FIELD TRIP REPORT

DATE: AUGUST 30-31, 2005
TITLE: BIG SPRINGS CREEK FISH POPULATION INVENTORY POPULATION SURVEY
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OBJECTIVE

To conduct a survey to document and inventory fish populations inhabiting Big Springs Creek, Snake Valley, White Pine County, Nevada.

BACKGROUND

Located in southern Snake Valley, Big Springs Creek (Lake Creek) arises from a number of spring sources at an elevation of approximately 1800 meters (5905 feet) at the southeast end of the south Snake Range and flows northeastward into Pruess Lake (Utah), a span of approximately 25.0 kilometers (15.5 miles). From its origin to the Nevada-Utah state line, it contains approximately 10.5 kilometers (6.5 miles) of habitat, of which 6.0 kilometers (3.72 miles) is on land administered by the BLM. The remainder of the stream within Nevada (4.5 kilometers – 2.79 miles) sits on private property owned by Brian Okelberry.

Big Springs Creek is unique in the fact that it is one of only two waters in Nevada (Thousand Springs Creek – Elko County) that contain Bonneville Basin endemic non-salmonid fishes. The first documented collection of fish from the stream was conducted in 1938 by the University of Michigan and found redside shiners (*Richardsonius balteatus*), speckled dace (*Rhinichthys osculus*), Utah chub (*Gila atraria*), Utah suckers (*Catostomus ardens*), and mottled sculpin (*Cottus bairdi*). Since then, a number of surveys of the stream have been conducted by both academic institutions and NDOW personnel with varying results (Table 1). The most recent comprehensive survey of the stream was conducted by M.E. Anderson in 1991. The survey classified redside shiners and speckled dace as abundant. Utah suckers and mottled sculpin were classified as rare while Utah chub were determined to be extirpated from the stream. The last survey to document all five original species in Big Springs Creek occurred in 1968.

A number of non-native game fish species have been introduced into Big Springs Creek over the course of the past 60 years in an attempt to establish a sport fishery. Beginning in 1945 and 1948 respectively, rainbow trout and brown trout were first released into the stream. From 1953 to 1968, rainbow trout, brown trout, largemouth bass, smallmouth bass, crappie, and channel catfish were all introduced. Using rotenone, the stream was treated in 1968 in an effort to reduce numbers of Utah chub and Utah sucker

that were judged to be at nuisance levels. One year subsequent to its eradication, Utah chub and redside shiners were found in the stream while smallmouth bass were stocked again in 1971. The last non-native introduction conducted at the stream was in 1980 when 152 brown trout were stocked. Although rainbow trout and brown trout were occasionally found in survey work completed in 1960's and 1970's, all other non-native sport fish species failed to become established in Big Springs Creek.

Table 1. Historic Documentation of Fishes Inhabiting Big Springs Creek.

Year	Investigator	Utah chub	Speckled dace	Redside shiner	Utah sucker	Mottled sculpin	Other
1938	University of Michigan	X	X	X	X	X	
1952	Frantz – NDOW	X	X	X	X	X	Brown trout
1953	Frantz –NDOW	X					Brown trout
1962	Lockard – NDOW	X	X		X	X	Brown trout
1964	J. E. Deacon		X	X		X	
1968	J.E. Deacon	X	X	X	X	X	
1968	Lockard – NDOW (Pre-treatment)	X	X	X	X	X	
1969	Dodge - NDOW	X		X			
1970	NDOW	X		X			Brown trout Rainbow trout
1975	McLelland - NDOW	X	X	X	X		
1978	NDOW						Rainbow trout
1984	NDOW - Stream Survey		X	X			
1991	M.E. Anderson		X	X	X	X	
1996	Haskins - NDOW	X	X	X		X	

PROCEDURES

Electroshocking activities were conducted at stations located 0.8 kilometers (0.5 miles) apart that were established from a literature search and pre-plotted on a USGS 1:100,000 topographical map. Stations were given named waypoints using a Garmin 12CX hand-held GPS unit. A stream length of 50.0 meters (164.0 feet) was measured at each station and a block net set at the upper end to prevent escape. A Smith Root Model 24 backpack electroshocker was employed in a one-pass procedure to sample the entire stream length. Two or three standard dip nets were used to capture stunned fish which were temporarily held in a 5-gallon bucket until shocking activities were completed. At each station, a representative sample of 50 speckled dace, redside shiners, Utah suckers, Utah chub, and mottled sculpin were measured (total length – millimeters) and returned to the stream. Remaining fish were counted. A rough estimate of fish missed with the dip

nets was noted. Basic habitat parameters were recorded at each station and temperature taken with a standard bulb thermometer. Stream widths and depths (1/4, 1/2, and 3/4) were recorded at three locations (0 meters, 50 meters, and 100 meters) at each station.

