RECLAMATION

Managing Water in the West

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RIO GRANDE FISH COMMUNITY SURVEYS

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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.

Methods

Data Collection and Analysis

Fish surveys conducted by Reclamation use standard electrofishing gear (boat and backpack), and seining in the Middle Rio Grande in New Mexico. 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 or printed datasheets. 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 tabulated by site. The Shannon-Weiner index was calculated for each site as a measure of species diversity.

Surveys for Silvery Minnow Eggs

Surveys for silvery minnow eggs were conducted at Middle Rio Grande Project irrigation diversions (Figure 1). Moore egg collectors (Altenbach et al. 2000) were used for collecting egg in the canals. Egg data was collected by SWCA Environmental Consultants under contract to the U.S. Bureau of Reclamation (Beck and Fluder 2006).

Electrofishing surveys

Surveys were conducted by Reclamation biologists along several reaches of the Middle Rio Grande (Figure 1) as part of monitoring project requirements. Within each reach, electrofishing was conducted at sites selected from previous studies and new sites where monitoring is required. Surveys sampled a range of habitat types, including natural (defined as not altered), backwater, riprap and jetty areas. Data were recorded by sample reach. GPS coordinates were recorded when silvery minnows were collected in dipnets to identify preferred habitat.

A Smith-Root 1.5 kV pulsed-DC electrofisher system was used to sample designated segments along the study reaches in February 2005. 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 (seconds) electrofished. Water quality measures were usually recorded upon arrival at the raft launch site. Data for water temperature, conductivity, dissolved oxygen and pH were recorded using a Eureka probe and handheld computer. A Secchi disk was used to measure light penetration as an index of water clarity, with increasing depth of visibility indicating less turbid water.

