































In 1999, the study area was expanded downstream to Clay Hills Crossing, Utah (RM 3) thereby encompassing reaches 1 through 4. The upstream-most sampling area remained at RM 127.5 during 1999. There were seven razorback sucker larval fish collection efforts between 5 April and 14 June 1999. Four of the sampling efforts were between RM 127.5 and Bluff and three were in the lower reach. Of the three lower reach sampling efforts, one was between Bluff and Mexican Hat, and two were between Mexican Hat and Clay Hills. For presentation purposes, the 1999 data were separated into upper and lower reaches with the former including collections between RM 127.5 and Bluff and the latter containing collections from Bluff downstream to Clay Hills Crossing.

## Methods

Access to the river and sampling localities was gained through the use a 16' inflatable raft that transported both personnel and collecting gear. There was not a predetermined number of samples per river mile or geomorphic reach for this study. Instead, an effort was made to collect in as many suitable larval fish habitats as possible within the river reach being sampled. Previous San Juan River investigations have clearly demonstrated that larval fish most frequently occur and are most abundant in low velocity habitats such as isolated pools, backwaters, and secondary channels.

Sampling efforts for larval fish concentrated on low velocity habitats using small mesh seines (1 m x 1 m x 0.8 mm) and light-traps. Mesohabitat type, length, maximum depth, and substrate were recorded for each sample. For seine samples, the length of each seine haul was determined in addition to the number of seine hauls per site. The aforementioned habitat conditions were recorded at light-trap sampling sites in addition to the time of placement and retrieval of the light-trap.

All retained specimens were placed in plastic bags containing a solution of 5% buffered formalin and a tag inscribed with unique alphanumeric code that was also recorded on the field data sheet. Samples were returned to the laboratory where they were sorted, specimens identified to species, enumerated, measured (minimum and maximum size [mm SL] for each species at each site), transferred to 70% ethyl alcohol, and catalogued in the Division of Fishes of the Museum of Southwestern Biology (MSB) at the University of New Mexico (UNM). Scientific and common names of fishes that are used in this report follow Robins et al. (1991) while six letter codes for species are derived from the first three letters of the genus followed by the first three letters of the species (Table 1). Common names, arranged in phylogenetic order, are presented in tables in this report.

Specimens whose species-specific identity was questionable were forwarded to Darrel E. Snyder (Larval Fish Laboratory, Colorado State University) for review. In addition, all specimens identified as razorback sucker (by MSB personnel) were sent to Darrel E. Snyder for verification. An electronic copy of the 1998 and 1999 fish collection data were submitted to Keller-Bliesner Engineering for inclusion in the San Juan River database.

This study was annually initiated prior to spring runoff and completed a few weeks before the cessation of spring runoff. Daily mean discharge during the study period was determined from U.S. Geological Survey Gauge (# 09368000) at Shiprock, New Mexico (Figures 3 and 4).

Table 1. Scientific and common names and species codes of fish collected from the San Juan River during 1998 and 1999.

Scientific Name	Common Name	Code
Order Cypriniformes		
Family Cyprinidae		
	carps and minnows	
<i>Cyprinella lutrensis</i> .....	red shiner	(CYPLUT)
<i>Cyprinus carpio</i> .....	common carp	(CYPCAR)
<i>Gila robusta</i> .....	roundtail chub	(GILROB)
<i>Pimephales promelas</i> .....	fathead minnow	(PIMRPO)
<i>Ptychocheilus lucius</i> .....	Colorado pikeminnow	(PTYLUC)
<i>Rhinichthys osculus</i> .....	speckled dace	(RHIOSC)
Family Catostomidae		
	suckers	
<i>Catostomus commersoni</i> .....	white sucker	(CATCOM)
<i>Catostomus (Pantosteus) discobolus</i> .....	bluehead sucker	(CATDIS)
<i>Catostomus latipinnis</i> .....	flannelmouth sucker	(CATLAT)
<i>Xyrauchen texanus</i> .....	razorback sucker	(XYRTEX)
Order Siluriformes		
Family Ictaluridae		
	bullhead catfishes	
<i>Ictalurus punctatus</i> .....	channel catfish	(ICTPUN)
Order Atheriniformes		
Family Cyprinodontidae		
	killifishes	
<i>Fundulus zebrinus</i> .....	plains killifish	(FUNZEB)
Family Poeciliidae		
	livebearers	
<i>Gambusia affinis</i> .....	western mosquitofish	(GAMAFF)
Order Perciformes		
Family Centrarchidae		
	sunfishes	
<i>Lepomis cyanellus</i> .....	green sunfish	(LEPCYA)



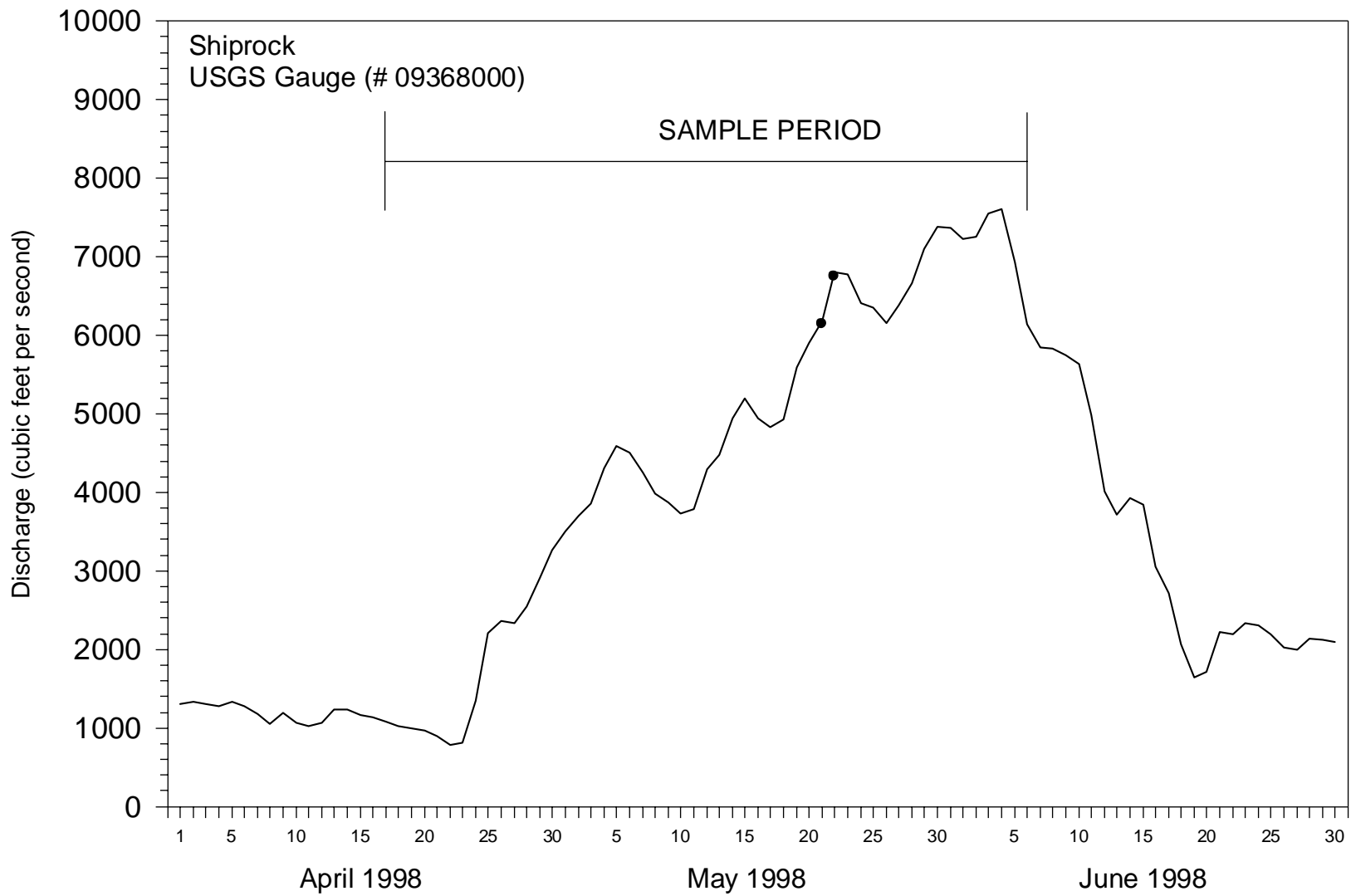


Figure 3. Hydrograph of the San Juan River at Shiprock, New Mexico during the 1998 sample period.

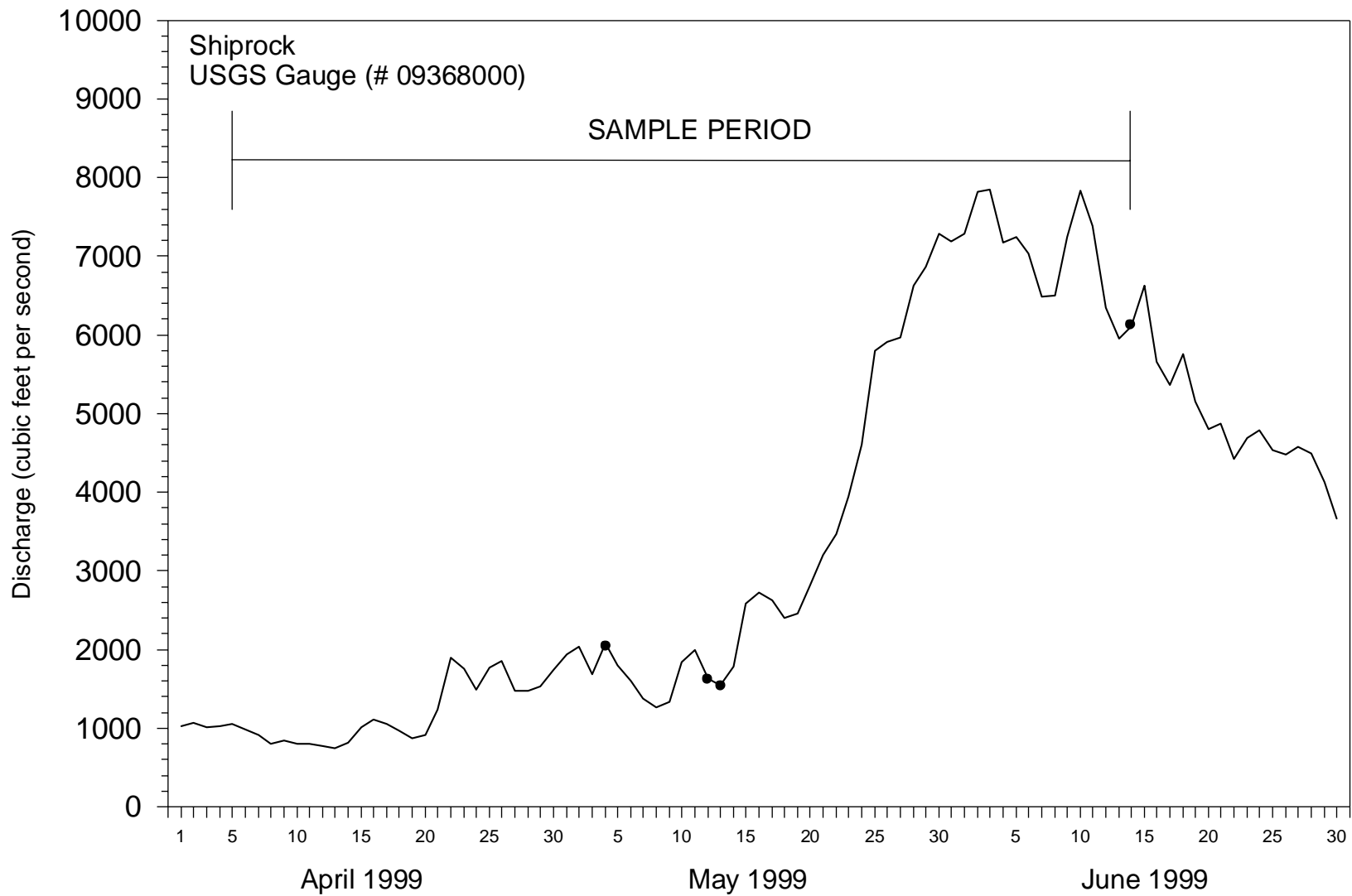


Figure 4. Hydrograph of the San Juan River at Shiprock, New Mexico during the 1999 sampling period.

