Big Spring Spinedace Research

Langhorst

JM / JM

AUG 26 1994

August 10, 1994

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Leroy McLelland
Nevada Department of Wildlife
P.O. Box 10678
Reno, Nevada 89520

Dear Mr. McLelland:

Enclosed are materials you requested during our phone conversation on August 9, 1994. I hope you find them helpful. If you need any clarification on any of the enclosed tables don't hesitate to ask. I greatly appreciate your patience in these matters.

Sincerely,

Dan Langhorst

Dan Langhorst

DL
Enclosures

Summary Report
Big Spring Spinedace

Introduction

The Big Spring spinedace (Lepidomeda mollispinis pratensis) is a member of the minnow family (Cyprinidae) and is endemic to Condor Canyon of the Meadow Valley Wash drainage of Lincoln County, Nevada. The Big Spring spinedace was originally collected in 1938 from the outflow and marshy areas below Big (Panaca) Spring, about 2 km northeast of Panaca, Nevada. The outflow ranged in width from .30 to 1.0 m, while the depth was .50 m or less. Upon revisiting the type locality in 1959, Miller and Hubbs found the channel clogged with silt, vegetation and algae. After sampling produced no Big Spring spinedace, the collectors concluded that the taxon had been exterminated. In 1977, a population of Big Spring spinedace was discovered in Condor Canyon of Meadow Valley Wash, several km upstream from the type locality, and is the only site where Big Spring spinedace are presently found in nature.

On March 28, 1985, the U.S. Fish and Wildlife Service (USFWS) listed the Big Spring spinedace as threatened. The action was taken because one population of the taxon had been eliminated and the one remaining population is potentially threatened by drought, dewatering, livestock grazing, exotic fishes, and human activities. Approximately 6.5 km of stream along Meadow Valley Wash in Condor Canyon was designated as critical Big Spring spinedace habitat. Conservation efforts for the Big Spring spinedace have been minimal to date. In 1987, the USFWS drafted a Recovery Plan; however, this document has not been finalized. The primary objective of recovery efforts is to restore the taxon to a point where it can be removed from the Federal List of Threatened and Endangered Species. Information regarding habitat requirements and life history characteristics is necessary to support delisting the subspecies. Because of the status of this taxon and the lack of specific information on its habitat requirements, a study was initiated to quantify physical habitat use by the Big Spring spinedace in Condor Canyon. To reduce the possibility of extinction from a catostrophic event, establishment of another population within Meadow Valley Wash drainage is desirable. Data acquired from studying the Big Spring spinedace population will aid in selecting introduction sites, and enhancing habitat within Condor Canyon. In 1989 the University of Nevada-Las Vegas was contracted by the Nevada Department of Wildlife to study the ecological characteristics of L. m. pratensis in Condor Canyon. This document serves as a summary report of the study.

Study Area

Meadow Valley Wash through Condor Canyon is a small perennial stream, one to two m wide and less than .50 m deep. A 10 m high waterfall separates the stream into two segments; however, no discernible habit differences are apparent above and below the falls. Open sunlit areas and dense riparian vegetation are interspersed along the stream. Dominant riparian species include boxelder, black willow, coyote willow, and tamarisk. Common understory species include cattails, redtop, cutleaf water parsnip, and

watercress. In open areas, wiregrass, sedges, and bulrushes are most common.

Methods and Materials

Fourteen stream reaches or microhabitats within Condor Canyon were identified for specific study. Reaches were selected to represent the range of microhabitat types within the stream and are defined as relatively homogeneous segments of stream with a uniform set of physical habitat variables. Examples include riffles, runs, and pools with or without various combinations of aquatic vegetation, undercut banks, and other cover such as woody debris or cobble/boulders. Study reaches ranged in length from 5 to 25 m depending on homogeneity. Habitat variables measured within study reaches include length, width, depth, current velocity, substrate composition, and instream cover. Width, depth, and current velocity were averaged for each respective study reach, while substrate types were categorized as organic matter, silt, sand, gravel, cobble, boulder, and bedrock. Percent of each substrate type was estimated at respective study sites. Instream cover including aquatic vegetation, undercut banks, boulders, overhanging vegetation, and woody debris was quantified and expressed as square meters of the given cover type in each respective study site.