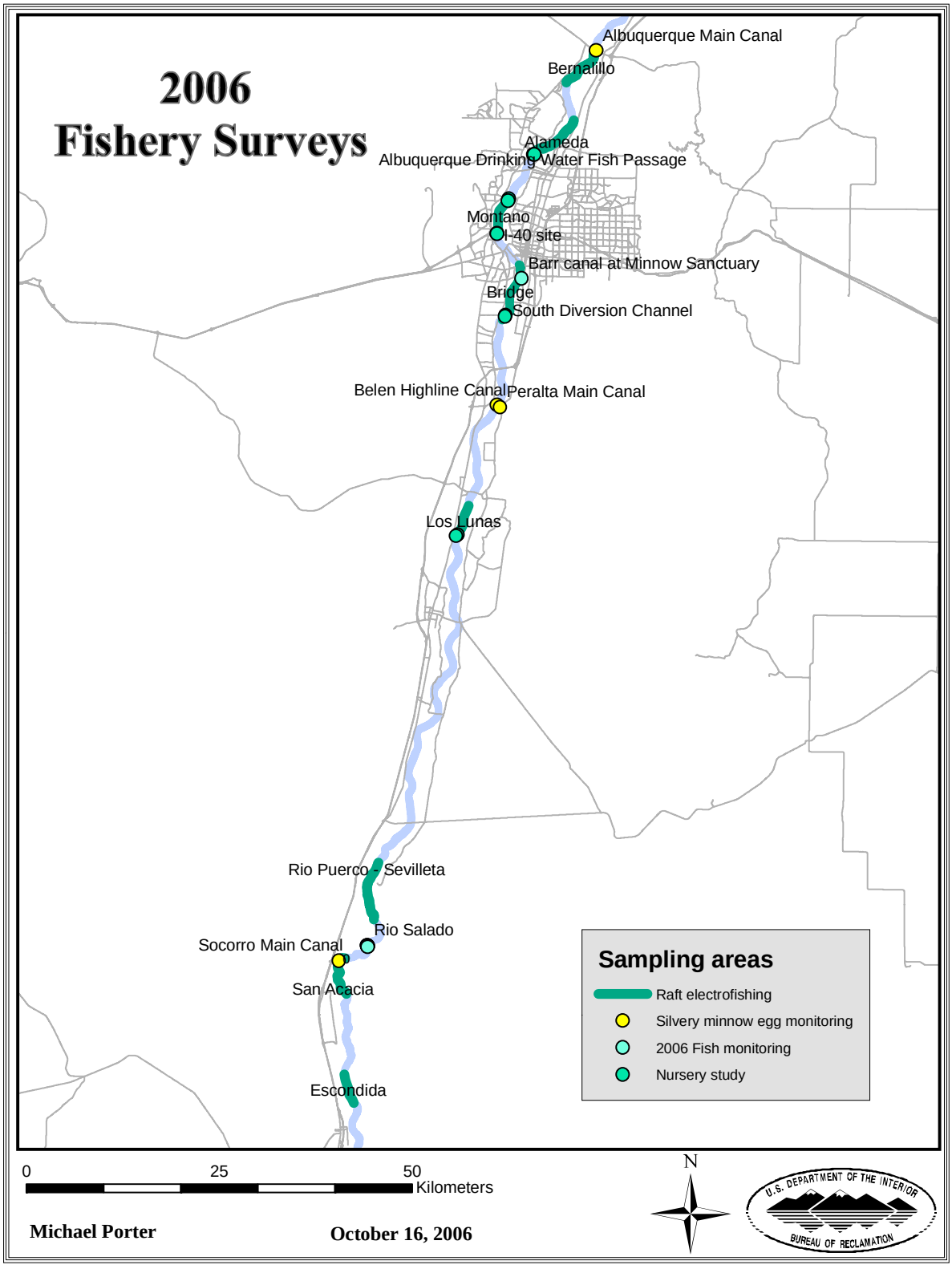

Figure 1. Sites for irrigation diversion monitoring, fish sampling, and electrofishing trips.

Seining Surveys

Two fish monitoring (seining) surveys (Figure 1) were conducted in 2006. The first survey was for removing fish trapped in a pool in the Barr Canal at the Rio Grande Silvery Minnow Sanctuary construction site (Table 3). The second survey was to evaluate changes in the fish community at the Rio Salado following early monsoonal floods.

Fish Passage Survey

A preliminary survey was conducted in the Albuquerque Drinking Water Project Fish Passage Channel in May 2006. A Smith-Root backpack electrofisher was used for sampling the Albuquerque Drinking Water Fish Passage Channel. The electrofisher was set at 2.0-3.5 amp using a single handheld anode with a trailing cathode. Dip-netted fish locations were recorded using a Trimble GeoXT GPS unit along with species name, water depth and velocity.

Nursery Habitat Study

Hoop nets were used to capture fish to evaluate use of potential nursery areas. Rectangular hoop nets (0.5 × 0.5 m, 6.4-mm mesh size) were placed in pairs at five locations (Figure 1). Sites were selected to evaluate potential spawning habitat areas with low or no current velocity and depths between 20 and 30 cm. Artificial embayments were created by placing silt fences in an elongated horseshoe shape on mid channel bars to create a reduced velocity area. The hoop nets were securely attached to the substrate with two square quadrats (0.5 × 0.5m) fitted with 1-mm mesh placed under the rear section of each hoop net for egg collection.

Results and Discussion

Monitoring for silvery minnow eggs at the irrigation diversion structures (Table 1) collected a total of 33 silvery minnow eggs using Moore egg collectors. All eggs were returned to the river following enumeration.

The raft electrofishing results are presented in Table 2. Sampling with the raft usually encompassed between 3-5 miles of river per site. Lower winter flows in 2006 precluded using the electrofishing raft on the Los Lunas Restoration Site. Monsoon rains provided sufficient flow in August for rafting the target reaches rather than use the amphibious ATV as in previous years. The values for temperature, conductivity, dissolved oxygen, pH and turbidity (Secchi depth) appear in Table 3. The total number of silvery minnows collected during February increased about 50% in 2006 based on the seven subreaches sampled in both 2005 and 2006 (Table 2). The total number of fish collected increased 15% for the same period from 2005.

The survey in the Barr Canal at the Rio Grande Silvery Minnow Sanctuary construction site removed fish trapped in a pool (Table 4) following high rain events in June. Fish were identified to species, counted, and released. Two young of year walleye were preserved as voucher specimens and to verify identification. The survey at the Rio Salado (Table 4) was a follow-up to a survey conducted in 2005. No silvery minnows were collected in 2006, compared to 267 (66% of the fish sampled) in 2005. Summer rains this year produced several large flow events on the Rio Salado resulting in changes in the Rio Grande planform at the confluence. The Rio Salado alluvial fan expanded into the channel filling in a major side channel and narrowing the remaining channel. Down-cutting of the Rio Salado mouth will create potential nursery habitat at a lower flow than in recent years.

The Albuquerque Drinking Water Project Fish Passage Channel was completed in early April 2006. Eight fish species including silvery minnows were observed several weeks later (Table 4), distributed throughout the channel (Figure 2).