Portions of an irrigation ditch running somewhat parallel to the west of Big Springs creek was also spot-shocked in an effort to determine the presence or absence of fish species. No effort was made to analyze age structure or quantify fish densities in the channel.

Employees of Bio-West, Inc. assisted in survey activities and gathered a multitude of water quality and limnological data while sampling for fish and benthic macroinvertebrate species in spring sources at the stream's origin. The independent consulting firm is under contract by the Southern Nevada Water Authority to gather baseline data relative to plans to construct series of deep wells in Snake Valley with an associated pipeline to transport water to the Las Vegas Valley. Data from Bio-West, Inc. is available at the Ely Field Office of the Nevada Department of Wildlife.

PROJECT DETAILS AND EVALUATION

A total of 896 fish consisting of 403 speckled dace, 343 redside shiners, 92 Utah suckers, 56 Utah chub, and 2 mottled sculpin were captured from 11 stations (550.0 m) sampled on Big Springs Creek. At least two separate species were found at all eleven stations sampled. One station yielded all five species while five stations held four species. Three separate species were found at four of the eleven stations sampled and just one station revealed two species (Table 2). Because of high fish densities and mostly murky water, many fish were missed with the dip nets at a number of stations. This survey is not intended to guess the actual number of fish in a stream, but rather give a comparison of the relative abundance of particular species over a period of time.

Table 2. Big Springs Creek Physical Parameters and Fish Captured

STATION	AVERAGE WIDTH (m)	AVERAGE DEPTH (m)	LENGTH SAMPLED (m)	# OF SPECKLED DACE CAPTURED	# OF REDSIDE SHINERS CAPTURED	# OF UTAH SUCKERS CAPTURED	# OF UTAH CHUB CAPTURED	# OF MOTTLED SCULPIN CAPTURED
BSC 01	6.57	0.26	50	180	2	0	0	1
BSC 02	2.93	0.18	50	95	93	4	7	1
BSC 03	3.73	0.30	50	97	88	14	1	0
BSC 04	2.47	0.25	50	11	17	10	0	0
BSC 05	3.34	0.28	50	3	22	9	2	0
BSC 06	3.03	0.44	50	2	16	7	0	0
BSC 07	2.25	0.29	50	14	69	18	2	0
BSC 08	3.17	0.34	50	1	26	8	1	0
BSC 09	2.45	0.29	50	0	9	8	1	0
BSC 10	2.50	0.25	50	0	0	9	5	0
BSC 11	3.90	0.46	50	0	1	5	37	0
TOTALS	**3.30**	**0.30**	**550**	**403**	**343**	**92**	**56**	**2**

