RECLAMATION
Managing Water in the West

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RIO GRANDE FISH COMMUNITY SURVEYS

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U.S. BUREAU OF RECLAMATION
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 ENVIRONMENT DIVISION

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Introduction

The U.S. Bureau of Reclamation annually conducts fish community surveys on the Rio Grande to document trends in fish community structure, evaluate the effects of river maintenance and water operations, and other project-related commitments. The data collected supplement surveys conducted by the U.S. Fish and Wildlife Service, New Mexico Department of Game and Fish, and the American Southwest Ichthyological Research Foundation.

Methods

Fish surveys conducted by Reclamation use standard electrofishing gear (boat and backpack), seining, and trapping in four reaches of the Middle Rio Grande in New Mexico. Additional sampling for Rio Grande silvery minnow (*Hybognathus* amarus) eggs was performed using Moore egg collectors (Altenbach et al. 1999) and quadrats.

Data Collection and Analysis

Captured fish were identified to species, enumerated for all surveys, and released. Fish collected during electrofishing were measured for total length (mm), weighed (g), and released. Data was recorded using HanDBase (DDH software) on Palm or Hewlett Packard handheld computers. The handheld computers were transported in waterproof OtterBox cases. Data was downloaded onto workstations frequently and exported into Excel for summarization. The total number of species and individuals for each species were calculated by site. The Shannon-Weiner index was calculated for each site as a measure of species diversity.

Surveys for Silvery Minnow Eggs and Larvae

Surveys for silvery minnow eggs were conducted (Figure 1) at Middle Rio Grande Conservancy District (MRGCD) irrigation diversions (U.S. Fish and Wildlife Service 2003), and at a series of sites for evaluating nursery habitat (Porter and Massong 2004). Moore egg collectors were used in both projects for collecting egg from the current. Quadrats were used in the nursery habitat study to collect eggs that settled onto the substrate in the drift zones (Porter and Massong 2003). Egg data was collected by SWCA Environmental Consultants under contract to the U.S. Bureau of Reclamation.

Seining Surveys

Two sites were surveyed using seines, the habitat restoration site at Los Lunas, and backwater habitat at Santa Clara Pueblo. Fish were identified to species, counted, and released.