## Results

### 1998 Survey

There were 182 samples taken at over 114 sites (Figure 5) during the 1998 razorback sucker larval fish project yielding 13,608 fish representing 14 species (Table 2). All except one of the 122 seine samples made during the 17 April 1998 to 6 June 1998 duration of the study produced fish. Included in this catch were razorback sucker ( $n=2$ ), roundtail chub ( $n=18$ ), and Colorado pikeminnow ( $n=4$ ). The 1998 catch was numerically dominated by a native sucker and nonnative cyprinid that collectively accounted for about 96% of the total catch. Over three times as many flannelmouth sucker, the most abundant fish, was taken as red shiner, the second most abundant taxon. The former species accounted for over 72% ( $n=9,810$ ) of the total catch by number while red shiner was 23.88% ( $n=3,249$ ) of the catch. None of the other 12 other species taken during 1998 accounted for more than 1.6% of the 1998 catch.

The 61 light-trap samples from 1998 sampling yielded three species and 721 specimens (Table 3). Almost one-third ( $n=20$ ) of the 61 light-trap samples failed to yield fish. Flannelmouth sucker was the most abundant taxon taken using this sampling methodology comprising almost 90% of the catch and occurring in 29.5% of the samples. About 82% ( $n=590$ ) of the light-trap catch was taken during the final sampling effort (3-6 June 1998) in which 17 light-trap collections were made. Over 100 flannelmouth sucker specimens were present in four of those 17 collections. Conversely, there were never more than 16 red shiner or bluehead sucker present in light-traps sample.

The first 1998 sampling effort yielded the fewest fish ( $n=123$ ) of this survey (Table 4). Only four species were collected in the 29 samples from 17 to 20 April 1998 of which 87% were red shiner (Figure 6). The other three taxa were each represented by eight or fewer individuals. No larval sucker were collected during the first 1998 sampling effort. There was a marked increase in the number of species and fish collected during the second sampling trip, as compared with the first. The 1,526 individuals taken in the 36 samples from 29 April to 1 May 1998 were represented by 10 species, two of which were native suckers (Table 5). Single juvenile specimens of roundtail chub and Colorado pikeminnow were present in samples from the second survey. Red shiner numerically dominated the second sampling effort comprising 55.18% of the catch while flannelmouth sucker was the second most abundant taxon ( $n=567$ ). None of the remaining eight species accounted for more than 4.4% of the total catch.

The third sampling effort yielded 10 species but, in contrast to the second trip, flannelmouth sucker was the most abundant species (Table 6). Red shiner was the second most abundant fish species during the third collecting effort but occurred in more samples ( $n=14$ ) than flannelmouth sucker. The number of larval bluehead sucker taken from 7 to 9 May 1998 remained low ( $n=6$ ) as this taxon accounted for <1% of the sucker catch. As during the second trip, a single juvenile Colorado pikeminnow was collected during this effort.

There was little difference in the total number of fish collected during the second, third, and fourth sampling trips (1,526, 1,350, 1,573). From 12 to 14 May 1998, flannelmouth sucker was again the most common fish while red shiner was the second most abundant species taken during sampling efforts (Table 7). Likewise, juvenile roundtail chub ( $n=3$ ) and Colorado pikeminnow ( $n=2$ ) were again present in collections made during the fourth sampling effort. Flannelmouth sucker and red shiner accounted for almost 95% of the total fourth trip sample while none the remaining seven species comprised >2.25% of the catch.

The fifth sampling effort yielded the greatest number of fish ( $n=6,373$ ) during the 1998 sampling effort accounting for almost 47% of that year's catch. Flannelmouth sucker remained the most abundant species in the samples (Table 8) comprising about 84% of the total catch with red

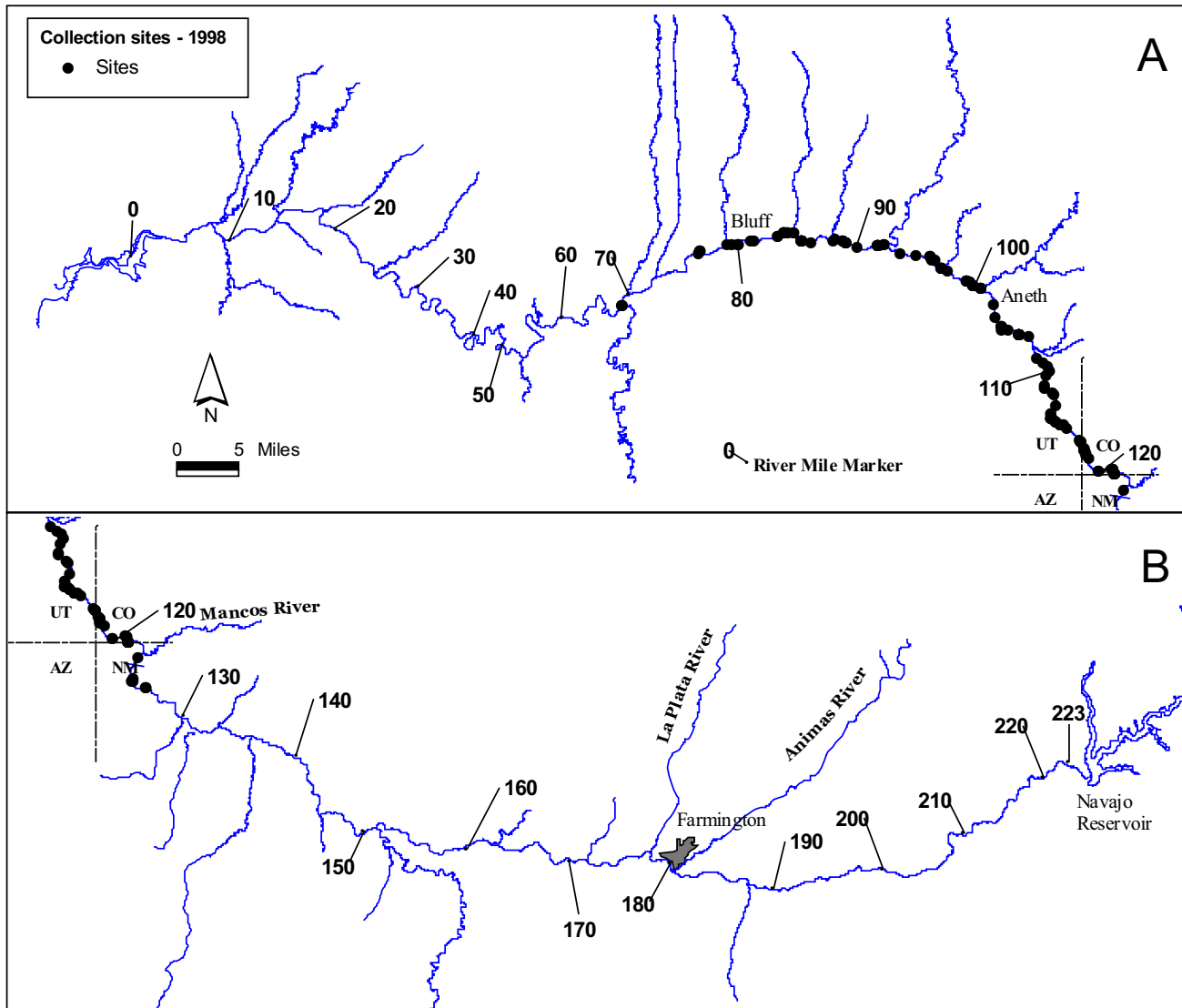


Figure 5. Distribution map of localities sampled during 1998.

Table 2. Summary of 1998 San Juan River larval razorback sucker project fish collections.

SPECIES	RESIDENCE STATUS <sup>1</sup>	TOTAL NUMBER OF SPECIMENS	PERCENT OF % OF TOTAL	FREQUENCY OF OCCURRENCE <sup>2</sup>	% FREQUENCY OF OCCURRENCE <sup>2</sup>
<b>CARPS AND MINNOWS</b>					
red shiner	I	3,249	23.88	107	58.47
common carp	I	2	0.01	1	0.55
roundtail chub	N	18	0.13	12	6.56
fathead minnow	I	210	1.54	54	29.51
Colorado pikeminnow	N	4	0.03	4	2.19
speckled dace	N	139	1.02	50	27.32
<b>SUCKERS</b>					
white sucker	I	1	0.01	1	0.55
flannelmouth sucker	N	9,810	72.09	103	56.28
bluehead sucker	N	147	1.08	36	19.67
razorback sucker	N	2	0.01	2	1.09
<b>BULLHEAD CATFISHES</b>					
channel catfish	I	2	0.01	2	1.09
<b>KILLIFISHES</b>					
plains killifish	I	4	0.03	4	2.19
<b>LIVEBEARERS</b>					
western mosquitofish	I	17	0.12	12	6.56
<b>SUNFISHES</b>					
green sunfish	I	3	0.02	3	1.64
<b>TOTAL</b>		<b>13,608</b>			

<sup>1</sup> N = native; I = introduced

<sup>2</sup> Frequency and % frequency of occurrence are based on n=183 samples.

Table 3. Summary of 1998 San Juan River larval razorback sucker project light-trap collections.