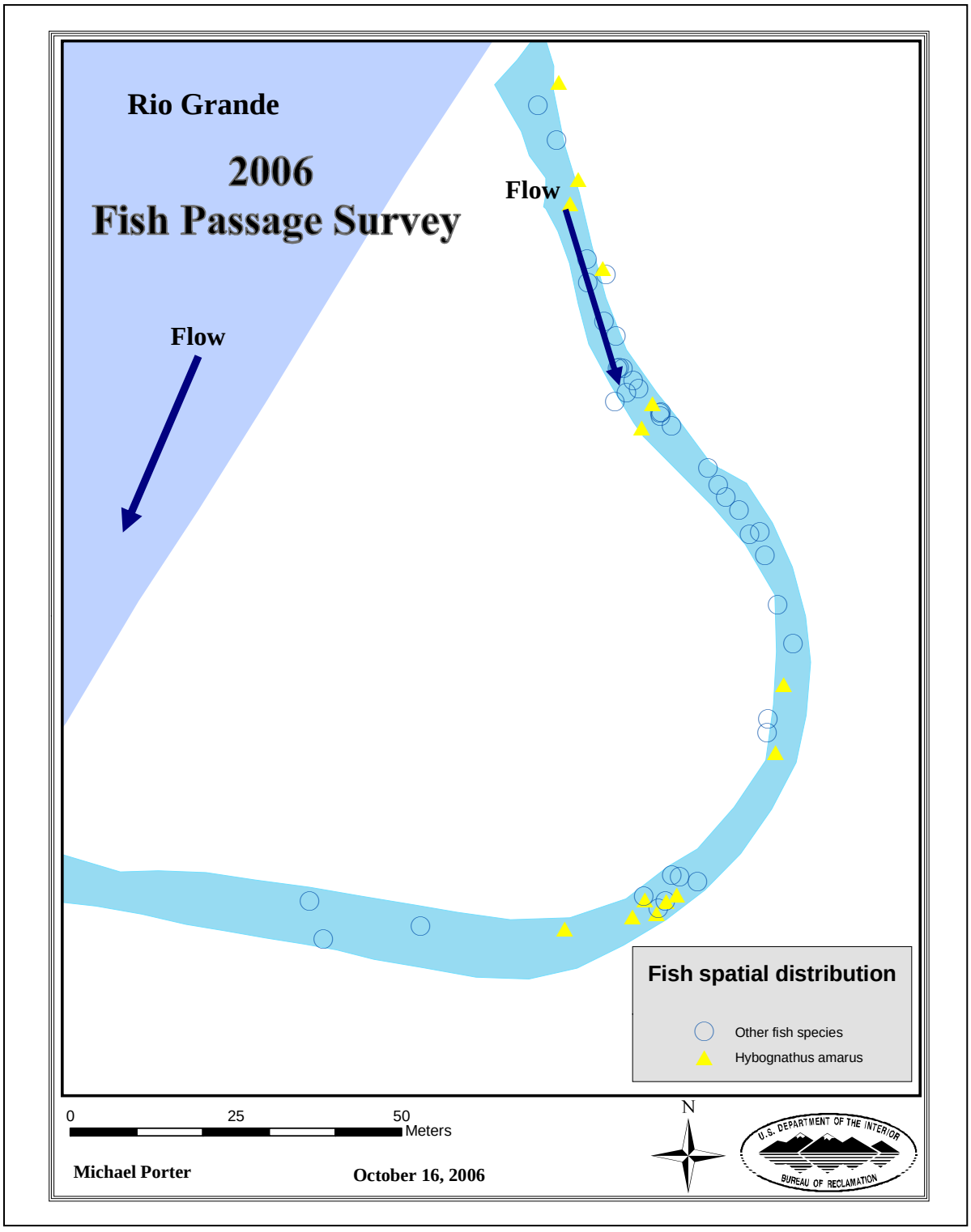

Figure 2. Distribution of fish in the Albuquerque Drinking Water Project Fish Passage Channel.

A total of 1092 fish were captured and released during the nursery habitat survey including 103 silvery minnows (Table 5). The negative data for spawning habitat selection by silvery minnows provide a starting point for future studies investigating nursery habitat. Future research will increase sampling effort at naturally occurring habitats.

The availability of nursery habitat in 2006 was limited by regulated flow less than 900 cfs during the prime spawning period (late April through June). Monsoonal rains may have provided some nursery habitat later in the year with flow in Albuquerque exceeding 2000 cfs and flow in the San Acacia reach exceeding 10,000 cfs. Other studies will document any recruitment of a new cohort of silvery minnows. The degradation of habitat quality and availability for producing young of year silvery minnows has probably contributed to their declining populations in recent years. Common and species names for fish in the Middle Rio Grande appear in Table 6.