Electrofishing surveys

Surveys were conducted by Reclamation biologists along three study reaches of the Middle Rio Grande, and portions of the Low Flow Conveyance Channel (LFCC). Within each reach, a varying number of electrofishing passes were conducted at sites selected from previous studies and new sites where monitoring is required. Surveys included a range of habitat types, including natural (defined as not altered), backwater, riprap and jetty areas. Data were recorded relative to sample reach and habitat pass. Sampling by habitat pass allowed for replication and subsequent statistical inference. GPS coordinates were recorded when silvery minnows were identified in a net to identify preferred habitat.
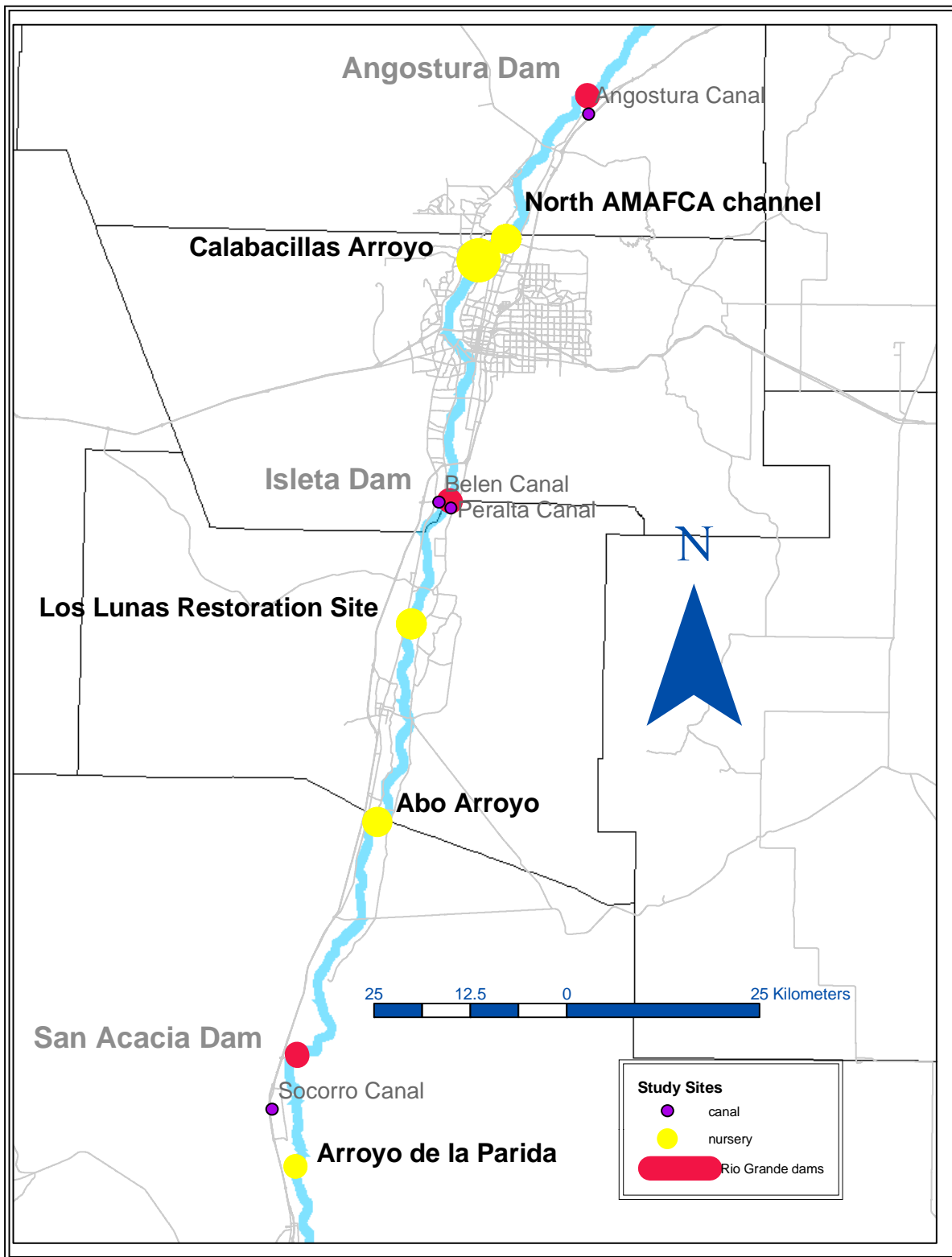
Figure 1. Nursery habitat study and irrigation diversion sampling locations.

A Smith-Root backpack electrofisher was used for fish surveys in the Low Flow Conveyance Channel (LFCC) prior to parrot feather removal for Experimental Operations, and in October 2004 as a follow-up survey (Figure 2). Fish during these surveys were only identified, counted, and released. Three reaches were sampled in March 2004 between LFCC-LF15-U and LFCC-LF43-D for removal of parrot feather. The reaches at LFCC 113.5 and LFCC-113 were added to sampling in October 2004 to evaluate for the presence of Rio Grande silvery minnow for the Levee Setback Project.

A Smith-Root 1.5 kV pulsed-DC electrofisher system was used to sample designated passes along the study reaches. The electrofisher unit was mounted on a raft with two sphere anodes and adjusted to produce 2.0-3.5 amps at 30 pulses per second for sampling in reaches with 400 cfs flows. Water conductance varied from 300 to 600 ms/cm upstream to downstream. Sampling effort was measured by time (sec) electrofished.