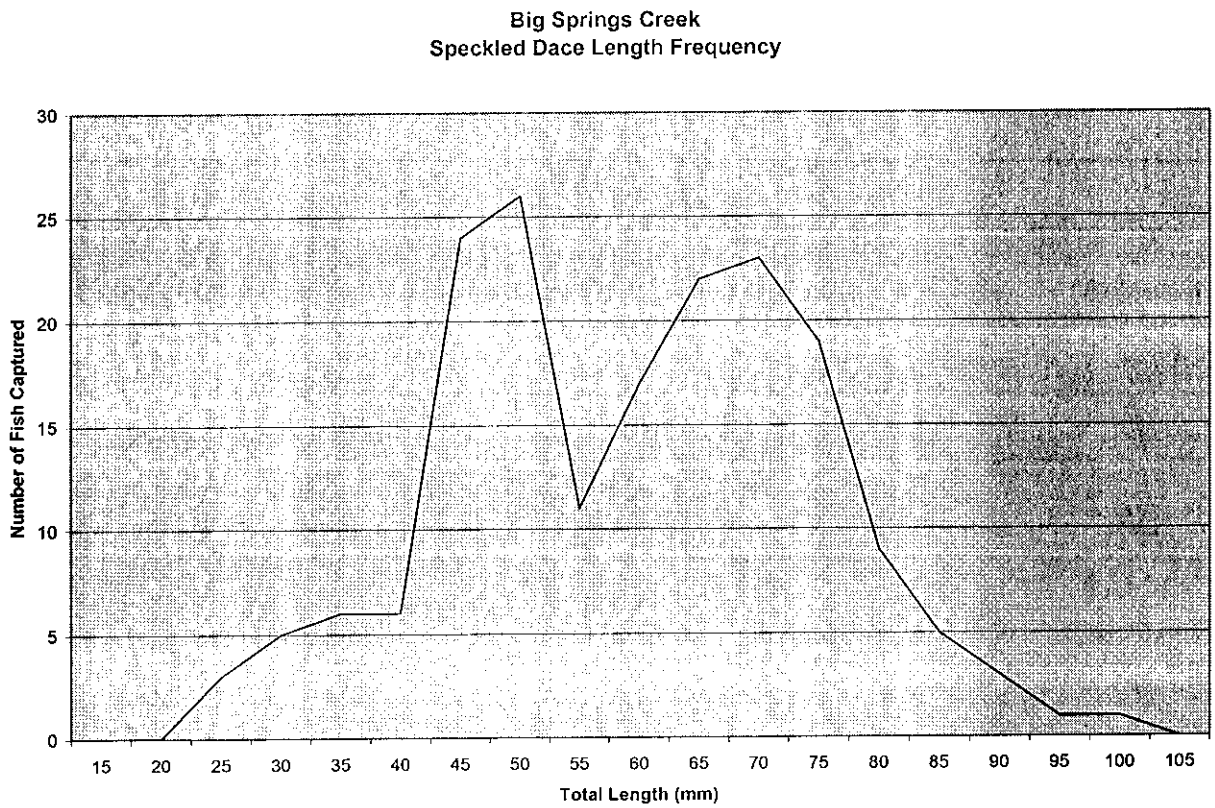
A total of 403 speckled dace were captured from eight of the eleven stations sampled on Big Springs Creek accounting for 45.0% of all fish captured and resulting in a population estimate of 1007.5 fish per kilometer (624.7 fish per mile). The lower-most three stations sampled on the stream were devoid of speckled dace and thus are not included in population estimates. It must be noted that this population estimate is

artificially low due to the fact that only a single pass was made with the electroshocker at each station and numerous misses with the dip nets were noted. Total length of 181 speckled dace measured ranged from 23 mm (0.91 inches) to 96 mm (3.78 inches) and averaged 57.54 mm (2.27 inches) overall. Given a current distribution of 7.5 kilometers (4.65 miles) in the Nevada portion of Big Springs Creek, a conservative total population estimate of 7556.3 speckled dace can be made.

Using breakpoints of 40 mm and 55 mm, length frequency analysis of reveals at least three distinct age classes of speckled dace in Big Springs Creek (Graph 1). Because speckled dace rarely live beyond the age of three years, it is assumed that individuals shorter than 40 mm are class 0 young-of-the-year fish while the remaining two age classes represent one and two year-olds (Class I and II) respectively. Regardless, this analysis provides evidence of continued spawning success by speckled dace in recent years.

Because no speckled dace were found downstream of BSC08, it is likely that habitat requirements for the species preclude its persistence in this portion of the stream. The reason for its absence from the lower section of the stream is unknown but could be related to water quality and sedimentation issues related to livestock impacts.

Graph 1.