SPECIES	RESIDENCE STATUS <sup>1</sup>	TOTAL NUMBER OF SPECIMENS	PERCENT OF % OF TOTAL	FREQUENCY OF OCCURRENCE <sup>2</sup>	% FREQUENCY OF OCCURRENCE <sup>2</sup>
<b>CARPS AND MINNOWS</b>					
red shiner	I	54	7.49	10	16.39
common carp	I	—	—	—	—
roundtail chub	N	—	—	—	—
fathead minnow	I	—	—	—	—
Colorado pikeminnow	N	—	—	—	—
speckled dace	N	—	—	—	—
<b>SUCKERS</b>					
white sucker	I	—	—	—	—
flannelmouth sucker	N	645	89.46	18	29.51
bluehead sucker	N	22	3.05	7	11.48
razorback sucker	N	—	—	—	—
<b>BULLHEAD CATFISHES</b>					
channel catfish	I	—	—	—	—
<b>KILLIFISHES</b>					
plains killifish	I	—	—	—	—
<b>LIVEBEARERS</b>					
western mosquitofish	I	—	—	—	—
<b>SUNFISHES</b>					
green sunfish	I	—	—	—	—
TOTAL		721			

<sup>1</sup> N = native; I = introduced

<sup>2</sup> Frequency and % frequency of occurrence are based on n=61 samples.

Table 4. Summary of the 1<sup>st</sup> 1998 San Juan River larval razorback sucker project fish collection (17-20 April 1998; Four Corners to Bluff).

SPECIES	RESIDENCE STATUS <sup>1</sup>	TOTAL NUMBER OF SPECIMENS	PERCENT OF % OF TOTAL	FREQUENCY OF OCCURRENCE <sup>2</sup>	% FREQUENCY OF OCCURRENCE <sup>2</sup>
<b>CARPS AND MINNOWS</b>					
red shiner	I	107	86.99	9	31.033
common carp	I	—	—	—	—
roundtail chub	N	—	—	—	—
fathead minnow	I	7	5.69	1	3.45
Colorado pikeminnow	N	—	—	—	—
speckled dace	N	8	6.50	4	13.79
<b>SUCKERS</b>					
white sucker	I	—	—	—	—
flannelmouth sucker	N	—	—	—	—
bluehead sucker	N	—	—	—	—
razorback sucker	N	—	—	—	—
<b>BULLHEAD CATFISHES</b>					
channel catfish	I	—	—	—	—
<b>KILLIFISHES</b>					
plains killifish	I	—	—	—	—
<b>LIVEBEARERS</b>					
western mosquitofish	I	—	—	—	—
<b>SUNFISHES</b>					
green sunfish	I	1	0.81	1	3.45
TOTAL		123			

<sup>1</sup> N = native; I = introduced

<sup>2</sup> Frequency and % frequency of occurrence are based on n=29 samples.

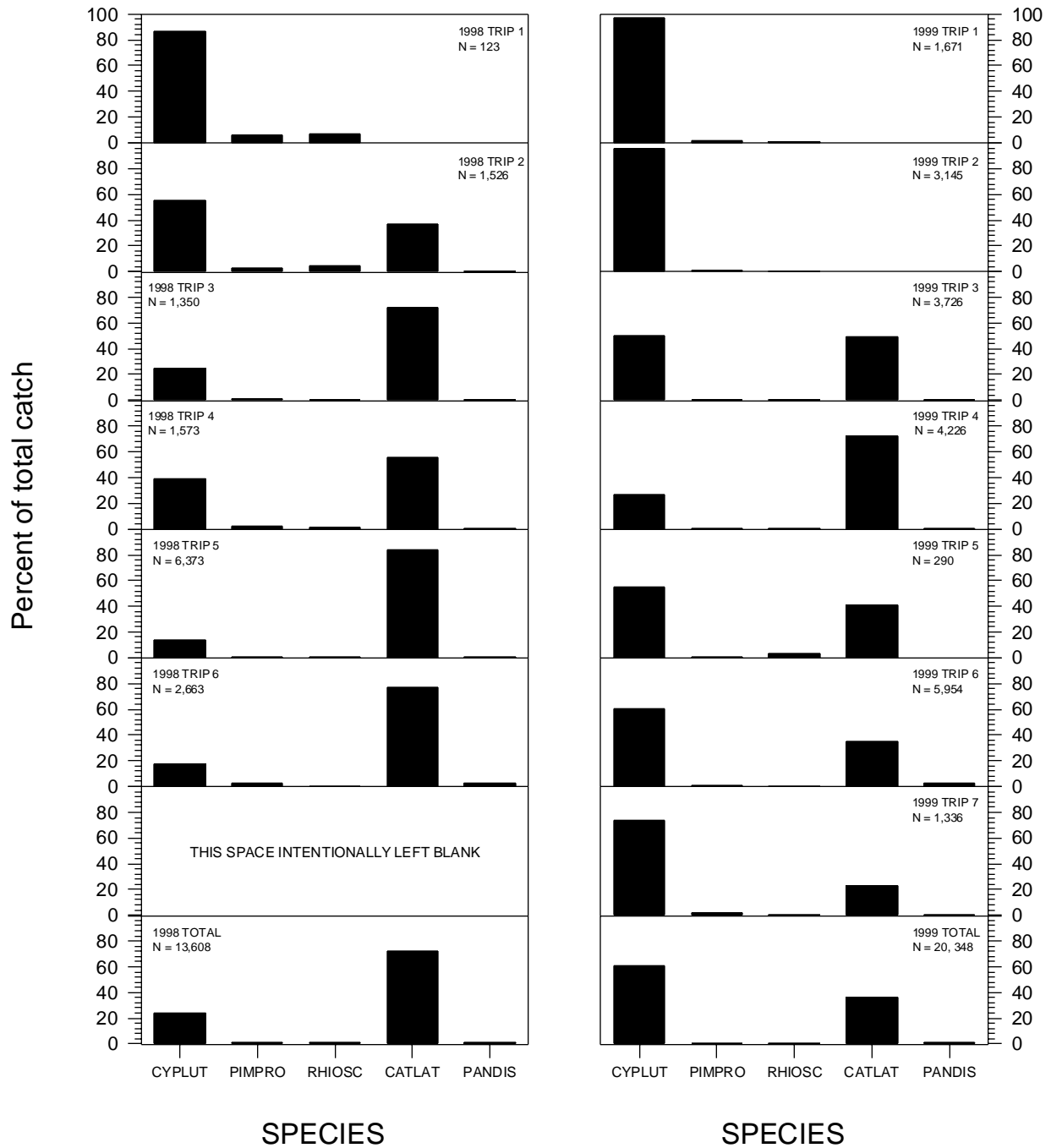


Figure 6. Ichthyofaunal composition of 1998 and 1999 sampling efforts by trip.



Table 5. Summary of 2<sup>nd</sup> 1998 San Juan River larval razorback sucker project fish collection (15-29 April - 1 May 1998; Four Corners to Bluff).

SPECIES	RESIDENCE STATUS <sup>1</sup>	TOTAL NUMBER OF SPECIMENS	PERCENT OF % OF TOTAL	FREQUENCY OF OCCURRENCE <sup>2</sup>	% FREQUENCY OF OCCURRENCE <sup>2</sup>
<b>CARPS AND MINNOWS</b>					
red shiner	I	842	55.18	19	52.78
common carp	I	2	0.13	1	2.78
roundtail chub	N	1	0.07	1	2.78
fathead minnow	I	41	2.69	11	30.56
Colorado pikeminnow	N	1	0.07	1	2.78
speckled dace	N	67	4.39	18	50.00
<b>SUCKERS</b>					
white sucker	I	—	—	—	—
flannelmouth sucker	N	567	37.16	12	33.33
bluehead sucker	N	2	0.13	2	5.56
razorback sucker	N	—	—	—	—
<b>BULLHEAD CATFISHES</b>					
channel catfish	I	—	—	—	—
<b>KILLIFISHES</b>					
plains killifish	I	2	0.13	2	5.56
<b>LIVEBEARERS</b>					
western mosquitofish	I	1	0.07	1	2.78
<b>SUNFISHES</b>					
green sunfish	I	—	—	—	—
<b>TOTAL</b>		1,526			

<sup>1</sup> N = native; I = introduced

<sup>2</sup> Frequency and % frequency of occurrence are based on n=36 samples.

Table 6. Summary of 3<sup>rd</sup> 1998 San Juan River larval razorback sucker project fish collection (7-9 May 1998; Four Corners to Bluff).

SPECIES	RESIDENCE STATUS <sup>1</sup>	TOTAL NUMBER OF SPECIMENS	PERCENT OF % OF TOTAL	FREQUENCY OF OCCURRENCE <sup>2</sup>	% FREQUENCY OF OCCURRENCE <sup>2</sup>
<b>CARPS AND MINNOWS</b>					
red shiner	I	339	25.11	14	73.68
common carp	I	—	—	—	—
roundtail chub	N	—	—	—	—
fathead minnow	I	18	1.33	6	31.58
Colorado pikeminnow	N	1	0.07	1	5.26
speckled dace	N	5	0.37	3	15.79
<b>SUCKERS</b>					
white sucker	I	—	—	—	—
flannelmouth sucker	N	976	72.30	11	57.89
bluehead sucker	N	6	0.44	3	15.79
razorback sucker	N	—	—	—	—
<b>BULLHEAD CATFISHES</b>					
channel catfish	I	1	0.07	1	5.26
<b>KILLIFISHES</b>					
plains killifish	I	1	0.07	1	5.26
<b>LIVEBEARERS</b>					
western mosquitofish	I	2	0.15	2	10.53
<b>SUNFISHES</b>					
green sunfish	I	1	0.07	1	5.26
TOTAL		1,350			

<sup>1</sup> N = native; I = introduced

<sup>2</sup> Frequency and % frequency of occurrence are based on n=19 samples.

Table 7. Summary of 4<sup>th</sup> 1998 San Juan River larval razorback sucker project fish collection (12-14 May 1998; Four Corners to Bluff).

SPECIES	RESIDENCE STATUS <sup>1</sup>	TOTAL NUMBER OF SPECIMENS	PERCENT OF % OF TOTAL	FREQUENCY OF OCCURRENCE <sup>2</sup>	% FREQUENCY OF OCCURRENCE <sup>2</sup>
<b>CARPS AND MINNOWS</b>					
red shiner	I	615	39.10	24	77.42
common carp	I	—	—	—	—
roundtail chub	N	3	0.19	2	6.45
fathead minnow	I	35	2.23	12	38.71
Colorado pikeminnow	N	2	0.13	2	6.45
speckled dace	N	27	1.72	8	25.81
<b>SUCKERS</b>					
white sucker	I	—	—	—	—
flannelmouth sucker	N	874	55.56	24	77.42
bluehead sucker	N	6	0.38	4	12.90
razorback sucker	N	—	—	—	—
<b>BULLHEAD CATFISHES</b>					
channel catfish	I	—	—	—	—
<b>KILLIFISHES</b>					
plains killifish	I	—	—	—	—
<b>LIVEBEARERS</b>					
western mosquitofish	I	10	0.64	5	16.13
<b>SUNFISHES</b>					
green sunfish	I	1	0.06	1	3.23
TOTAL		1,573			

<sup>1</sup> N = native; I = introduced

<sup>2</sup> Frequency and % frequency of occurrence are based on n=31 samples.

