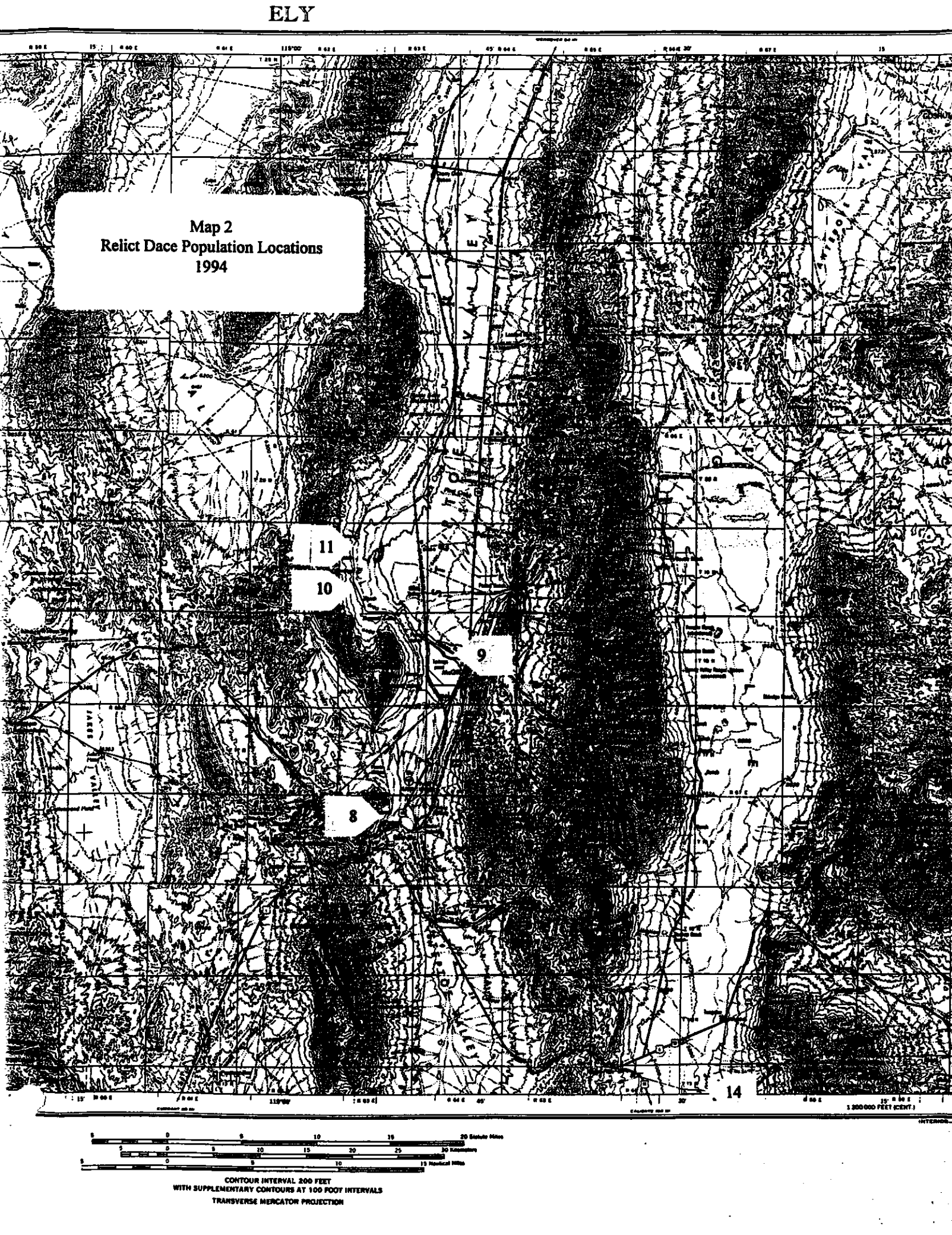
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Map 1
Relict Dace Population Locations
1994



CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS
TRANSVERSE MERCATOR PROJECTION

Map 2
Relict Dace Population Locations
1994



11

10

9

8

14

1:200,000 FEET SCALE



CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS
TRANSVERSE MERCATOR PROJECTION

APPENDIX 2
1994 Status and Distribution of Relict Dace (*Relictus solitarius*)

Valley	Site	Location *	Population Estimate **	Security ***	Notes
Ruby Valley	Narcisse 246	T25N R57E sec 2 lot 2	1,883	1	mark-recapture estimate excluding YOY; isolated; good habitat condition
	Narcisse 226	T25N R57E nw¼sw¼ sec2	1,584	2	mark-recapture estimate excluding YOY; potential access to speckled dace; good habitat condition
	Narcisse 220 outflow terminus	T25N R57E sec 2 lot 2	<100	4	limited habitat; direct access to speckled dace; good habitat condition
	Ramiriz 244	T26N R57E sec 34	300 to 500	3	excluding YOY; potential access to speckled dace; good habitat condition
	Cow Camp 236	T27N R58E sec 32	200 to 300	3	recent introduction; isolated; limited habitat
Butte Valley	Atwood Ranch #1	T29N R62E	abundant	2	private ownership; good habitat condition; outflow 1.0 cfs
	Atwood Ranch #2	T29N R62E	abundant	3	private ownership; good habitat condition; limited outflow <0.1cfs
	Atwood Ranch #3	T29N R62E	scarce	4	private ownership; shallow; limited outflow <0.1cfs
	Odgers Creek	T27N R62E	30,888	1	public ownership; improving habitat condition; 7.5 miles of available habitat
	Quilicy Spring	T28N R61E sec 2	abundant	3	public ownership; extremely poor habitat condition; no evidence of reproduction for two years
	Spr. NE of Odgers	T28N R62E sec 16	abundant	3	limited habitat; flow <0.5 cfs; poor habitat condition
Steptoe Valley	Lusetti Ranch #1 Grass Springs	T19N R63E sec 17	2,500	2	private ownership; stable conditions; 0.75 miles of occupied habitat
	Lusetti Ranch #2	T19N R63E sec 17	300	3	private ownership; pond and ditch; stable habitats
	Steptoe Ranch #1	T19N R63E sec 5	1,000	2	private ownership; very good habitat condition
	Steptoe Ranch #2	T19N R63E sec 5	500	3	private ownership; limited habitat; fair condition
	Georgetown Ranch	T16N R63E	scarce	4	public land; low population; poor water quality
	Dairy Springs	T18N R64E sec 20	10,000	2	private ownership; excellent habitat condition; competing and predatory species

Valley	Site	Location *	Population Estimate **	Security ***	Notes
Goshute Valley	Johnson Ranch #1	T26N R66E sec 29	25	4	private ownership; small, isolate population; good habitat condition
	Johnson Ranch #2	T26N R66E sec 29	200	2	private ownership; excellent habitat condition; good reproduction evident
	Johnson Ranch #3	T26N R66E sec 29	100	2	private ownership; excellent habitat condition; enclosure; reproduction evident
	Johnson Ranch #4	T26N R66E sec 29	100	2	private ownership; excellent habitat condition; enclosure
	Johnson Ranch #5	T 26N R66E sec 29	2000	2	private ownership; extensive habitat, springhead, 1 mile of ditch and pond
	Twin Springs	T29N R63E sec 22	abundant	2	private ownership; enclosure; spring diverted for irrigation; excellent reproduction evident
Spring Valley	Shoshone Ponds	T13N R65E	1,500	1	Public owned refugium; excellent habitat condition

* Location - See report for detailed description of location.

**Population Estimate - Numbers provided if an estimate was made or computed, else subjectively evaluated as abundant, moderate or scarce.

** Security - A subjective assessment based upon population size, land ownership, habitat extent and condition, and potential threats. Value is from 1 to 5 where 1 is most secure and 5 is least secure.