Larger fishes were collected using a 170 v pulsed DC from a Coffelt Model BP-6 backpack electroshocker. Sites were sampled using a depletion method whereby the section of stream to be sampled was blocked off both up- and downstream with seines. The section was then sampled without replacement of fishes until the final sampling pass contained not more than 10% of the Big Spring spinedace captured in the most productive pass. All fish were collected, identified to species, counted, measured (Total Length [TL], nearest mm), and weighed (nearest gm). Big Spring spinedace were examined for breeding coloration and condition. After sampling was completed at a given site, fish were returned to the stream. Juvenile and young-of-the-year fishes were collected opportunistically within study sites using a fine mesh dip-net, with location and habitat type recorded for each successful capture.

In November 1990, March 1991, and May 1991; 30, 47. and 23 (total=100) Big Spring spinedace respectively were retained after collection, killed. preserved intact in 20% formalin, and returned to the lab for stomach contents analysis.

Results and Discussion

Habitat Big Spring spinedace were found throughout the entire study area; however, they were most abundant at several specific collection locations. These locations included Sites 6, 8, 9, 12, 13, and 14 (Table 1). Generally these sites consisted of slow flowing runs with abundant cover consisting of either overhanging shoreline grasses, undercut banks, or watercress along the stream margin and quiet eddy pools on the downstream edge of riffles. Site 14 was unique among sampling locations and consisted of a large (17 x 5 m), deep (mean depth .50 m) pool as the base of a small (1 m high) travertine falls. This site consistently produced by far the most spinedace of any location (Table 1). Young-of-the-year and larval spinedace were collected in quiet pools and slow runs where dense overhanging grasses or watercress provided ample cover.

Foods The diet of Big Spring spinedace consists primarily of larval aquatic insects entrained in stream drift. Adult spinedace were often observed darting from stream margin cover to inspect floating or partially submerged particles. Non food items were rejected immediately while presumed food items were retained in the mouth as the fish quickly returned to the stream margin cover. Stomach analysis of 100 individual spinedace (mean TL=64 mm) collected in November 1990, March 1991, and May 1991 found larval ephemeropterans to be most common followed by chironomid larvae. Plant material including diatoms and algae was next in abundance; however, it is unknown whether these items were ingested incidentally or were specific target items. The latter seems unlikely except in times when insects were scarce. Other food items included adult and juvenile amphipods of the family Gammaridae, and larval trichopterans. Spinedace also prey on fish as a juvenile speckled dace (15 mm TL) was found in the stomach of one adult (73 mm TL) spinedace.

Reproduction Big Spring spinedace spawn in spring through early summer (April to early July) and likely varies in response to changes in water temperature, stream discharge, and daylength. Water temperature during the course of this study ranged from 10° C in April to 15° C in July. Spawning activity was never observed; however, adults (presumably males) exhibited breeding colors (red to orange at base of paired fins and anal fin) and tubercles on the head in late March, with fainter fin coloration extending to early July. Examination of gravid females collected in late March found near mature ova, with individual fecundity ranging from 100 to 1300 ova. Ovum diameter at spawning is near 1.5 mm. Larval and post-larval spinedace were collected along quiet stream margins from early May to August.

Growth Generally, young Big Spring spinedace grow rapidly during summer and autumn, reaching 45 mm Total Length (TL) by late November. Winter growth is slight with fish averaging near 50 mm TL at the end of one year. Two year old fish generally range from 60 to 85 mm TL, while three year olds range from 90 to 110 mm TL. Exceptional individuals may attain four years of age. Maximum size is near 120 mm TL and 16 gms, based on the collection of one such individual in May of 1990. No specific information on size at hatching is available.

Table 1. Summary of Big Spring spinedace collected on each respective date. Top number is total catch while the bottom number is mean Total Length (mm) ± one standard deviation.