Table 8. Summary of 5<sup>th</sup> 1998 San Juan River larval razorback sucker project fish collection (19-22 May 1998; Four Corners to Bluff).

SPECIES	RESIDENCE STATUS <sup>1</sup>	TOTAL NUMBER OF SPECIMENS	PERCENT OF % OF TOTAL	FREQUENCY OF OCCURRENCE <sup>2</sup>	% FREQUENCY OF OCCURRENCE <sup>2</sup>
<b>CARPS AND MINNOWS</b>					
red shiner	I	880	13.81	25	75.76
common carp	I	—	—	—	—
roundtail chub	N	4	0.06	3	9.09
fathead minnow	I	50	0.78	14	42.42
Colorado pikeminnow	N	—	—	—	—
speckled dace	N	23	0.36	10	30.30
<b>SUCKERS</b>					
white sucker	I	1	0.02	1	3.03
flannelmouth sucker	N	5,347	83.90	31	93.94
bluehead sucker	N	63	0.99	9	27.27
razorback sucker	N	2	0.03	2	6.06
<b>BULLHEAD CATFISHES</b>					
channel catfish	I	—	—	—	—
<b>KILLIFISHES</b>					
plains killifish	I	—	—	—	—
<b>LIVEBEARERS</b>					
western mosquitofish	I	3	0.05	3	9.09
<b>SUNFISHES</b>					
green sunfish	I	—	—	—	—
<b>TOTAL</b>		<b>6,373</b>			

<sup>1</sup> N = native; I = introduced

<sup>2</sup> Frequency and % frequency of occurrence are based on n=33 samples.

shiner being the second most common species. The number of larval bluehead sucker taken during this trip had increased by over 10-fold compared with the four previous collections. Two larval razorback sucker were caught in two separate localities during the fifth 1998 sampling effort. Other noteworthy catches during this trip were juvenile roundtail chub and the only 1998 specimen of white sucker taken during this project.

The final 1998 sampling trip produced the second largest number of fish collected ( $n=2,663$ ) accounting for about 20% of the total catch (Table 9). Over 76% of the catch were larval and juvenile flannelmouth sucker while 17.5% were red shiner. This sample effort yielded both the largest number of roundtail chub ( $n=10$ ) and bluehead sucker ( $n=70$ ) taken during 1998. As in all previous sample efforts, no species other than flannelmouth sucker and red shiner, accounted for more than 6.5% of the total catch.

#### *Razorback sucker - 1998*

Two razorback sucker were collected at two separate localities during the 1998 larval razorback sucker survey (Figure 7). Both individuals were taken during the fifth 1998 sampling effort which occurred from 19 to 22 May 1998 (Figure 8). The first larval razorback sucker was collected with a seine between 16:30 - 16:50 hr on 21 May 1998 in a 22°C backwater located about 12.2 river miles downstream of Aneth, Utah (RM 88.8; 37° 16' 21.5" N, 109° 23' 35.8" W). The backwater was about 180 m long, 2 m wide, had depth of 29 cm, a substrate comprised of mud over cobble, and exhibited virtually no flow (WHB98-143). The 4.2 m long seine haul made at head of the backwater yielded over 3,800 larval or early juvenile fish of which 3,672 were flannelmouth sucker and 23 were bluehead sucker. The larval razorback sucker was a 12.7 mm TL flexion mesolarvae (MSB 42207) distinguishable from larval bluehead sucker by its pigmentation pattern and developmental state at that length.

The second larval razorback sucker was collected in a large, murky backwater on 22 May 1998 between 11:07 - 11:29 hr about 3.8 river miles upstream of Bluff, UT (RM 80.2; 37° 16' 18.4" N, 109° 32' 37.8" W). This large backwater was about 8 m wide, over 50 m long, 27 cm deep, 19°C, and had a mud substrate (WHB98-147). Two seine hauls (total 11 m) were made near the head of the backwater producing 960 larval fish. Flannelmouth sucker was the most abundant species taken accounting for 78% ( $n=752$ ) of the catch while red shiner ( $n=185$ ; 19.3%) and bluehead sucker ( $n=14$ ; 1.5%) were the second and third, respectively, most common fish at this site. This larval razorback sucker was a 12.1 mm TL flexion mesolarvae (MSB 42218) also distinguishable by from larval bluehead sucker by its pigmentation pattern and developmental state.

#### *1999 Survey*

The 173-1999 larval razorback sucker fish samples taken at over 75 separate localities between the confluence of the San Juan and Mancos rivers and Clay Hills, Utah (Figure 9) produced 20,348 specimens represented by 11 species (Table 10). Over 90% ( $n=130$  of 144) of the seine samples resulted in the collection of fish. Included in the catch during the 5 April 1999 to 14 June 1999 duration of this study were five juvenile roundtail chub and seven larval razorback sucker. In contrast to the 1998 sampling effort, Colorado pikeminnow were absent from 1999 collections. Red shiner was the most abundant species in 1999 comprising 61.3% of the total catch and occurring in over 66% of the samples. Flannelmouth sucker was the second most common taxon accounting for 36.5% of the catch and occurring in 63% of the samples. Collectively these two species were 97.8% ( $n=19,901$ ) of the 1999 larval razorback sucker project catch. Individually, none of the other nine species taken in 1999 even comprised 1% of the total catch.

Table 9. Summary of 6<sup>th</sup> 1998 San Juan River larval razorback sucker project fish collection (3-6 June 1998; Four Corners to Bluff).

SPECIES	RESIDENCE STATUS <sup>1</sup>	TOTAL NUMBER OF SPECIMENS	PERCENT OF % OF TOTAL	FREQUENCY OF OCCURRENCE <sup>2</sup>	% FREQUENCY OF OCCURRENCE <sup>2</sup>
<b>CARPS AND MINNOWS</b>					
red shiner	I	466	17.50	16	45.71
common carp	I	—	—	—	—
roundtail chub	N	10	0.38	6	17.14
fathead minnow	I	59	2.22	10	28.57
Colorado pikeminnow	N	—	—	—	—
speckled dace	N	9	0.34	7	20.00
<b>SUCKERS</b>					
white sucker	I	—	—	—	—
flannelmouth sucker	N	2,046	76.83	25	71.43
bluehead sucker	N	70	2.63	18	51.43
razorback sucker	N	—	—	—	—
<b>BULLHEAD CATFISHES</b>					
channel catfish	I	1	0.04	1	2.86
<b>KILLIFISHES</b>					
plains killifish	I	1	0.04	1	2.86
<b>LIVEBEARERS</b>					
western mosquitofish	I	1	0.04	1	2.86
<b>SUNFISHES</b>					
green sunfish	I	—	—	—	—
<b>TOTAL</b>		2,663			

<sup>1</sup> N = native; I = introduced

<sup>2</sup> Frequency and % frequency of occurrence are based on n=35 samples.

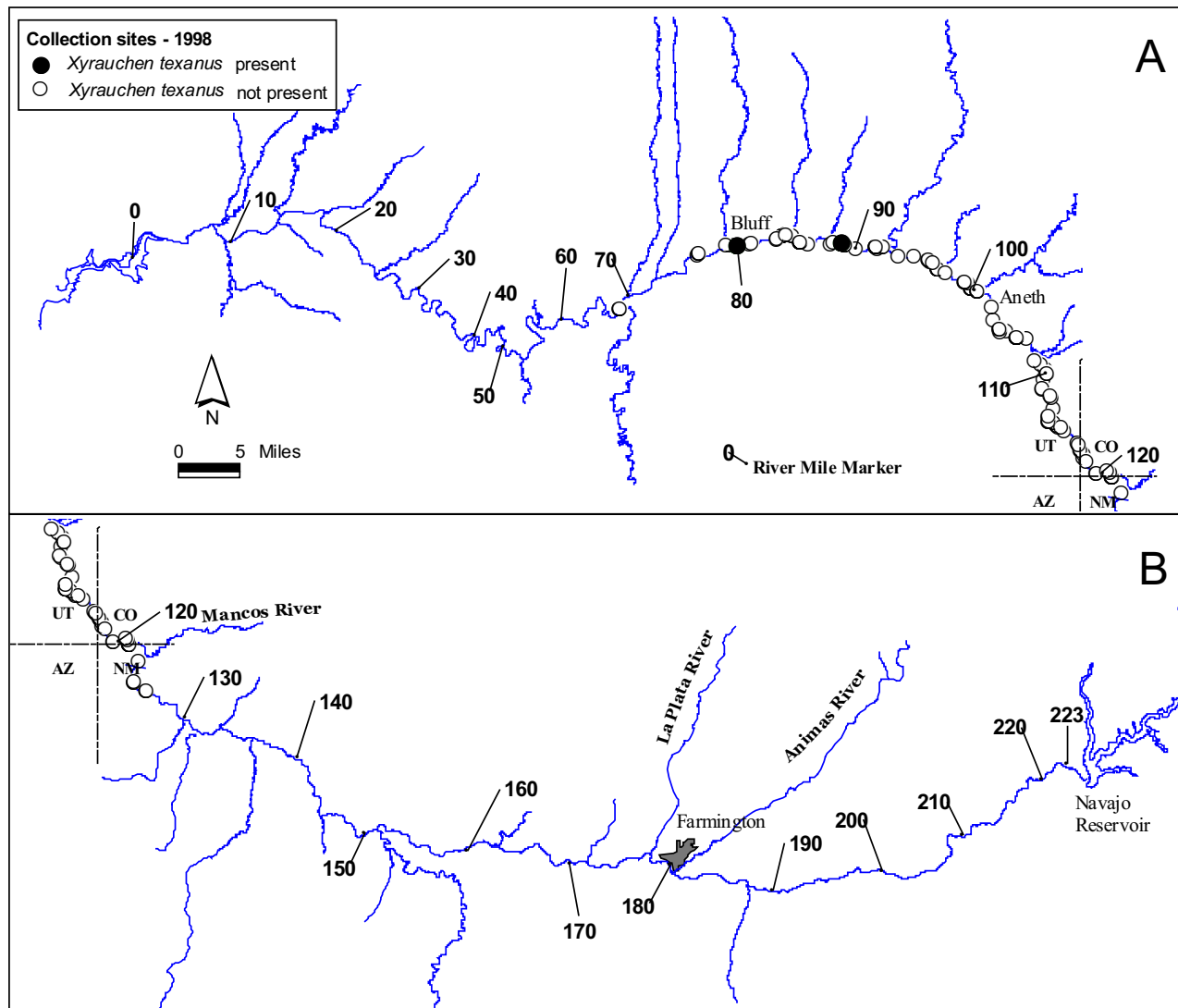


Figure 7. Distribution map of localities that yielded larval razorback sucker during 1998.