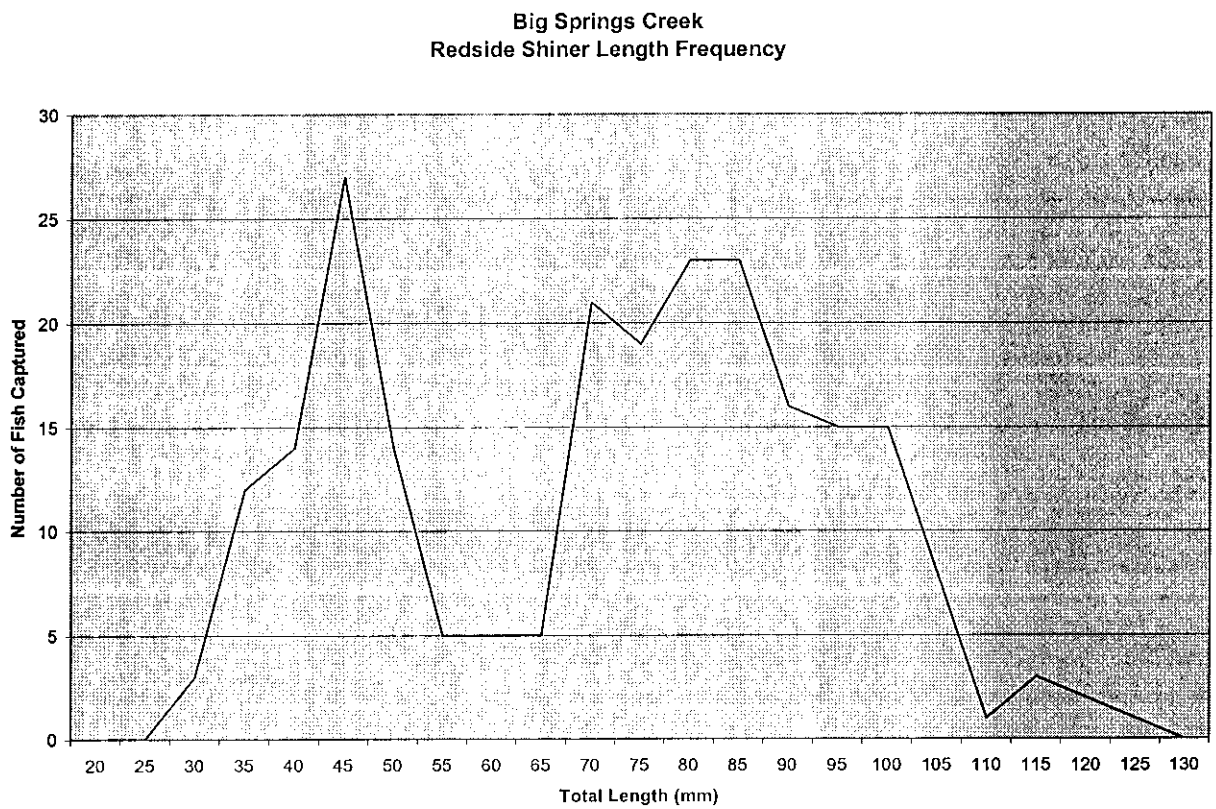


A total of 343 redside shiners were captured from ten of the eleven stations sampled on Big Springs Creek accounting for 38.3% of all fish captured and resulting in a

population estimate of 623.6 fish per kilometer (386.7 fish per mile). Station BSC10 had shiners present in stations both upstream and downstream from it and thus is included in population estimates. It must be noted that this population estimate is artificially low due to the fact that only a single pass was made with the electroshocker at each station and numerous misses with the dip nets were noted. Total length of 232 redside shiners measured ranged from 27 mm (1.06 inches) to 121 mm (4.76 inches) and averaged 69.63 mm (2.74 inches) overall. Given a current distribution of 10.5 kilometers (6.51 miles) in the Nevada portion of Big Springs Creek, a conservative total population estimate of 6547.8 redside shiners can be made.

Using breakpoints of 60 mm and 110 mm, length frequency analysis of reveals at least three distinct age classes of redside shiners in Big Springs Creek (Graph 2). Because young shiners are less susceptible to shocking and somewhat difficult to capture with the dip nets employed, it is unknown if the smallest of the three age classes represents YOY or Class I fish. Regardless, this analysis provides evidence of continued spawning success by redside shiners in recent years.

Graph 2.