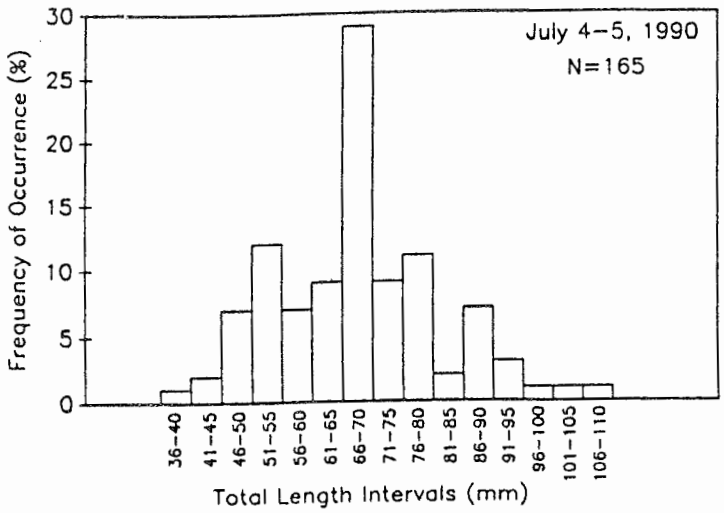
Site #	MAY 23-24 1990	JUL 4-5 1990	AUG 2-4 1990	AUG 15-17 1990	NOV 25-27 1990	MAR 25-28 1991	MAY 4 1991	MAY 16-18 1991	Total
1	0	-	12	-	1	1	2	1	17
	-	-	84±18	-	63±0	109±0	81±7	108±0	
2	2	-	5	-	5	1	0	1	14
	106±1	-	75±14	-	75±16	96±0	-	106±0	
3	4	-	-	11	1	0	1	2	19
	92±12	-	-	67±23	40±0	-	95±0	68±38	
4	14	-	-	9	0	0	-	1	24
	93±11	-	-	73±26	-	-	-	107±0	
5	4	-	-	-	15	8	10	6	43
	78±27	-	-	-	78±22	80±25	87±15	71±22	
6	15	-	-	-	27	59	18	14	133
	81±21	-	-	-	82±21	84±18	83±11	92±12	
7	-	7	-	2	1	11	-	7	28
	-	87±14	-	35±4	80±0	82±12	-	81±11	
8	-	69	-	-	23	72	-	58	222
	-	67±13	-	-	73±11	77±12	-	56±16	
9	-	13	-	-	57	16	-	26	112
	-	74±14	-	-	59±18	50±12	-	62±17	
10	-	14	-	-	9	20	-	32	75
	-	77±12	-	-	65±19	78±11	-	77±13	
11	-	21	-	-	11	17	-	25	74
	-	61±14	-	-	56±20	67±17	-	64±17	
12	-	41	-	-	23	53	-	38	155
	-	65±10	-	-	62±17	63±15	-	67±12	
13	-	-	40	-	32	4	-	144	220
	-	-	44±18	-	52±17	82±6	-	54±13	
14	-	-	549	-	341	265	-	199	1354
Totals	39	165	606	22	546	527	31	554	2490

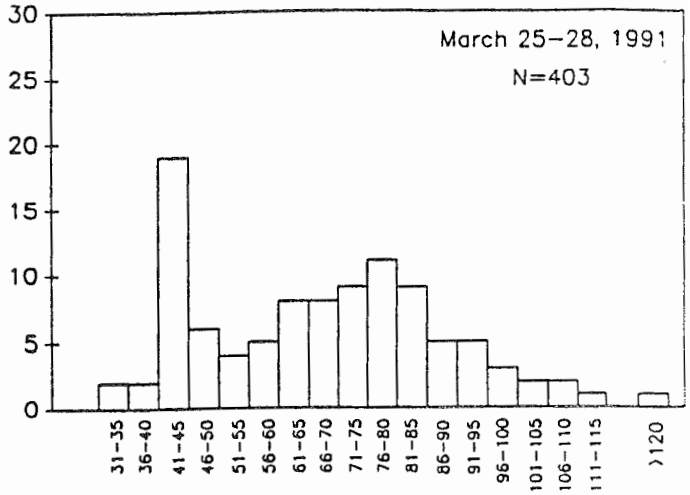
Table . Measurements of water quality variables recorded at respective sites and dates at Condor Canyon, Meadow Valley Wash during course of present study.