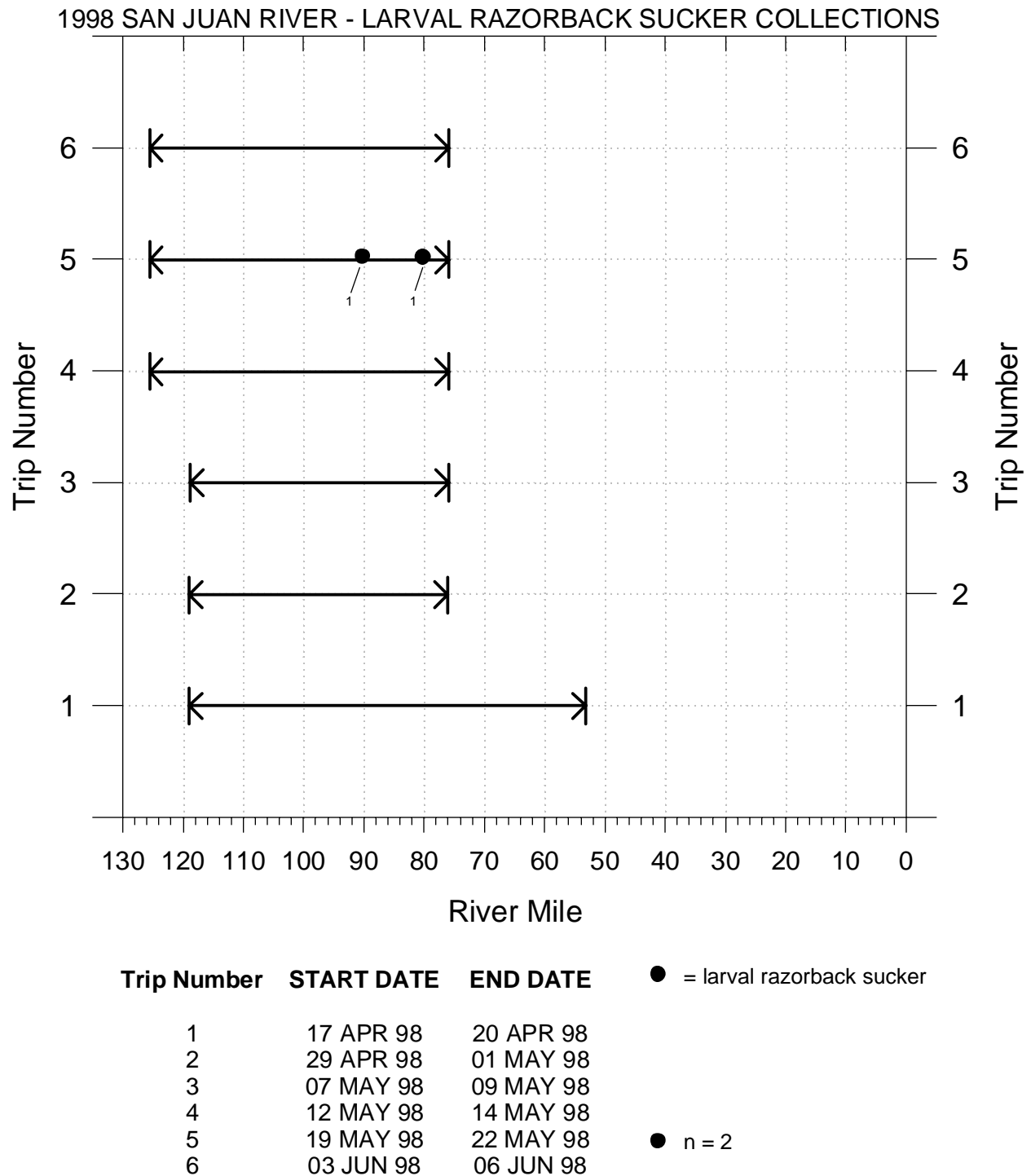


Figure 8. Diagrammatic representation of 1998 sampling effort.



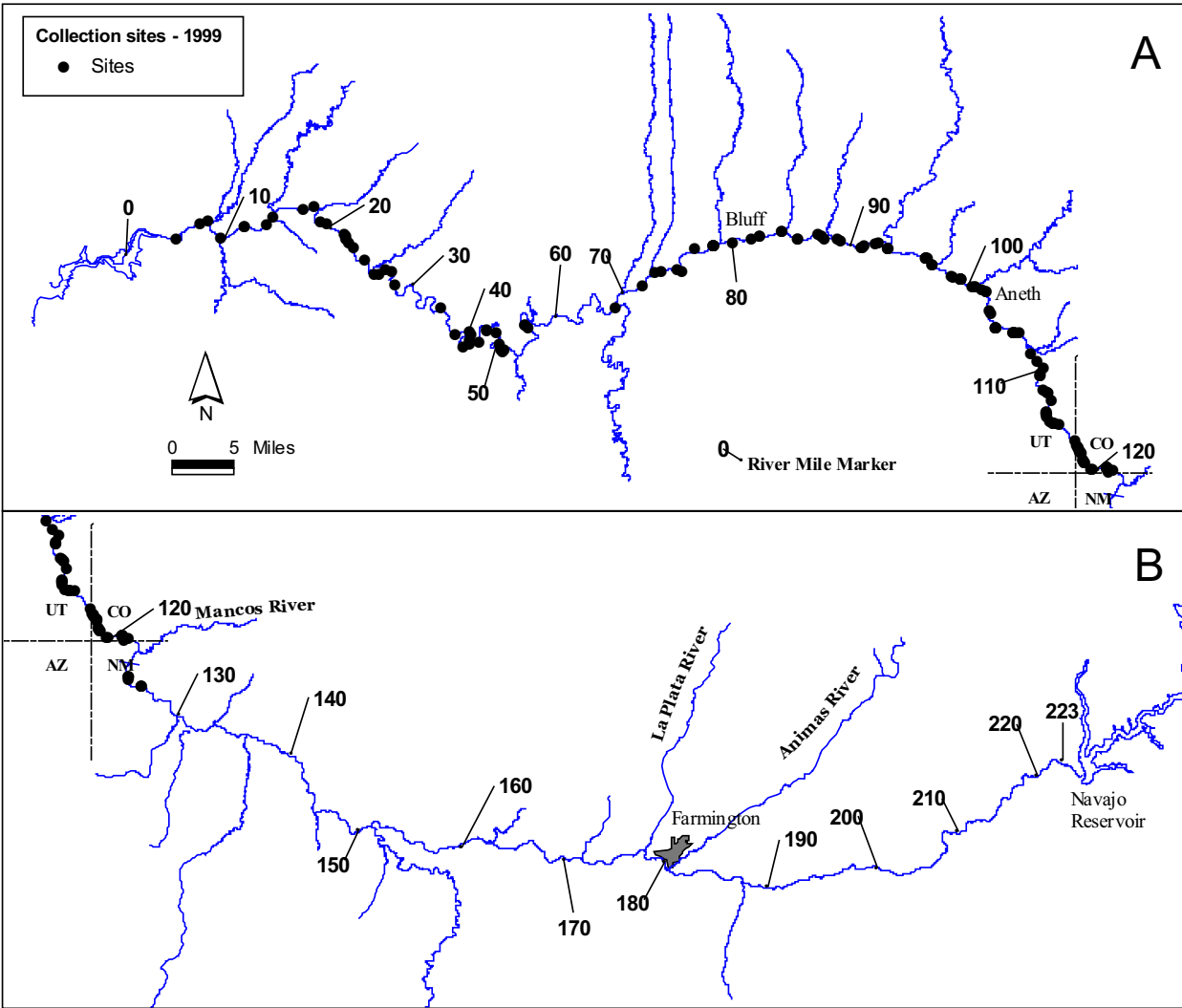


Figure 9. Distribution map of localities sampled during 1999.

Table 10. Summary of 1999 San Juan River larval razorback sucker project fish collections.

SPECIES	RESIDENCE STATUS <sup>1</sup>	TOTAL NUMBER OF SPECIMENS	PERCENT OF % OF TOTAL	FREQUENCY OF OCCURRENCE <sup>2</sup>	% FREQUENCY OF OCCURRENCE <sup>2</sup>
<b>CARPS AND MINNOWS</b>					
red shiner	I	12,469	61.28	115	66.47
common carp	I	5	0.02	5	2.89
roundtail chub	N	5	0.02	4	2.31
fathead minnow	I	163	0.80	46	26.59
speckled dace	N	60	0.29	27	15.61
<b>SUCKERS</b>					
flannelmouth sucker	N	7,432	36.52	109	63.01
bluehead sucker	N	197	0.97	36	20.81
razorback sucker	N	7	0.03	7	4.05
<b>BULLHEAD CATFISHES</b>					
channel catfish	I	4	0.02	4	2.31
<b>KILLIFISHES</b>					
plains killifish	I	3	0.01	3	1.73
<b>LIVEBEARERS</b>					
western mosquitofish	I	3	0.01	3	1.73
TOTAL		20,348			

<sup>1</sup> N = native; I = introduced

<sup>2</sup> Frequency and % frequency of occurrence are based on n=173 samples.

There were 29 light-traps samples in 1999, 25 (86%) of which resulted in the collection of larval fish. While only four species of fish were collected in light-traps, three of those four species were catostomids. Flannelmouth sucker was 98.8% of the light-trap catch followed by bluehead sucker, red shiner, and razorback sucker (Table 11). Only four of over 1,700 larval fish collected using this sampling methodology were nonnative (red shiner).

The majority (77%) of the total catch and sampling effort (73%) was from the upper reach of the study area (Table 12). The vast majority of those individuals were either red shiner (52.7%) or flannelmouth sucker (45.0%). All roundtail chub (n=5) and a little more than half of the razorback sucker (n=4) collected in 1999 were taken in the upper reach. Western mosquitofish was the only other species, beside roundtail chub, that was present in upper reach samples but absent from those in the lower reach. While red shiner comprised over 50% of the upper reach sample, this species accounted for about 90% of lower reach collections (Table 13). In addition, red shiner was almost ten-times more abundant than flannelmouth sucker in lower reach samples. Conversely, bluehead sucker, was seven times more abundant (based on percent of total catch) in upper than lower reach samples.

The first 1999 sampling trip was between Four Corners and Bluff in early April (5 to 7 April 1999) and yielded 1,671 fish represented by exclusively by cyprinid species (Table 14). Red shiner was the numerically dominant taxon during this first trip accounting for over 97% of the total catch. The absence of larval catostomids indicated that spawning by members of this family had not yet initiated in the San Juan River. The second 1999 sampling effort (15 to 18 April 1999) was in the reach between Mexican Hat and Clay Hills Crossing, Utah. The slightly more than twice the number of samples taken in the lower reach, as compared to the upper reach, resulted in almost twice as many fish in the lower portion of the study area. As had been observed 10 days earlier in the upper reach, red shiner numerically dominated the lower reach catch (99%) while larval catostomids were absence from the sample (Table 15).