CONCLUSIONS

High silvery minnow recruitment in 2005 was associated with increased floodplain inundation (Bureau of Reclamation 2005). Regulated spring flow in 2006 resulted in poor recruitment. The area and availability of floodplain nursery habitat is an important limiting factor on silvery minnow populations. The presence of silvery minnows in the Albuquerque Fish Passage Channel documented and will be investigated further during water diversion operations.

ACKNOWLEDGMENTS

Product names in this report are provided to illustrate examples of techniques, and do not imply endorsement of commercial equipment or software used during these studies.

Funding for these surveys was provided by the U.S. Bureau of Reclamation Albuquerque Area Office and the New Mexico Interstate Stream Commission. We appreciate the cooperation of the Middle Rio Grande Conservancy District, Sandia Pueblo, City of Albuquerque Open Space and Sevilleta National Wildlife Refuge in providing access to study sites. SWCA environmental consultants provided valuable expertise and personnel for monitoring silvery minnow egg entrainment, the nursery habitat study and other sampling. The Friends of the Rio Grande Nature Center provided volunteers for the summer fish sampling.

Literature Cited

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Beck, S.E. and J.J. Fluder 2006. Silvery Minnow Egg and Larval Fish Monitoring in Nursery Habitats: Summary of Findings Report. Report prepared for the Bureau of Reclamation, 26 pgs.

Bureau of Reclamation 2002. Rio Grande Silvery Minnow Egg Entrainment in Irrigation Canals during 2002. 6 pgs.

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Bureau of Reclamation 2004. Annual Report 2004. Rio Grande Fish Community Surveys. 12 pgs.

Bureau of Reclamation 2005. Annual Report 2005. Rio Grande Fish Community Surveys. 13 pgs.

Table 1. Results of monitoring for silvery minnow eggs at irrigation diversion structures. Data compiled by SWCA.

Date	Albuquerque Main	Peralta Main	Belen Highline	Socorro Main Canal
Time (hours)	31:00	30:00	31:00	31:00
5/1/2006	0	0	0	0
5/2/2006	0	0	1	0
5/3/2006	0	0	1	0
5/4/2006	0	0	0	0
5/5/2006	0	0	0	0
5/6/2006	0	-	0	0
5/7/2006	0	0	0	0
5/8/2006	0	0	0	0
5/9/2006	0	3	0	0
5/10/2006	0	1	0	0
5/11/2006	0	0	0	0
5/12/2006	0	0	0	0
5/13/2006	0	0	0	0
5/14/2006	0	0	0	0
5/15/2006	0	0	0	0
5/16/2006	0	0	0	0
5/17/2006	0	0	0	0
5/18/2006	0	2	0	0
5/19/2006	0	1	0	0
5/20/2006	0	0	0	0
5/21/2006	0	0	0	0
5/22/2006	0	0	0	0
5/23/2006	0	0	0	0
5/24/2006	0	0	0	0
5/25/2006	0	0	0	0
5/26/2006	0	6	3	0
5/27/2006	0	1	1	0
5/28/2006	0	0	0	0
5/29/2006	0	0	2	0
5/30/2006	0	3	0	8
5/31/2006	0	0	0	0
Totals				
2006	0	17	8	8
2005[1,2]	1	1	3	24[3]
2004[1,2]	0	3	3	-
2003[1,2]	3	26	48	-
2002[2]	0	729	826	28

1. Diversions managed to minimize entrainment of silvery minnow eggs.
2. Bureau of Reclamation 2002, 2003, 2004, 2005.
3. Alamillo Arroyo

Table 2. Rio Grande raft electrofishing surveys.