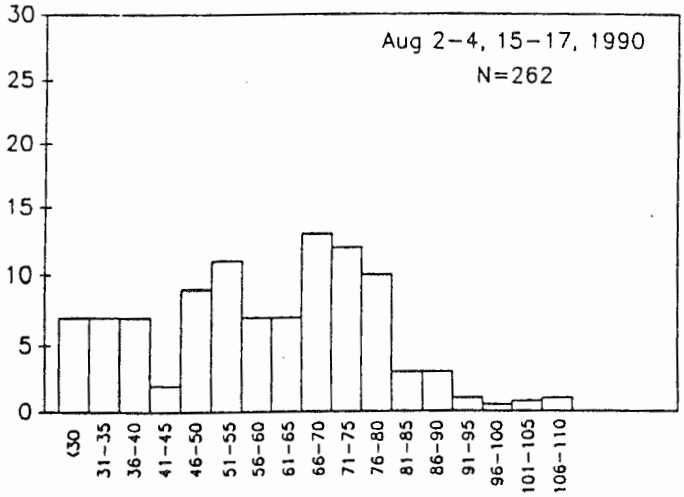
		(°C)	(NTU's)	(mg/l)		(µmhos/cm)
		Water Temp.	Turbidity	Dissolved Oxygen	pH	Conductivity
May 23-24, 1990						
Site #	Time					
1	1100	14.4	-	6.9	7.4	890
2	1320	16.1	-	8.0	6.7	870
3	1545	16.9	-	7.8	6.9	870
4	0830	12.2	-	8.6	7.6	890
5	1200	14.8	-	8.5	7.5	860
6	1400	15.5	-	8.1	7.8	850
Aug 2-4,15-17, 1990						
Site #	Time					
1	0830	16.0	36.6			
2	1230	18.0	16.4			
3	1400	17.2	10.7			
4	1330	17.8	17.5			
7	1500	17.8	14.1			
13	1300	18.0	27.0			
14	0900	15.0	-			
Nov 25-27, 1990						
Site #	Time					
1	0745	3.3	5.5			
2	0900	3.3	5.8			
3	1100	3.9	7.2			
4	1215	3.9	8.0			
5	1330	5.0	14.2			
6	1500	5.6	13.6			
7	1600	4.4	45.1			
8	1230	5.0	40.4			
9	1330	6.1	-			
10	1115	5.0	-			
11	1000	4.4	35.9			
12	0845	7.8	24.2			
13	1515	11.7	46.9			
14	1230	13.9	26.2			
Mar 25-28, 1991						
Site #	Time					
1	1115	5.6	6.2			
2	1300	5.6	6.8			
3	1500	5.6	6.4			
4	1600	6.1	7.1			
5	0830	3.3	13.4			

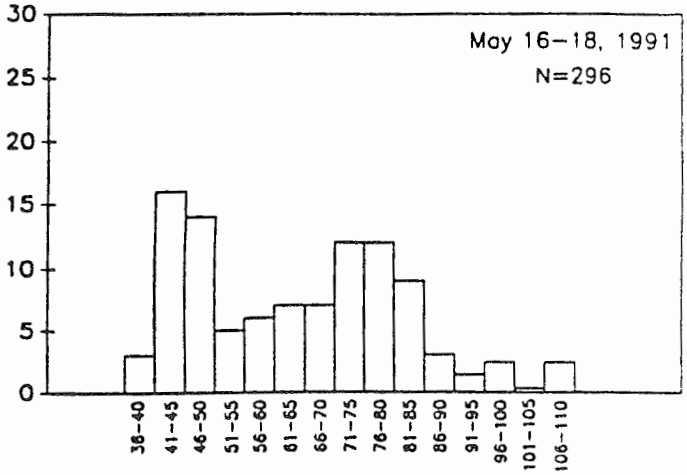
Table (Continued)