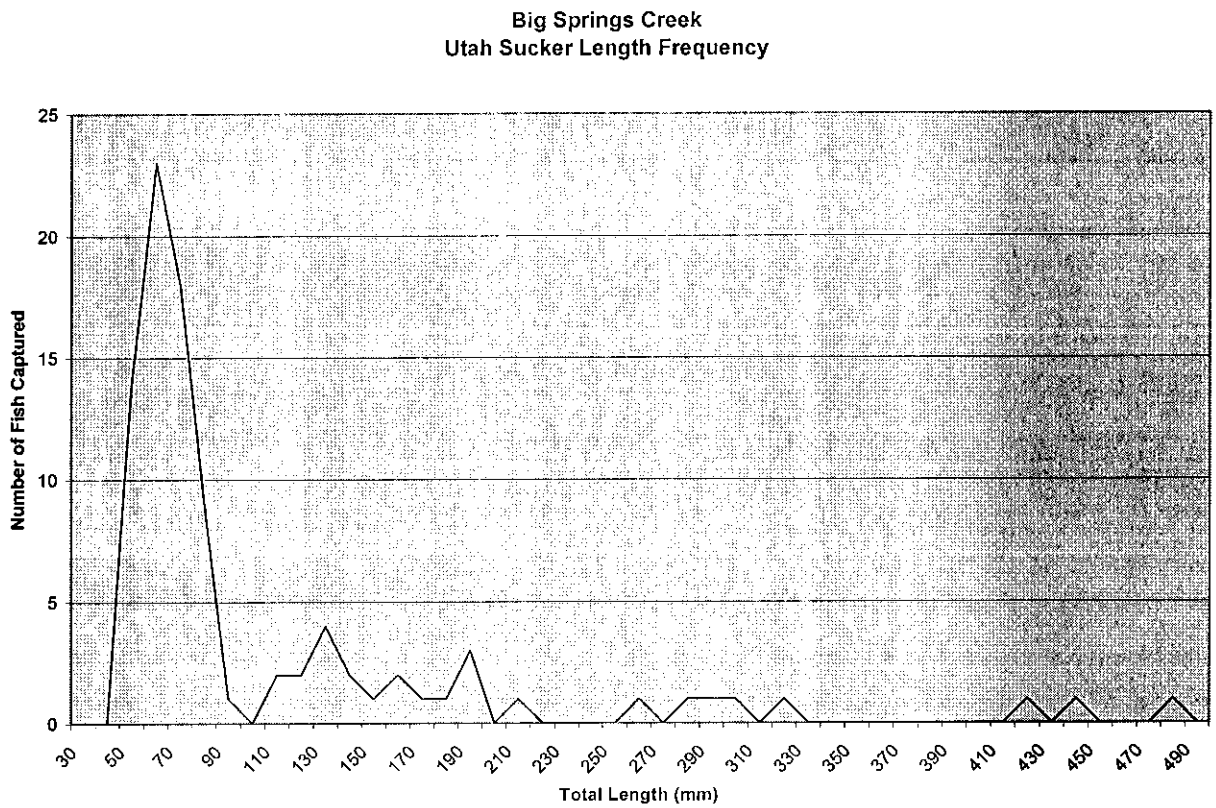


A total of 92 Utah suckers were captured from ten of the eleven stations sampled on Big Springs Creek accounting for 10.3% of all fish captured and resulting in a population estimate of 184.0 fish per kilometer (114.1 fish per mile). The lower-most station sampled

(BSC01) on the stream was devoid of suckers and thus is not included in population estimates. It must be noted that this population estimate is artificially low due to the fact that only a single pass was made with the electroshocker at each station and numerous misses with the dip nets were noted. Total length of 92 Utah suckers measured ranged from 42 mm (1.65 inches) to 473 mm (18.62 inches) and averaged 102.61 mm (4.04 inches) overall. Given a current distribution of 9.4 kilometers (5.83 miles) in the Nevada portion of Big Springs Creek, a conservative total population estimate of 1729.6 Utah suckers can be made.

Using breakpoints of 100 mm, 220 mm, and 330 mm, length frequency analysis of reveals at least four distinct age classes of Utah sucker in Big Springs Creek (Graph 3). Of note, are the three largest suckers captured in the survey. With lengths ranging from 420 mm (16.54 inches) to 473 mm (18.62 mm), this age class is a full 108 mm (4.25 inches) longer than all other suckers captured. These are undoubtedly mature fish and suggest habitat conditions in the stream are conducive to sucker growth and survival. Regardless, this analysis provides evidence of continued spawning success by Utah suckers in recent years.

Graph 3.