The next sampling effort occurred in the upper reach from 2 to 5 May 1999 and resulted in the capture of numerous larval sucker (Table 16). Flannelmouth sucker comprised 49.2% of the third sample while red shiner were 50.0% of that sample. Juvenile roundtail chub (n=1), larval bluehead sucker (n=6) and larval razorback sucker (n=1) were taken for the first time in 1999 during this collection effort. The fourth sampling effort, also in the upper reach, occurred about one week after the conclusion of the previous trip. During the fourth sampling trip, flannelmouth sucker increased to over 72% of the catch but red shiner declined from 50% to 26.5% of the total catch (Table 17). Bluehead sucker (n=12) and razorback sucker (n=3) were again present in the samples however, roundtail chub was not collected.

During 1 and 2 June 1999, larval fish were sampled from the Bluff to Mexican Hat portion of the study area resulting in the collection of five species but only 290 specimens. Only nine samples were taken because few suitable larval fish habitats were present in this reach of the study area during that discharge (7,200 - 7,800 cfs). There was little difference in the ichthyofaunal composition of this reach of the river, as compared with either up or downstream segments, as red shiner and flannelmouth sucker comprised about 55% and 41% of the total catch, respectively, with most other taxa being represented by relatively few specimens (Table 18).

Red shiner and flannelmouth sucker continued to be the numerically dominant species during the 8 to 10 June 1999 upper reach sampling effort (sixth of seven 1999 trips). The 41 samples taken during this trip yielded the largest number of specimens (n=5,954) taken in 1999 (Table 19). Red shiner abundance increased to over 60% of the catch, as compared to 26.5% in mid-May, while flannelmouth sucker relative abundance declined from 72% to 35% during the same period. The sixth sampling effort produced 86.8% (n=171) of all larval bluehead sucker collected during 1999 portion of this study. Razorback sucker, which had been collected the on

Table 11. Summary of 1999 San Juan River larval razorback sucker project light-trap collections.

SPECIES	RESIDENCE STATUS <sup>1</sup>	TOTAL NUMBER OF SPECIMENS	PERCENT OF % OF TOTAL	FREQUENCY OF OCCURRENCE <sup>2</sup>	% FREQUENCY OF OCCURRENCE <sup>2</sup>
<b>CARPS AND MINNOWS</b>					
red shiner	I	4	0.23	3	10.34
common carp	I	—	—	—	—
roundtail chub	N	—	—	—	—
fathead minnow	I	—	—	—	—
speckled dace	N	—	—	—	—
<b>SUCKERS</b>					
flannelmouth sucker	N	1,717	98.79	25	86.21
bluehead sucker	N	15	0.86	2	24.14
razorback sucker	N	2	0.12	2	6.90
<b>BULLHEAD CATFISHES</b>					
channel catfish	I	—	—	—	—
<b>KILLIFISHES</b>					
plains killifish	I	—	—	—	—
<b>LIVEBEARERS</b>					
western mosquitofish	I	—	—	—	—
<b>TOTAL</b>		<b>1,738</b>			

<sup>1</sup> N = native; I = introduced

<sup>2</sup> Frequency and % frequency of occurrence are based on n=29 samples.

Table 12. Summary of 1999 San Juan River larval razorback sucker project fish collections in the upper portion of the study area (between Shiprock, New Mexico and Bluff, Utah).

SPECIES	RESIDENCE STATUS <sup>1</sup>	TOTAL NUMBER OF SPECIMENS	PERCENT OF % OF TOTAL	FREQUENCY OF OCCURRENCE <sup>2</sup>	% FREQUENCY OF OCCURRENCE <sup>2</sup>
<b>CARPS AND MINNOWS</b>					
red shiner	I	8,210	52.71	80	63.49
common carp	I	2	0.01	2	1.59
roundtail chub	N	5	0.03	4	3.17
fathead minnow	I	117	0.75	28	22.22
speckled dace	N	40	0.26	18	14.29
<b>SUCKERS</b>					
flannelmouth sucker	N	7,003	44.96	92	73.02
bluehead sucker	N	189	1.21	33	26.19
razorback sucker	N	4	0.03	4	3.17
<b>BULLHEAD CATFISHES</b>					
channel catfish	I	2	0.01	2	1.59
<b>KILLIFISHES</b>					
plains killifish	I	2	0.01	2	1.59
<b>LIVEBEARERS</b>					
western mosquitofish	I	3	0.02	3	2.38
TOTAL		15,577			

<sup>1</sup> N = native; I = introduced

<sup>2</sup> Frequency and % frequency of occurrence are based on n=126 samples.

Table 13. Summary of 1999 San Juan River larval razorback sucker project fish collections in the lower portion of the study area (between Bluff and Clay Hills Crossing, Utah).

SPECIES	RESIDENCE STATUS <sup>1</sup>	TOTAL NUMBER OF SPECIMENS	PERCENT OF % OF TOTAL	FREQUENCY OF OCCURRENCE <sup>2</sup>	% FREQUENCY OF OCCURRENCE <sup>2</sup>
<b>CARPS AND MINNOWS</b>					
red shiner	I	4,259	89.27	35	74.47
common carp	I	3	0.06	3	6.38
roundtail chub	N	—	—	—	—
fathead minnow	I	46	0.96	18	38.30
speckled dace	N	20	0.42	9	19.15
<b>SUCKERS</b>					
flannelmouth sucker	N	429	8.99	17	36.17
bluehead sucker	N	8	0.17	3	6.38
razorback sucker	N	3	0.06	3	6.38
<b>BULLHEAD CATFISHES</b>					
channel catfish	I	2	0.04	2	4.26
<b>KILLIFISHES</b>					
plains killifish	I	1	0.02	1	2.13
<b>LIVEBEARERS</b>					
western mosquitofish	I	—	—	—	—
TOTAL		4,771			

<sup>1</sup> N = native; I = introduced

<sup>2</sup> Frequency and % frequency of occurrence are based on n=47 samples.

Table 14. Summary of the 1<sup>st</sup> 1999 San Juan River larval razorback sucker project fish collection (5-7 April 1999; Four Corners to Bluff).

SPECIES	RESIDENCE STATUS <sup>1</sup>	TOTAL NUMBER OF SPECIMENS	PERCENT OF % OF TOTAL	FREQUENCY OF OCCURRENCE <sup>2</sup>	% FREQUENCY OF OCCURRENCE <sup>2</sup>
<b>CARPS AND MINNOWS</b>					
red shiner	I	1,623	97.13	8	61.54
common carp	I	—	—	—	—
roundtail chub	N	3	0.18	2	15.38
fathead minnow	I	33	1.97	3	23.08
speckled dace	N	12	0.72	3	23.08
<b>SUCKERS</b>					
flannelmouth sucker	N	—	—	—	—
bluehead sucker	N	—	—	—	—
razorback sucker	N	—	—	—	—
<b>BULLHEAD CATFISHES</b>					
channel catfish	I	—	—	—	—
<b>KILLIFISHES</b>					
plains killifish	I	—	—	—	—
<b>LIVEBEARERS</b>					
western mosquitofish	I	—	—	—	—
<b>TOTAL</b>		1,671			

<sup>1</sup> N = native; I = introduced

<sup>2</sup> Frequency and % frequency of occurrence are based on n=13 samples.

Table 15. Summary of 2<sup>nd</sup> 1999 San Juan River larval razorback sucker project fish collection (15-18 April 1999; Mexican Hat to Clay Hills Crossing).

SPECIES	RESIDENCE STATUS <sup>1</sup>	TOTAL NUMBER OF SPECIMENS	PERCENT OF % OF TOTAL	FREQUENCY OF OCCURRENCE <sup>2</sup>	% FREQUENCY OF OCCURRENCE <sup>2</sup>
<b>CARPS AND MINNOWS</b>					
red shiner	I	3,114	99.01	20	71.43
common carp	I	—	—	—	—
roundtail chub	N	—	—	—	—
fathead minnow	I	21	0.67	8	28.57
speckled dace	N	9	0.29	4	14.29
<b>SUCKERS</b>					
flannelmouth sucker	N	—	—	—	—
bluehead sucker	N	—	—	—	—
razorback sucker	N	—	—	—	—
<b>BULLHEAD CATFISHES</b>					
channel catfish	I	1	0.03	1	3.57
<b>KILLIFISHES</b>					
plains killifish	I	—	—	—	—
<b>LIVEBEARERS</b>					
western mosquitofish	I	—	—	—	—
TOTAL		3,145			

<sup>1</sup> N = native; I = introduced

<sup>2</sup> Frequency and % frequency of occurrence are based on n=28 samples.



Table 16. Summary of 3<sup>rd</sup> 1999 San Juan River larval razorback sucker project fish collection (2-5 May 1999; Four Corners to Bluff).

SPECIES	RESIDENCE STATUS <sup>1</sup>	TOTAL NUMBER OF SPECIMENS	PERCENT OF % OF TOTAL	FREQUENCY OF OCCURRENCE <sup>2</sup>	% FREQUENCY OF OCCURRENCE <sup>2</sup>
<b>CARPS AND MINNOWS</b>					
red shiner	I	1,861	49.95	23	57.50
common carp	I	—	—	—	—
roundtail chub	N	1	0.03	1	2.50
fathead minnow	I	11	0.30	5	12.50
speckled dace	N	9	0.24	6	15.00
<b>SUCKERS</b>					
flannelmouth sucker	N	1,834	49.22	26	65.00
bluehead sucker	N	6	0.16	4	10.00
razorback sucker	N	1	0.03	1	2.50
<b>BULLHEAD CATFISHES</b>					
channel catfish	I	1	0.03	1	2.50
<b>KILLIFISHES</b>					
plains killifish	I	1	0.03	1	2.50
<b>LIVEBEARERS</b>					
western mosquitofish	I	1	0.03	1	2.50
TOTAL		3,726			

<sup>1</sup> N = native; I = introduced

<sup>2</sup> Frequency and % frequency of occurrence are based on n=40 samples.

Table 17. Summary of 4<sup>th</sup> 1999 San Juan River larval razorback sucker project fish collection (11-13 May 1999; Four Corners to Bluff).

SPECIES	RESIDENCE STATUS <sup>1</sup>	TOTAL NUMBER OF SPECIMENS	PERCENT OF % OF TOTAL	FREQUENCY OF OCCURRENCE <sup>2</sup>	% FREQUENCY OF OCCURRENCE <sup>2</sup>
<b>CARPS AND MINNOWS</b>					
red shiner	I	1,118	26.46	20	62.50
common carp	I	—	—	—	—
roundtail chub	N	—	—	—	—
fathead minnow	I	17	0.40	5	15.63
speckled dace	N	9	0.21	3	9.38
<b>SUCKERS</b>					
flannelmouth sucker	N	3,066	72.55	28	87.50
bluehead sucker	N	12	0.28	4	12.50
razorback sucker	N	3	0.07	3	9.38
<b>BULLHEAD CATFISHES</b>					
channel catfish	I	1	0.02	1	3.13
<b>KILLIFISHES</b>					
plains killifish	I	—	—	—	—
<b>LIVEBEARERS</b>					
western mosquitofish	I	—	—	—	—
<b>TOTAL</b>		<b>4,226</b>			

<sup>1</sup> N = native; I = introduced

<sup>2</sup> Frequency and % frequency of occurrence are based on n=32 samples.