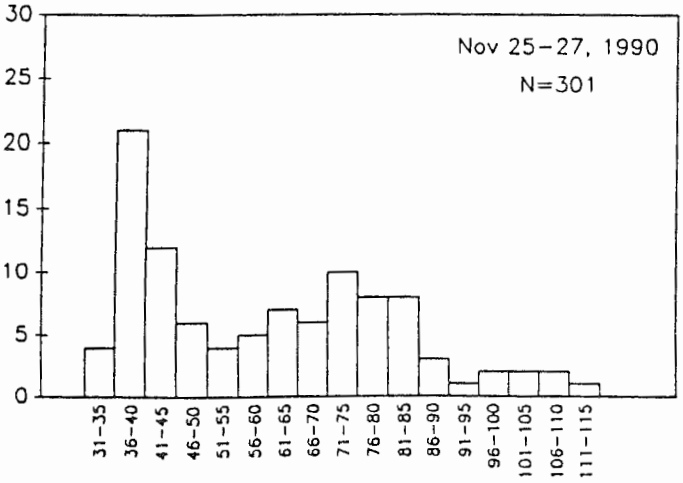
		Water Temp.	Turbidity
Mar 25-28, 1991			
Site #	Time		
6	1030	3.3	13.7
7	1600	3.9	-
8	1245	5.6	-
9	1430	8.3	-
10	1045	8.9	-
11	0900	8.9	-
12	1000	10.6	-
13	1115	15.0	13.5
14	1500	13.9	11.7
May 4, 1991			
Site #	Time		
1	1030	8.5	10.4
2	1130	10.0	9.4
3	1330	12.0	9.4
5	1500	14.0	-
6	1700	15.0	45.4
May 16-18, 1991			
Site #	Time		
1	0730	11.0	25.3
2	0930	12.0	23.3
3	1030	13.5	27.5
4	1530	18.0	56.0
5	1215	15.5	49.2
6	1345	18.0	65.0
7	1530	17.0	-
8	1145	17.0	-
9	1400	18.0	-
10	0945	13.5	-
11	0745	13.0	-
12	0800	12.0	30.0
13	1000	17.0	37.0
14	1745	15.0	11.8











Length Frequency distribution of B.S. Spiridens captured during course of study (

UNITS = m^2

SITE #

	1	2	3	4	5	6	7
OVERHANGING GRASS							
Apr 12, 1990	9.0	1.0	0	0	3.0	3.0	0
Jul 4, 1990	9.0	1.0	0	0	3.0	3.0	0
Aug 4, 1990	9.0	1.0	4.1	3.7	3.0	3.0	.30
Nov 26, 1990	9.0	1.0	4.1	3.7	3.0	3.0	.30
Apr 13, 1991	4.2	1.0	4.1	3.7	.90	.65	.30
May 16, 1991	4.2	1.0	4.1	3.7	.90	.65	.30
UNDERCUT BANK							
Apr 12, 1990	0	0	0	0	0	0	0
Jul 4, 1990	0	0	0	0	0	0	0
Aug 4, 1990	0	0	0	0	0	0	0
Nov 26, 1990	0	0	0	0	0	0	0
Apr 13, 1991	0	0	0	0	0	0	0
May 16, 1991	0	0	0	0	0	0	0
WOODY DEBRIS							
Apr 12, 1990	0	1.0	0	0	3.0	0	.03
Jul 4, 1990	0	1.0	0	0	3.0	0	.03
Aug 4, 1990	0	.10	.10	.20	3.0	0	.20
Nov 26, 1990	0	.10	.10	.20	3.0	0	.20
Apr 13, 1991	0	.10	.20	.50	3.0	0	.05
May 16, 1991	0	.10	.20	.50	3.0	0	.05
WATERCRESS							
Apr 12, 1990	0	2.0	1.0	0	0	0	.40
Jul 4, 1990	0	2.0	1.0	0	0	0	.40
Aug 4, 1990	0	2.5	1.6	0	0	0	2.0
Nov 26, 1990	0	Tr	Tr	0	0	0	.90
Apr 13, 1991	0	.40	.20	0	.10	.20	.20
May 16, 1991	0	.40	.20	0	.10	.20	1.60
BOULDER/COBBLE							
Apr 12, 1990	0	0	.25	0	0	0	.02
Jul 4, 1990	0	0	.25	0	0	0	.02
Aug 4, 1990	0	0	.25	0	0	0	.02
Nov 26, 1990	0	0	.25	0	0	0	.02
Apr 13, 1991	0	0	.25	0	0	0	.02
May 16, 1991	0	0	.25	0	0	0	.02
SUBMERGED AQUATIC VEG'TN							
Apr 12, 1990	0	0	0	0	0	0	0
Jul 4, 1990	0	0	0	0	0	0	0
Aug 4, 1990	0	0	0	0	0	0	0
Nov 26, 1990	0	0	0	0	0	0	0
Apr 13, 1991	0	0	0	0	0	0	0
May 16, 1991	0	0	0	0	0	0	0