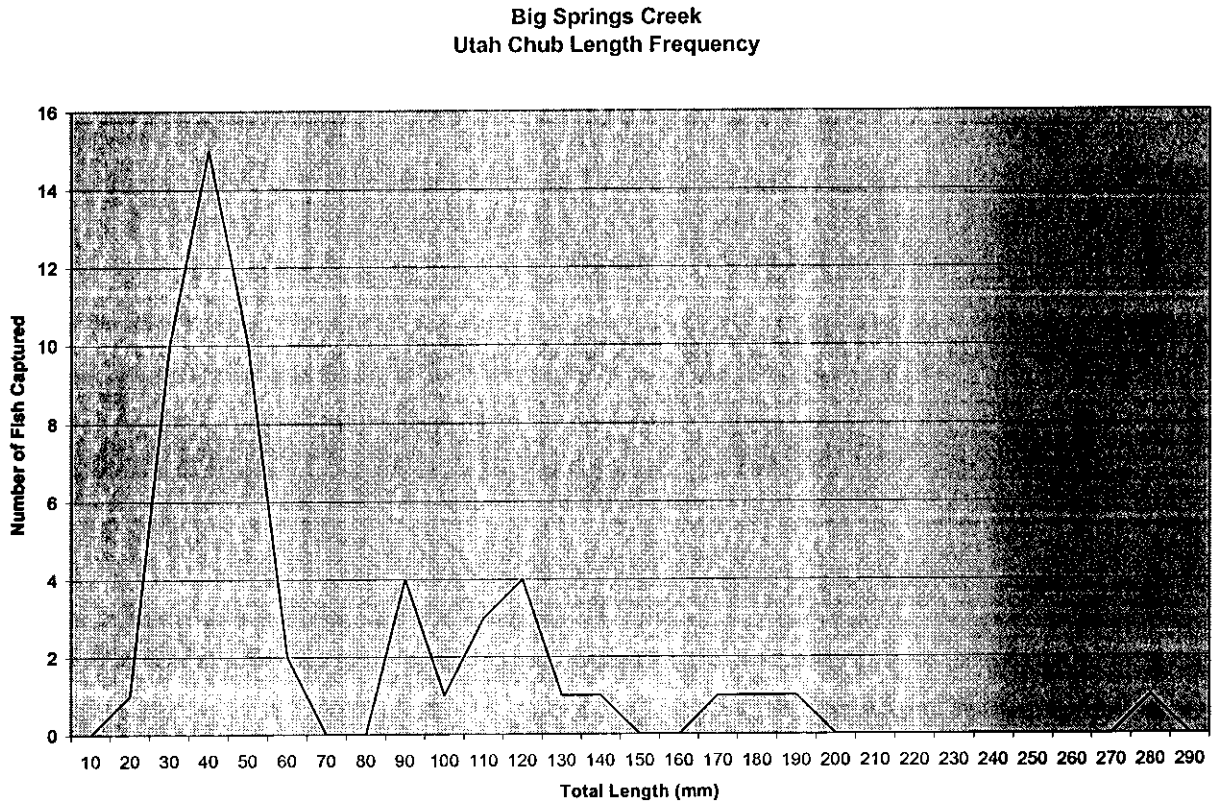


A total of 56 Utah chub were captured from eight of the eleven stations sampled on Big Springs Creek accounting for 6.2% of all fish captured and resulting in a population

estimate of 112.0 fish per kilometer (69.4 fish per mile). The lower-most station sampled (BSC01) on the stream was devoid of chubs and thus is not included in population estimates, however stations BSC04 and BSC06 had chubs present both upstream and downstream from them and are indeed included in population estimates. It must be noted that this population estimate is artificially low due to the fact that only a single pass was made with the electroshocker at each station and numerous misses with the dip nets were noted. Total length of 56 Utah chub measured ranged from 19 mm (0.75 inches) to 274 mm (10.79 inches) and averaged 65.02 mm (2.56 inches) overall. Given a current distribution of 9.4 kilometers (5.83 miles) in the Nevada portion of Big Springs Creek, a conservative total population estimate of 1052.8 Utah chubs can be made.

Using breakpoints of 70 mm and 150 mm, and 200 mm, length frequency analysis of reveals at least four distinct age classes of Utah chub in Big Springs Creek (Graph 4). Similar to the length analysis of Utah suckers, a single Utah chub was captured that was a full 86 mm (3.39 inches) longer than all other chubs in the survey. This is obviously a very old fish and again suggests habitat conditions in the stream are conducive to chub growth and survival. Regardless, this analysis provides evidence of continued spawning success by Utah chub in recent years.

Graph 4.



A total of 2 mottled sculpins were captured from two of the eleven stations sampled

on Big Springs Creek accounting for 0.2% of all fish captured and resulting in a population estimate of 20.0 fish per kilometer (12.4 fish per mile). The lower-most nine stations sampled on the stream were devoid of sculpins and thus are not included in population estimates. It must be noted that this population estimate is artificially low due to the fact that only a single pass was made with the electroshocker at each station. Total length of the two sculpins averaged 79.0 mm (3.11 inches) and were 72 mm and 86 mm respectively. Given a current distribution of just 0.9 kilometers (0.56 miles) in the Nevada portion of Big Springs Creek, a conservative total population estimate of 18 mottled sculpins can be made.