The Smith-Root pulsed-DC electroshocking system was mounted on an Argo all-terrain vehicle (ATV) replacing the spherical anodes with a pair of wands with anode hoops. The ATV facilitated sampling in 100-200 cfs flows where the river channel is wider with shallow water (mean depth < 0.5 m). Two technicians walk beside the ATV, sweeping the water area with the wands. Two additional technicians net the electro-anesthetized fish.

Monitoring Surveys for the Temporary Channel

Monitoring of the Temporary Channel in the headwaters area of Elephant Butte Reservoir were conducted using minnow traps (Figure 3). Traps were set for two to 18 hours (overnight) prior to retrieval. Fish were identified to species, counted and released. The area sampled extended over 36 km from the confluence of the LFCC down to the upper end of the reservoir.
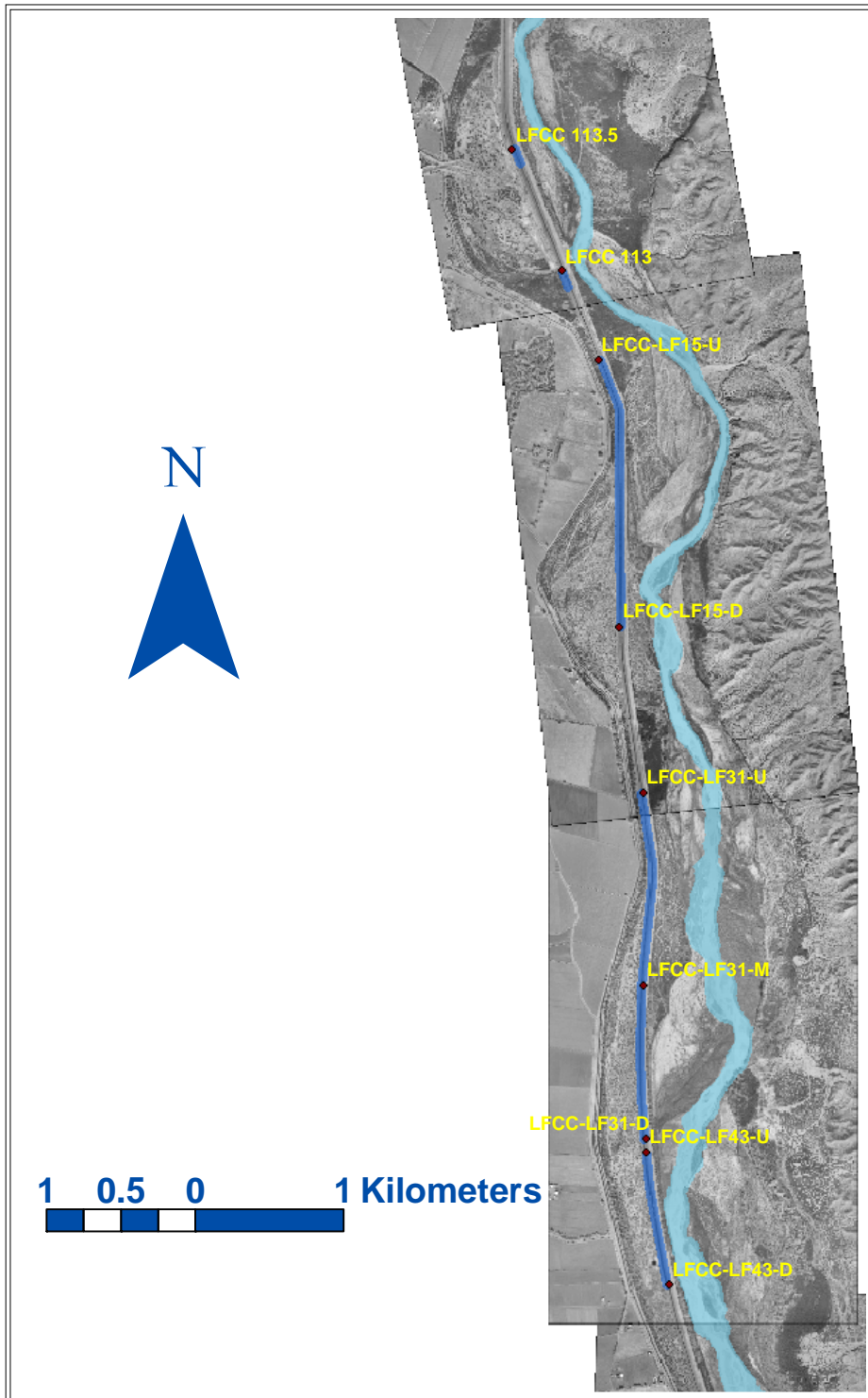
Figure 2. Sampling reaches on the Low Flow Conveyance Channel for parrot feather removal, experimental operations monitoring, and pre-project assessment for the Levee Setback Project.
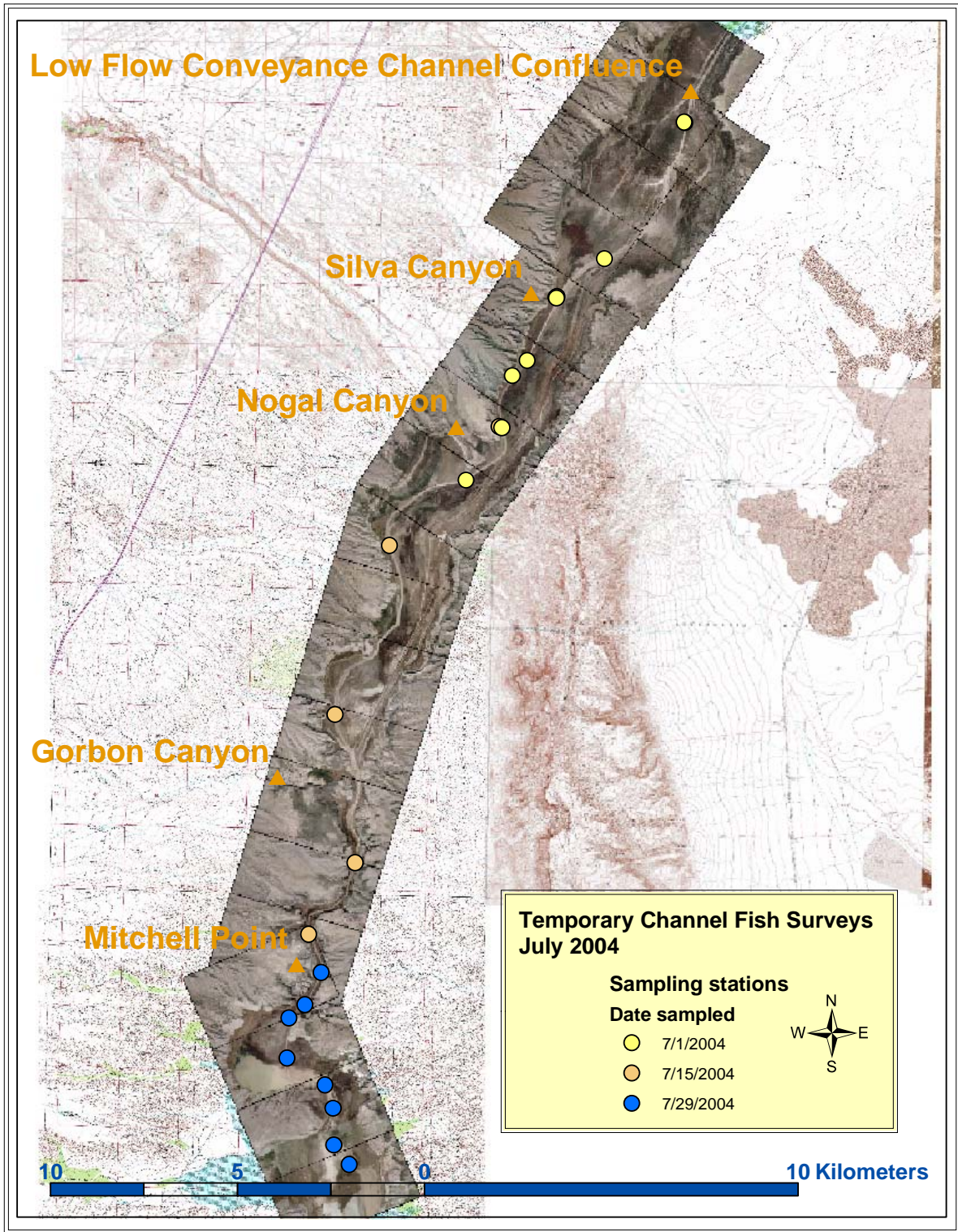
Figure 3. Minnow trap locations for Temporary Channel fish community monitoring.