Tr=Trace (<.01)

SITE #

	8	9	10	11	12	13	14
OVERHANGING GRASS							
Apr 12, 1990	0	0	0	0	0	0	3.7
Jul 4, 1990	0	0	0	0	0	0	3.7
Aug 4, 1990	0	0	0	0	0	0	3.7
Nov 26, 1990	0	6.75	0	0	0	0	3.7
Apr 13, 1991	.20	.95	.20	0	0	0	.10
May 16, 1991	.20	.95	.20	0	0	0	.10
UNDERCUT BANK							
Apr 12, 1990	.60	2.15	.45	0	0	0	1.1
Jul 4, 1990	.60	2.15	.45	0	0	0	1.1
Aug 4, 1990	.60	2.15	.45	0	0	0	1.1
Nov 26, 1990	.60	2.15	.45	0	0	0	1.1
Apr 13, 1991	.60	2.15	.45	0	0	0	1.1
May 16, 1991	.60	2.15	.45	0	0	0	1.1
WOODY DEBRIS							
Apr 12, 1990	.10	.20	.08	.50	.10	.03	0
Jul 4, 1990	.10	.20	.10	.10	.10	.03	0
Aug 4, 1990	.10	.20	.10	.10	.10	.03	0
Nov 26, 1990	.10	.20	.10	.10	.10	.03	0
Apr 13, 1991	.10	.20	.10	.01	.10	.03	0
May 16, 1991	.10	.20	.10	.01	.10	.03	0
WATERCRESS							
Apr 12, 1990	0	.60	1.20	33.0	29.0	2.6	0
Jul 4, 1990	0	.60	4.10	33.0	29.0	2.6	0
Aug 4, 1990	0	.60	4.10	33.0	29.0	2.6	0
Nov 26, 1990	0	0	Tr	1.5	1.5	32.0	0
Apr 13, 1991	0	0	.35	0	0	1.5	.10
May 16, 1991	0	.60	1.35	0	0	4.5	0
BOULDER/COBBLE							
Apr 12, 1990	0	0	.10	.20	0	.20	0
Jul 4, 1990	0	0	.10	.20	0	.20	0
Aug 4, 1990	0	0	.10	.20	0	.20	0
Nov 26, 1990	0	0	.10	.20	0	.20	0
Apr 13, 1991	0	0	.10	.20	0	.20	0
May 16, 1991	0	0	.10	.20	0	.20	0
SUBMERGED AQUATIC VEG'TN							
Apr 12, 1990	0	0	3.2	0	0	2.1	0
Jul 4, 1990	0	0	3.2	0	0	2.1	0
Aug 4, 1990	0	0	3.2	0	0	2.1	0
Nov 26, 1990	0	0	0	0	0	0	0
Apr 13, 1991	0	0	0	0	0	.46	0
May 16, 1991	0	0	0	0	0	3.5	0

Physical Habitat Variables measured at each site at beginning of study

SITE #

	1	2	3	4	5
LENGTH (m)	22.5	10	10	10	10
WIDTH (m)					
Mean±SD	.74±.35	3.0±.54	2.2±.81	3.5±.49	2.1±.68
Range	.30-1.2	1.9-3.9	1.2-3.6	2.6-4.1	1.1-3.1
DEPTH (m)					
Mean±SD	.23±.08	.17±.08	.14±.06	.17±.08	.23±.13
Range	.06-.42	.03-.42	.03-.27	.05-.33	.03-.44
VELOCITY (m/sec)					
Mean±SD	.43±.27	.12±.09	.21±.18	.09±.06	.12±.09
Range	0-.91	0-.46	0-.76	0-.24	0-.34
SUBSTRATE (Mean %±SD)					
Organic Matter (Live Roots)	37±19	26±18	12±14	1±3	15±7
Organic Matter (Detritus)	0	15±6	8±9	8±9	12±4
Silt	0	59±17	26±13	72±9	64±17
Sand	4±10	1±2	17±18	10±9	6±11
Gravel	15±21	0	23±13	5±4	5±8
Cobble	11±16	0	12±13	0	1±3
Boulder	0	0	2±4	0	0
Bedrock	0	0	0	0	0
Other (Clay)	33±10	0	0	0	0