Both mottled sculpins captured in the survey appeared to be adults and are undoubtedly from the same age class. Additional work completed by the Great Basin National Park subsequent to this survey found high densities and numerous age classes of sculpins in the Utah portion of Big Spring Creek near a spring source. Most of the stream does not display the cool water, rocky substrate habitat traditionally associated with sculpins and thus it is not surprising that the species was found only near the spring sources at the stream's origin. Nevertheless, it is encouraging to know that the species is not only surviving, but spawning in the stream as well.

The irrigation channel that runs parallel to the west of Big Springs Creek was spot-shocked at regular intervals for a length of approximately 1.5 kilometers (0.93 mile) below the ranch headquarters where it is diverted to flood-irrigate a pasture. The channel was wide, shallow, and slow with an abundance of algae and submergent vegetation. Nonetheless, numerous fish were contacted throughout the length of the channel whose densities were estimated at 90% redside shiners, 9% Utah chubs, and 1% speckled dace. Crayfish were also present.

An additional channel (100 m in length) fed by a spring source was located along the same road (west side of Big Springs Creek) approximately 2.2 kilometers (1.36 miles) below the ranch house that was also sampled. Although it was also heavily vegetated, redside shiners and crayfish were found to be abundant.

Big Springs Creek is unlike many other streams in White Pine County in the fact that it originates at the toe slope of the Snake Mountains and flows across the valley floor through a salt desert scrub-type habitat. Its physical composition, hydrologic regime, soil profile, and vegetative makeup are very dissimilar to those found in the mountain streams that are typically surveyed for native trout. Likewise, the habitat requirements for the native species that evolved in this low-elevation environment are somewhat different than those for salmonid species. In general, habitat requirements for native species in Big Spring Creek are not as strict in relation to water quality, riparian vegetation, and temperature as those for native trout.

Habitat conditions at Big Springs Creek appear to be stable at this time and favorable to its populations of native fish. Water temperature ranged from 12.0°C (53.6°F) at station BSC07 to 21.8°C (71.2°F) at stations BSC04 and BSC05 and averaged 18.3°C (64.9°F) overall (Table 3). Silt made up 64.1% of the stream bottom substrate. The

balance was comprised mainly of sand (13.2%) and gravel (16.4%). Sedimentation was judged as light at the two upper-most stations sampled, moderate at BSC05, and either heavy or severe at the remaining stations. Turbidity was judged as clear at the upper-most two stations, cloudy at the next two stations downstream, and murky at the lower-most seven stations surveyed. Because much of the stream is situated within active pastures, livestock grazing undoubtedly contributes increased amounts of silt as well as elevated sedimentation and turbidity ratings.

Table 3. Big Springs Creek Habitat Conditions and Physical Parameters

Station	Temp. (°C)	Turbidity	Sedimentation	Pool / Riffle Ratio	Gradient	Riparian Canopy	% Bank Stability	Avg. Width	Avg. Depth
BSC 01	18.0	Clear	Light	10 / 90	Moderate	Open	40.0	6.57	0.26
BSC 02	19.0	Clear	Light	10 / 90	Low	Open	35.0	2.93	0.18
BSC 03	21.0	Cloudy	-	10 / 90	Low	-	25.0	3.73	0.30
BSC 04	21.8	Cloudy	Heavy	75 / 25	-	Open	90.0	2.47	0.25
BSC 05	21.8	Murky	Moderate	All Slow Run	-	Open	85.0	3.34	0.28
BSC 06	21.0	Murky	Severe	All Slow Run	Very Low	Open	10.0	3.03	0.44
BSC 07	12.0	Murky	Severe	All Slow Run	Very Low	Open	40.0	2.25	0.29
BSC 08	14.0	Murky	Severe	All Slow Run	Low	Open	65.0	3.17	0.34
BSC 09	17.8	Murky	Heavy	75 / 25	-	Open	92.5	2.45	0.29
BSC 10	16.4	Murky	Heavy	33 / 67	-	Open	75.0	2.50	0.25
BSC 11	-	Murky	Heavy	All Slow Run	-	Open	100.0	3.90	0.46
AVG.	18.3	-	-	-	-	-	59.8	3.30	0.30

Physical parameters of Big Springs Creek appear favorable to sustain its populations of native fish. Average stream widths ranged from 2.25 m (7.38 feet) at station BSC07 to 6.57 m (21.56 feet) at station BSC01 and averaged 3.30 m (10.83 feet) overall. Stream depth averaged 0.30 m (11.81 inches) and ranged from 0.18 m (7.09 inches) at station BSC02 to 0.46 m (18.11 inches) at BSC11. Pool to riffle ratios ranged from a low of 10 / 90 at the upper-most three stations to a high of 75 / 25 at BSC04 and BSC09 and averaged 35.5 / 64.5 overall. It must be noted that ratios could not be estimated at five stations that were classified as "slow runs." Gradient was judged as moderate at the upper-most station (BSC01) and either low or very low at the remaining stations sampled.