Results and Discussion

Monitoring for silvery minnow eggs at the irrigation diversion structures (Table 1) and at nursery habitat sites (Table 2) collected a total of 46 eggs using both Moore egg collectors and quadrats. The quadrats sampled 25% of the eggs captured at the nursery habitat sites.

Seining was used to sample at Los Lunas and in a side channel at Santa Clara Pueblo. The results from seining are shown in Table 3. The number of species present and the Shannon-Weiner index for both sites indicates a moderate level of species diversity. No silvery minnows were collected at Los Lunas or Santa Clara Pueblo. Electrofishing the Low Flow Conveyance Channel in spring and fall of 2004 indicates that no entrainment of Rio Grande silvery minnows occurred as a result of Experimental Operations (Table 4). The LFCC is outside the designated critical habitat for the silvery minnow. The number of species and Shannon-Weiner index are consistent with a moderate level of species diversity. No silvery minnows were collected in the LFCC in spring or fall surveys. The Temporary Channel sampling with minnow traps captured few fish (Table 5). The number of species and Shannon-Weiner index are both low. These values probably result from the selectivity of the traps and the quality of habitat present in the Temporary Channel. No silvery minnows were collected during the surveys.

The combined raft and ATV electrofishing results are presented in Table 6. Sampling with the raft usually encompassed about three miles of river. Using the ATV allowed sampling of about one mile of river with greater intensity and capture rates. The number of species and Shannon-Weiner index are generally low for areas sampled downstream of San Acacia Dam. Silvery minnows were pre-dominantly collected in the Albuquerque area during the electrofishing surveys, with a single silvery minnow downstream of San Acacia Dam.

ACKNOWLEDGMENTS

Table 1. Results of monitoring for silvery minnow eggs at irriigation diversion structures.

Date	Angostura	Belen Highline	Peralta Main	San Acacia
5/1/2004	0	0	0	0
5/2/2004	0	0	0	0
5/3/2004	0	0	0	0
5/4/2004	0	0	0	0
5/5/2004	0	0	0	0
5/6/2004	0	0	0	0
5/7/2004	0	1	0	0
5/8/2004	0	2	0	0
5/9/2004	0	0	0	0
5/10/2004	0	0	0	0
5/11/2004	0	0	0	0
5/12/2004	0	0	0	0
5/13/2004	0	0	0	1
5/14/2004	0	0	0	0
5/15/2004	0	0	0	1
5/16/2004	0	0	2	0
5/17/2004	0	0	1	0
5/18/2004	0	0	0	0
5/19/2004	0	0	0	2
5/20/2004	0	0	0	0
5/21/2004	0	0	0	0
5/22/2004	0	0	0	0
5/23/2004	0	0	0	0
5/24/2004	0	0	0	0
5/25/2004	0	0	0	0
5/26/2004	0	0	0	0
5/27/2004	0	0	0	0
5/28/2004	0	0	0	0
5/29/2004	0	0	0	0
5/30/2004	0	0	0	0
5/31/2004	0	0	0	0
	0	3	3	4
Hours	17.3	29.0	30.0	29.8

Table 2. The number of silvery minnow eggs and unidentified fish larvae collected on quadrats during the nursery habitat study.