SITE #

	6	7	8	9	10
LENGTH (m)	15	10	5	20	22.5
WIDTH (m)					
Mean±SD	1.4±.39	1.9±.73	1.8±.32	1.5±.30	1.4±.38
Range	.75-2.1	.95-3.3	1.4-2.3	.80-2.0	.90-2.1
DEPTH (m)					
Mean±SD	.24±.14	.13±.07	.27±.14	.20±.09	.13±.05
Range	.03-.55	.03-.32	.05-.62	.02-.39	.03-.25
VELOCITY (m/sec)					
Mean±SD	.21±.12	.40±.34	.21±.27	.21±.09	.40±.21
Range	0-.46	0-.98	0-.91	0-.37	0-1.1
SUBSTRATE (Mean%±SD)					
Organic Matter (Live Roots)	4±5	56±33	10±6	0	0
Organic Matter (Detritus)	18±10	8±6	7±5	4±5	0
Silt	61±15	30±26	38±26	70±15	9±8
Sand	14±14	2±4	35±19	20±13	12±6
Gravel	3±4	1±2	10±13	6±5	55±24
Cobble	0	1±2	0	0	21±23
Boulder	0	2±7	0	0	3±7
Bedrock	0	0	0	0	0
Other (Clay)	0	0	0	0	0

	SITE #			
	11	12	13	14
LENGTH (m)	25	20	20	17
WIDTH (m)				
Mean±SD	2.3±.34	1.5±.20	2.2±.58	5.4±1.8
Range	1.7-2.7	1.2-1.8	1.0-3.0	2.2-7.3
DEPTH (m)				
Mean±SD	.12±.05	.11±.05	.10±.05	.52±.23
Range	.05-.23	.02-.20	.03-.23	.13-1.1
VELOCITY (m/sec)				
Mean±SD	.21±.09	.40±.15	.21±.12	0
Range	0-1.3	.40-.67	0-.46	0
SUBSTRATE (Mean±SD)				
Organic Matter (Live Roots)	0	0	0	0
Organic Matter (Detritus)	0	0	0	0
Silt	50±20	20±11	45±17	45±25
Sand	21±11	17±17	14±10	27±17
Gravel	25±15	35±14	27±10	20±13
Cobble	2±4	28±24	3±6	3±6
Boulder	2±6	0	11±16	3±6
Bedrock	0	0	0	3±6
Other (Clay)	0	0	0	0

Table . Summary of sex ratios including mean TL (total length), weights, and ova weights of Big Spring spinedace examined during stomach analyses.

	Female	Male	Unknown
Nov 20, 1990			
Number	11	8	11
Mean TL(mm)±SD	82±12	73±16	38±4
Mean Wt(gm)±SD	5.5±2.7	4.2±3.0	.50±.20
Mean Wt(gm) Ova±SD	.15±.07	-	-
Mar 26, 1991			
Number	18	18	11
Mean TL(mm)±SD	83±18	63±18	45±9
Mean Wt(gm)±SD	6.3±4.1	3.0±2.6	.90±.70
Mean Wt(gm) Ova±SD	.57±.49	-	-
May 16, 1991			
Number	9	5	9
Mean TL(mm)±SD	74±6	76±16	42±5
Mean Wt(gm)±SD	4.2±1.1	4.4±2.6	.80±.20
Mean Wt(gm) Ova±SD	.47±.34	-	-
All Combined			
Number	38	31	31
Mean TL(mm)±SD	81±14	62±18	41±7
Mean WT(gm)±SD	5.6±3.3	3.5±2.7	.70±.50
Mean Wt(gm) Ova±SD	.42±.41	-	-