Because the stream flows through the bottom of the valley, riparian components are vastly different than those found in mountain streams as well. Other than an occasional Russian olive tree, a noticeable lack of any riparian vegetation or canopy was noted throughout the entire length of Big Springs Creek. Percent shading estimates were 0% at all stations. Bank cover was typically made up of grasses, sedges, and rushes only in the immediate vicinity of the stream channel. With a lack of any substantial riparian area, upland vegetation encroached directly into the stream channel and was comprised of traditional salt desert species such as sagebrush, greasewood, rabbit brush, and bunchgrasses. Bank stability was directly correlated to the accessibility of livestock to the stream channel. Ratings averaged 59.8% overall and ranged from 10% at BSC06 to 100% at BSC11. Aquatic vegetation consisted of watercress and filamentous algae found predominantly at the upper-most three stations.

Cattle were present throughout many portions of the stream at the time of the survey. With the exception of BSC03, the upper-most six stations are located on private property and were noted to be in meadows and/or pastures where livestock grazing was actively occurring. The remaining six stations were on land administered by the BLM and

also showed visible impacts from livestock utilization. Livestock utilization estimates ranged from 20% at BSC01 to 100% at five stations and averaged 69.5% overall. Estimated damage caused by livestock averaged 29.5% and ranged from 0% at BSC11 to 70% at BSC03. Specific damage was identified as hoof action, grazing, and trampling which resulted in bank erosion and sloughing at most stations and channel down cutting at two stations. Incised channels from livestock use were noted at BSC03 (1.8 m -2.4 m) and BSC06 (0.9 m - 1.2 m). As discussed above, increased sedimentation from livestock use was noted throughout the stream.

Numerous species of macroinvertebrates were noted during the survey which provides an adequate food base for the stream's populations of native fish. Most common were crayfish which were contacted at all stations sampled and found to be extremely abundant at most. Dragonfly nymphs were found at seven stations surveyed while predacious diving beetles were found at four. Aquatic earthworms, scuds, free-swimming caddisfly larvae, free-swimming mayfly larvae, stone-case caddisfly larvae, and blood midge larvae were noted at only one or two stations each.

Pill clams were observed at BSC08 and while an unidentified species of spring snail was found at BSC05. The spring snail may be the Hamlin Valley spring snail which was found in quantity by Bio-West personnel elsewhere at Big Springs Creek. Two species of non-native snail (not spring snails) were found at BSC09 as well.

Aside from better grazing practices, there appears to be no limiting factors to the native fish populations inhabiting Big Spring Creek. Although there are some obvious livestock impacts, it must be understood that habitat requirements for these species appear to be far less stringent than other fish. Land uses that would threaten the existence of other species do not appear to detrimentally affect native fish inhabiting Big Springs Creek. These species have evolved in these conditions and, evidenced by the habitat where they were encountered, appear to be very resilient and adaptable to change. Land uses practices at Big Springs Creek are not expected to change significantly in the future. Most species that reside in the stream are not only surviving, but thriving. Because none of the species contacted during the survey are federally listed as threatened or endangered, the private landowners have a positive or, at least indifferent attitude toward them. When contacted, the landowner was in favor of any scientific work that could potentially stop the pipeline project from becoming a reality in Snake Valley. Gratitude is greatly expressed toward Mr. Brian Okelberry, who not only granted permission for survey activities to be conducted on his property, but was also extremely helpful in identifying water conveyance patterns and access routes.

This survey was extremely significant and in the fact that it was the first time since 1968 (prior to a rotenone treatment) only the fourth time ever that all five native fish species were found in the Nevada segment of Big Springs Creek. Data gathered from this survey will prove invaluable in assisting future land management decisions and provide a valuable baseline comparison for future monitoring endeavors.

RECOMMENDATIONS

That population surveys be conducted on Big Springs Creek periodically in the future to monitor the densities and distribution of its native fish populations.