Sampler	Hours	MEC Eggs	MEC Fish Larvae	Quadrats Eggs	Quadrats Fish Larvae
Sandia / AMAFCA	6:30	7	2	6	3
Calabacillas Arroyo	4:45	16	1	6	2046
Los Lunas	6:40	0	0	0	52
Abo Arroyo	2:00	0	0	0	5
Arroyo de la Parida	8:15	1	0	0	2
Total	28:10	24	3	12	2108

Table 3. Fish collections by seining at two sites.

Species	Los Lunas	Santa Clara
Ameiurus melas	-	4
Carpoides carpio	2	2
Catostomus commersoni	13	72
Cyprinella lutrensis	6	9
Cyprinus carpio	27	-
Gambusia affinis	44	65
Lepomis cyanellus	-	66
Lepomis macrochirus	-	2
Micropterus salmoides	4	-
Perca flavescens	3	-
Pimephales promelas	115	50
Platygobio gracilis	-	1
Rhinichthys cataractae	-	3
Total Fish	214	274
Species	8	10
Shannon Weiner	1.37	1.66

Table 4. Fish collections in the Low Flow Conveyance Channel using a backpack electrofisher.

Species	LFCC
Ameiurus natalis	1
Carpoides carpio	24
Catostomus commersoni	5
Cyprinella lutrensis	145
Cyprinus carpio	152
Dorosoma cepedianum	1
Gambusia affinis	213
Ictalurus punctatus	2
Lepomis cyanellus	1
Micropterus dolomeiui	1
Micropterus salmoides	54
Pimephales promelas	53
Total Fish	652
Species	12
Shannon Weiner	1.67

Table 5. Fish collections using minnow traps on the Temporary Channel in the headwaters area of Elephant Butte Reservoir.

Species	Temp Channel
Carpoides carpio	2
Gambusia affinis	9
Ictalurus punctatus	1
Micropterus salmoides	1
Total Fish	13
Species	5
Shannon Weiner	0.94

Table 6. Fish collections using raft and ATV electrofishing on the Rio Grande. Raft surveys were conducted in January, February, and August. The ATV was used for the September surveys.