Table 18. Summary of 5<sup>th</sup> 1999 San Juan River larval razorback sucker project fish collection (1-2 June 1999; Bluff to Mexican Hat).

SPECIES	RESIDENCE STATUS <sup>1</sup>	TOTAL NUMBER OF SPECIMENS	PERCENT OF % OF TOTAL	FREQUENCY OF OCCURRENCE <sup>2</sup>	% FREQUENCY OF OCCURRENCE <sup>2</sup>
<b>CARPS AND MINNOWS</b>					
red shiner	I	159	54.83	7	77.78
common carp	I	—	—	—	—
roundtail chub	N	—	—	—	—
fathead minnow	I	2	0.69	2	22.22
speckled dace	N	9	3.10	3	33.33
<b>SUCKERS</b>					
flannelmouth sucker	N	119	41.03	8	88.89
bluehead sucker	N	—	—	—	—
razorback sucker	N	—	—	—	—
<b>BULLHEAD CATFISHES</b>					
channel catfish	I	—	—	—	—
<b>KILLIFISHES</b>					
plains killifish	I	1	0.34	1	11.11
<b>LIVEBEARERS</b>					
western mosquitofish	I	—	—	—	—
TOTAL		290			

<sup>1</sup> N = native; I = introduced

<sup>2</sup> Frequency and % frequency of occurrence are based on n=9 samples.

• Indicates a values <0.00

Table 19. Summary of 6<sup>th</sup> 1999 San Juan River larval razorback sucker project fish collection (8-10 June 1999; Four Corners to Bluff).

SPECIES	RESIDENCE STATUS <sup>1</sup>	TOTAL NUMBER OF SPECIMENS	PERCENT OF % OF TOTAL	FREQUENCY OF OCCURRENCE <sup>2</sup>	% FREQUENCY OF OCCURRENCE <sup>2</sup>
<b>CARPS AND MINNOWS</b>					
red shiner	I	3,608	60.60	29	70.73
common carp	I	2	0.03	2	4.88
roundtail chub	N	1	0.02	1	2.44
fathead minnow	I	56	0.94	15	36.59
speckled dace	N	10	0.17	6	14.63
<b>SUCKERS</b>					
flannelmouth sucker	N	2,103	35.32	38	98.68
bluehead sucker	N	171	2.87	25	60.98
razorback sucker	N	—	—	—	—
<b>BULLHEAD CATFISHES</b>					
channel catfish	I	—	—	—	—
<b>KILLIFISHES</b>					
plains killifish	I	1	0.02	1	2.44
<b>LIVEBEARERS</b>					
western mosquitofish	I	2	0.03	2	4.88
TOTAL		5,954			

<sup>1</sup> N = native; I = introduced

<sup>2</sup> Frequency and % frequency of occurrence are based on n=41 samples.

each of the two previous upper reach sampling efforts, were not taken during the 8 to 10 June 1999 trip.

The final 1999 collecting trip occurred on 14 June along the reach between Mexican Hat and Clay Hills Crossing, Utah. Ten 10 samples were taken over the 50 river mile reach yielding eight species and 1,336 specimens (Table 20). Red shiner numerically dominated the last 1999 sample accounting for 73.8% of the total catch. All three species of native sucker were collected in this reach with flannelmouth sucker being the most abundant ( $n=310$ ), followed by bluehead sucker ( $n=8$ ) and razorback sucker ( $n=3$ ). This was the only lower reach sample that contained razorback sucker and the second one during 1999 to produce three specimens.

#### *Razorback sucker - 1999*

A total of seven larval razorback sucker was collected in seven separate samples during 1999 (Figure 10). Four larval razorback sucker were collected upstream of Bluff and three were taken downstream of Bluff. Two of the seven razorback sucker were collected in light-traps with the remainder taken in larval fish seine (Figure 11).

The first 1999 larval razorback sucker was collected on 4 May 1999 in a backwater located about 6.1 miles upstream of Bluff, Utah (RM 82.5; 34° 16' 44.8" N, 109° 30' 16.0" W). Water temperature, at 16:05 to 16:25 hr, was about 15°C in the main river channel at the mouth of the backwater and 18.5°C near its head. The backwater was divided into two channels with the narrower segment being about 1 m in width and the primary channel about 4 m wide. Substrate was mud with some scattered instream vegetation debris present. Three seine hauls, encompassing about 22 surface m<sup>2</sup> of the backwater, were made at this site. The latter two seining runs were near the head of the mesohabitat and produced the majority of the catch. The collectors noted on the field data sheet that this was the most larval sucker they had seen to date (WHB99-075). There were 318 fish in this sample of which 305 (96%) were larval flannelmouth sucker and two were larval bluehead sucker. The single razorback sucker specimen collected at this site was a 11.2 mm TL, 10.7 mm SL flexion mesolarvae (MSB 44201) with a small amount of yolk remaining in the yolk-sac.

The fourth 1999 sampling trip yielded three larval razorback sucker, two of which were collected in light-traps. Light-traps ( $n=5$ ) were set in a backwater 4.8 miles downstream of Aneth (RM 96.2; 37° 15' 03.4" N, 109° 15' 45.2" W) on 12 May 1999 at 19:15 hr and retrieved the following morning at 07:10 hr. The backwater was about 50 m x 4.6 m and generally shallow (ca. 13 cm) except for two small pools, about 48 cm deep, located near its mouth ( $n=3$  traps) and middle section ( $n=2$  traps). Water temperature was 22°C when the traps were set and 13°C when retrieved. Field personnel noted a high level of water visibility (ca. 38 cm) in this backwater, especially compared to other sample sites.

The contents of each trap were maintained as separate collections. Almost 73% ( $n=851$ ) of the total catch in the backwater were taken in the two light-traps (WHB99-105, WHB99-106) set near the middle section of the site. Larval flannelmouth sucker, the most numerous fish in each of the five light-traps, achieved its greatest abundance in the two middle portion light-traps. Each of the two middle section traps captured one larval razorback sucker and were also the only traps at that site to capture bluehead sucker. The larval razorback sucker taken in sample WHB99-105 (MSB 44254) on 12-13 May 1999 was a 14.1 mm TL, 12.8 mm SL post-flexion mesolarvae while WHB99-106 (MSB 44257; 12-13 May 1999) was a 10.2 mm TL, 9.7 mm SL flexion mesolarvae. The latter specimen was the smallest individual (length) collected during either 1998 or 1999 but not the earliest developmental stage.

The third razorback sucker collected during the fourth 1999 sampling trip (MSB 44269) was taken on 13 May 1999 in a seine collection at a site about 6.1 miles upstream of Bluff (RM 82.5;

Table 20. Summary of 7<sup>th</sup> 1999 San Juan River larval razorback sucker project fish collection (14 June 1999; Mexican Hat to Clay Hills Crossing).

SPECIES	RESIDENCE STATUS <sup>1</sup>	TOTAL NUMBER OF SPECIMENS	PERCENT OF % OF TOTAL	FREQUENCY OF OCCURRENCE <sup>2</sup>	% FREQUENCY OF OCCURRENCE <sup>2</sup>
<b>CARPS AND MINNOWS</b>					
red shiner	I	986	73.80	8	80.00
common carp	I	3	0.22	3	30.00
roundtail chub	N	—	—	—	—
fathead minnow	I	23	1.72	8	80.00
speckled dace	N	2	0.15	2	20.00
<b>SUCKERS</b>					
flannelmouth sucker	N	310	23.20	9	90.00
bluehead sucker	N	8	0.60	3	30.00
razorback sucker	N	3	0.22	3	30.00
<b>BULLHEAD CATFISHES</b>					
channel catfish	I	1	0.07	1	10.00
<b>KILLIFISHES</b>					
plains killifish	I	—	—	—	—
<b>LIVEBEARERS</b>					
western mosquitofish	I	—	—	—	—
TOTAL		1,336			

<sup>1</sup> N = native; I = introduced

<sup>2</sup> Frequency and % frequency of occurrence are based on n=10 samples.

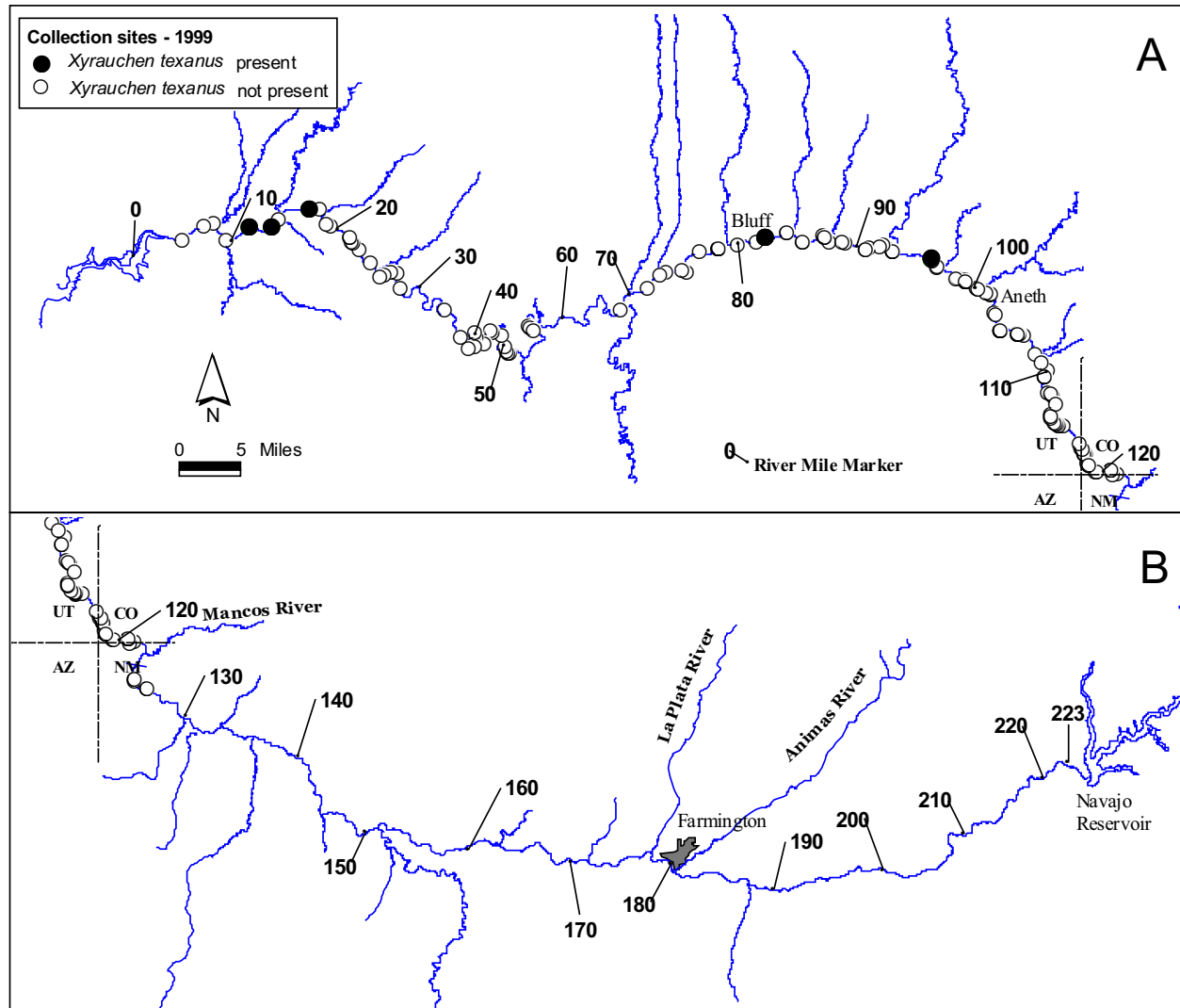


Figure 10. Distribution map of localities that yielded larval razorback sucker during 1999.