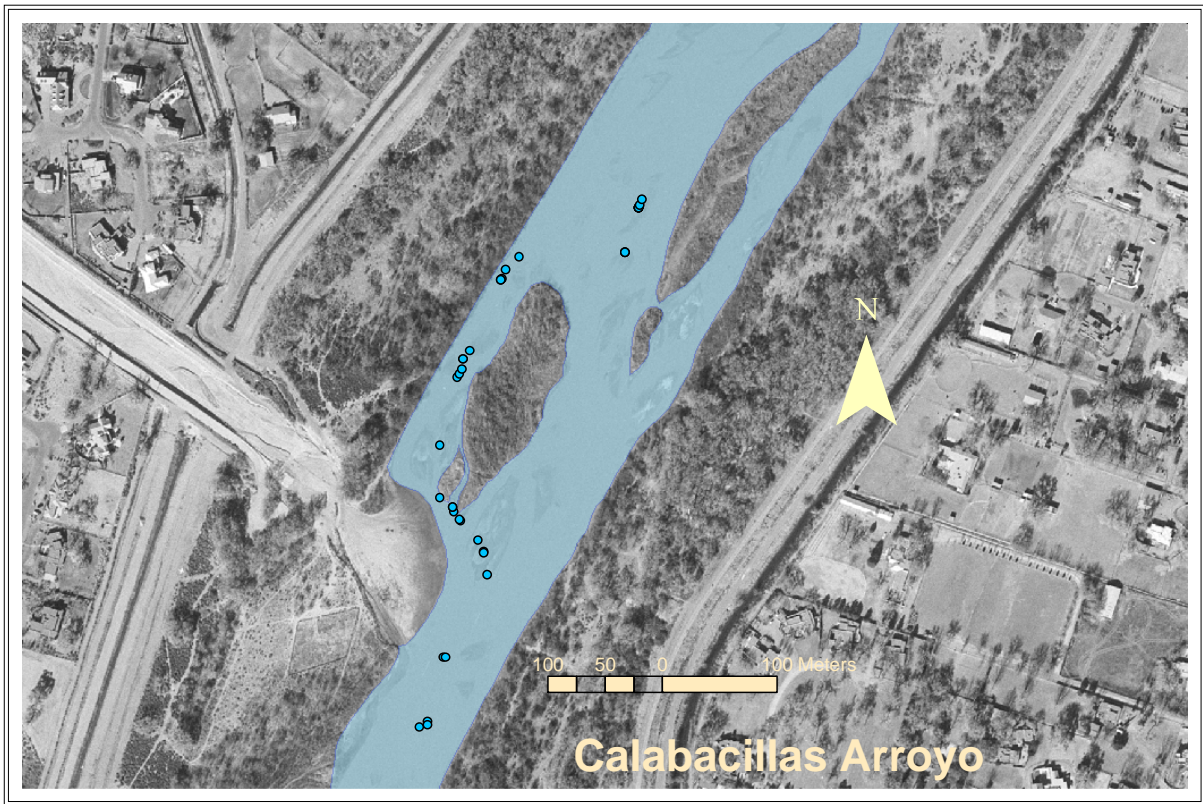| Species	Total	Ft. Craig	San Marcial	San Marcial	Escondida	San Acacia	Los Lunas	Paseo del Norte	Calabacillas	Sandia	Santa Clara	Santa Clara
		1/20/04	1/21/04	9/1/04	1/22/04	1/23/04	2/25/04	9/2/04	9/3/04	2/26/04	2/24/04	8/31/04
Ameiurus natalis	1	-	-	-	-	-	-	-	1	-	-	-
Carpoides carpio	89	1	1	-	4	6	11	6	31	28	1	-
Catostomus commersoni	144	-	-	-	-	-	-	-	1	5	68	70
Cyprinella lutrensis	164	-	-	45	-	-	3	22	89	5	-	-
Cyprinus carpio	177	1	4	3	2	40	7	1	4	61	31	23
Gambusia affinis	4	-	-	-	-	-	-	1	3	-	-	-
Hybognathus amarus	194	-	-	1	-	-	-	43	144	6	-	-
Ictalurus punctatus	84	-	1	10	-	1	2	10	30	24	1	5
Ictiobus bubalus	12	4	5	-	-	3	-	-	-	-	-	-
Lepomis cyanellus	2	-	-	-	-	-	-	-	-	-	2	-
Lepomis macrochirus	2	-	-	-	-	-	-	-	-	-	-	2
Micropterus dolomeiui	8	-	-	-	-	-	-	-	-	-	-	8
Morone chrysops	3	-	-	-	-	-	-	-	-	-	-	3
Pimephales promelas	21	-	-	-	-	-	-	4	17	-	-	-
Platygobio gracilis	206	-	-	-	-	-	2	72	115	2	2	13
Pomoxis annularis	1	-	-	-	-	-	-	-	-	-	-	1
Rhinichthys cataractae	55	-	-	-	-	-	-	1	15	-	3	36
Salmo trutta	14	-	-	-	-	-	-	-	-	-	9	5
Total Fish	1181	6	11	59	6	50	25	160	450	131	117	166
Species	18	3	4	4	2	4	5	9	11	7	8	10
Shannon Weiner	2.21	0.87	1.16	0.73	0.64	0.68	1.38	1.47	1.74	1.45	1.18	1.68
Vehicle		Raft	Raft	ATV	Raft	Raft	Raft	ATV	ATV	Raft	Raft	Raft

Figure 4. Point locations for Rio Grande silvery minnows collected by electrofishing.