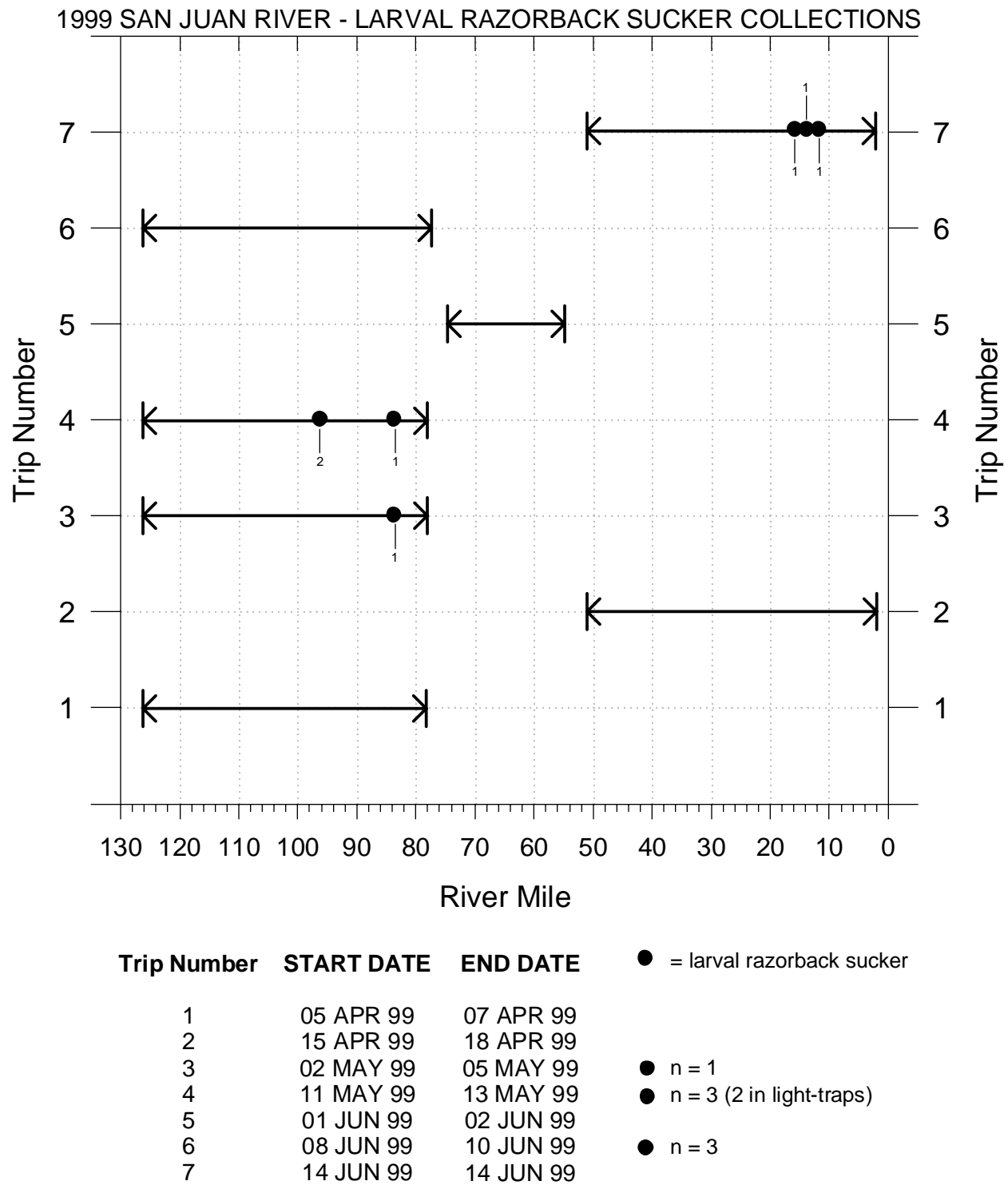


Figure 11. Diagrammatic representation of 1999 sampling effort.



37° 16' 44.8" N, 109° 30' 16.0" W). Fish were collected from a 15m x 4 m pool that had recently become separated from a backwater. The sample (WHB99-112) yielded 420 specimens, all of which were catostomids. Besides the single razorback sucker, the collection contained 412 larval flannelmouth sucker and seven larval bluehead sucker. The razorback sucker, a yolked 11.2 mm TL, 10.6 mm SL protolarvae, was the youngest (earliest ontogenetically) individual of this species collected.

Three razorback sucker larvae were collected in the lower reach during the final 1999 sampling trip. The three individuals were taken in three separate 14 June 1999 collections made between RM 16.5 and RM 11.5 on 14 June 1999. The most upstream site (WHB99-167; RM 16.5; 37° 19' 02.9" N, 110° 10' 19.3" W) was a large (40 m x 13 m), relatively deep (maximum depth > 2 m), backwater with shorelines that inundated extensive area of willows. This locality was about 36.5 miles downstream of Mexican Hat, Utah and under the influence of the fluctuating water levels of Lake Powell. The ichthyofaunal composition of the fish sample at this site was somewhat unusually, compared with other collections that contained razorback sucker, in that bluehead sucker were absent, flannelmouth sucker were rare, and red shiner numerically dominated (n=95%) the sample. The razorback sucker collected at this site (MSB 44421) was a 17.9 mm TL, 14.9 mm SL post-flexion mesolarvae.

The 14 June 1999 sample from RM 13.1 (WHB99-169; 37° 17' 33.5" N, 110° 13' 30.0" W) yielded only 120 fish but 74% were catostomids. As at WHB99-167, this backwater was long (50 m), wide (10 m), deep (> 2 m) and inundated large willow stands. Water visibility was relatively low (16 cm) and the majority of the fish were taken near the head of the backwater. The razorback sucker taken at this site (MSB 44428) was the largest (20.7 mm TL, 16.5 mm SL) and most developmentally advanced (metalarvae) individual collected to date.

The final 1999 larval razorback sucker collection (WHB99-170) was on 14 June 1999 in an extensive backwater located at RM 11.5 (37° 17' 53.3" N, 110° 15' 32.2" W). A total of 125 fish were collected at this site of which 62.4% (n=78) were flannelmouth sucker, five were larval bluehead sucker, and one was a post-flexion mesolarval razorback sucker (13.8 mm TL, 12.0 mm SL; MSB 44435). Maximum water depth at this site was >2 m with the majority of fish being collected near the head of this habitat in water 18-78 cm deep.

## Summary

A large portion of the approximately 1,000 razorback sucker that were introduced into the San Juan River since the 1994 initiation of the experimental stocking effort are believed to have survived. If this assumption is true, than the number of stocked razorback sucker that recruit to the adult cohort (i.e., able to reproduce) should be expected to continued to increase annually. It follows that as this segment of the population increases, so should the number and spatial distribution of collections of larval razorback sucker increase.

The 1998 sampling protocol resulted in the collection of over 13,000 specimens, the majority of which were larval catostomids. This 43-fold increase in number of specimens taken in 1998 provided the opportunity to determine, with a higher degree of confidence than in 1997, if razorback sucker reproduction occurred in the San Juan River during the study period. The high number of larval fish collected in combination with the large reach of river sampled also resulted in substantially better resolution of spawning periodicity of all San Juan River catostomids. The 1998-1999 results of the larval razorback sucker study provided unequivocal documentation of reproduction in the San Juan River by members of a razorback sucker cohort which had been stocked as part of the San Juan River Recovery Implementation Program.

The initial collection of larval razorback sucker in 1998 ( $n=2$ ) occurred during a single sampling effort and (19 - 22 May) with the specimens being taken and in relatively close proximity to each other (ca. 8 river miles). The effort (1998 sampling) demonstrated that targeting sampling to collect relatively large numbers of larval sucker was an effective means at acquiring information on razorback sucker reproductive efforts. Unlike the 1997 light-trap sampling project, this effort yielded a sufficient number of larval sucker so that biologically meaningful interpretation of the data could be developed.

There were two important discoveries that resulted from the 1999 larval razorback sucker study. The first was the collection of individuals ( $n=3$ ) from the lower portion of the San Juan River (between RM 10 - 20). As this reach of river was not sampled for larval razorback sucker in 1998, no conclusions could be made regarding expansion of the range of this species by this ontogenetic stage. The second noteworthy find in 1999 was the collection of larval razorback sucker in a single backwater (RM 96.2) in light-traps. This sampling technique (light-trapping) has been successfully employed in the Upper Colorado River Basin as a mechanism by which larval razorback sucker can be monitored. The aforementioned San Juan River collection suggests that this passive collecting technique may, one day, be suitable for monitoring of the San Juan River population of razorback sucker.

Future annual studies of larval razorback sucker should provide extremely important information on the level of reproduction of this species and direction necessary to achieve recovery.

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Appendix 1. Summary of larval razorback sucker collected in the San Juan River.

Field Number	MSB Catalog Number	Number of Specimens	Total Length	Larval Stage	Date Collected	River Mile	Sampling Method
<b>1998</b>	<b>TOTAL</b>	<b>2</b>					
WHB98-143	42207	1	12.7	mesolarvae	21 May 1998	88.8	larval fish seine
WHB98-147	42218	1	12.1	mesolarvae	22 May 1998	80.2	larval fish seine
<b>1999</b>	<b>TOTAL</b>	<b>7</b>					
WHB99-075	44201	1	11.2	mesolarvae/yolk	04 May 1999	82.5	larval fish seine
WHB99-105	44254	1	14.1	mesolarvae	12-13 May 1999	96.2	light-trap
WHB99-106	44257	1	10.2	mesolarvae	12-13 May 1999	96.2	light-trap
WHB99-112	44269	1	11.2	protolarvae/yolk	13 May 1999	82.5	larval fish seine
WHB99-167	44421	1	17.9	mesolarvae	14 June 1999	16.5	larval fish seine
WHB99-169	44428	1	20.7	metalarvae	14 June 1999	13.1	larval fish seine
WHB99-170	44435	1	13.8	mesolarvae	14 June 1999	11.5	larval fish seine
<b>TOTAL (1998-1999)</b>		<b>9</b>					