Species	Total	Bernalillo	Alameda	Montano	Bridge	Los Lunas	Rio Puerco	San Acacia	Escondida	Montano	Los Lunas	Bridge
		2/24/2006	2/23/2006	2/21/2006	2/20/2006	2/17/2006	2/16/2006	2/15/2006	2/22/2006	8/23/2006	8/24/2006	8/25/2006
Ameiurus natalis	3	0	0	0	0	0	0	1	0	2	0	0
Carpoides carpio	80	7	28	6	26	1	6	2	1	2	0	1
Catostomus commersoni	8	0	4	0	2	0	2	0	0	0	0	0
Cyprinella lutrensis	34	2	0	0	0	11	0	0	0	2	13	6
Cyprinus carpio	263	28	73	17	43	9	22	19	14	15	12	11
Gambusia affinis	3	0	0	0	0	2	0	0	0	0	1	0
Hybognathus amarus	200	2	3	40	15	26	18	32	45	4	12	3
Ictalurus furcatus	1	0	0	0	0	0	0	0	0	0	1	0
Ictalurus punctatus	271	26	55	32	33	13	21	20	3	3	48	17
Ictiobus bubalus	5	1	0	0	0	0	1	1	1	0	1	0
Micropterus salmoides	1	0	0	0	0	0	0	0	0	1	0	0
Morone chrysops	11	0	2	0	2	0	2	5	0	0	0	0
Pimephales promelas	11	1	0	0	0	8	0	0	0	0	2	**0**
Platygobio gracilis	7	1	1	1	2	0	2	0	0	0	0	**0**
Pylodictis olivaris	1	0	0	0	0	0	0	0	0	0	0	1
Rhinichthys cataractae	5	3	1	0	0	0	0	0	0	1	0	0
Salmo trutta	1	1	0	0	0	0	0	0	0	0	0	0
Sander vitreus	1	1	0	0	0	0	0	0	0	0	0	0
Total Fish	986	73	167	96	123	70	74	80	64	30	90	39
Shannon Weiner	1.71	1.58	1.30	1.26	1.51	1.65	1.62	1.43	0.85	1.61	1.39	1.39
2005												
Hybognathus amarus	1732		13	7	4	46	0	32	16	712		415
Total Fish	2712		103	94	95	77	35	78	101	807		485

Winter Sampling	2006	2005
Hybognathus amarus	181	118
Total Winter Fish	747	583

Table 3. Water quality associated with fish surveys.

Date	Location	Temp°C	Sp.Cond ms/cm	DO mg/L	pH	Secchi depth (cm)
16-Feb-06	Rio Puerco	6.01	0.48	13.49	8.26	
17-Feb-06	Los Lunas	5.71	0.449	11.97	8.22	
21-Feb-06	Montano	2.7	372	12.34	7.13	
22-Feb-06	Escondida	8.03	618	11.53	8.03	
23-Feb-06	Alameda	4.4	321	11.75	7.98	
25-Jul-06	Rio Salado	24.68	0.875	6.7	8.41	
23-Aug-06	Montano	20.78	0.17	5.92	8.13	1
24-Aug-06	Los Lunas	20.78	0.171	5.75	8.13	
25-Aug-06	Bridge	20.82	0.281	5.76	7.93	1
16-Oct 06	Bernalillo Priority Site (channel)					7
16-Oct 06	Bernalillo Priority Site (channel)					14
16-Oct 06	Bernalillo Bridge					14

Table 4. Rio Grande fish monitoring surveys.

Species	Total	Fish Passage	Barr Canal	Rio Salado	Rio Salado
		5/1/2006	6/30/2006	7/25/2006	7/25/2005
Carpoides carpio	1	1	0	0	0
Catostomus commersoni	12	0	12	0	0
Cyprinella lutrensis	156	9	0	147	50
Cyprinus carpio	5	2	3	0	31
Gambusia affinis	1	0	0	1	24
Hybognathus amarus	23	23	0	0	267
Ictalurus punctatus	1	0	0	1	4
Lepomis macrochirus	2	0	2	0	0
Micropterus salmoides	1	0	1	0	0
Perca flavescens	1	1	0	0	0
Pimephales promelas	31	30	0	1	17
Platygobio gracilis	70	9	0	61	4
Rhinichthys cataractae	5	4	0	1	0
Sander vitreus	2	0	2	0	0
Total Fish	311	79	20	212	402
Shannon Weiner	1.52	1.58	1.20	0.71	1.18

Table 5. Fish captured with hoop nets and released during nursery habitat surveys.

Species	Total	Alameda	Montano	I40	South Diversion Channel	Los Lunas
Ameiurus melas	3	0	0	0	1	2
Ameiurus natalis	8	1	0	0	0	7
Carpoides carpio	7	1	0	0	4	2
Catostomus commersoni	3	1	0	0	2	0
Cyprinella lutrensis	282	44	12	48	52	126
Cyprinus carpio	20	2	0	15	3	0
Gambusia affinis	42	1	0	10	8	23
Hybognathus amarus	103	66	8	1	11	17
Ictalurus punctatus	9	1	0	0	1	7
Lepomis cyanellus	12	6	0	0	6	0
Lepomis macrochirus	1	1	0	0	0	0
Micropterus salmoides	1	1	0	0	0	0
Pimephales promelas	556	242	7	26	139	142
Platygobio gracilis	42	13	4	3	7	15
Rhinichthys cataractae	3	0	0	0	3	0
Total Fish	1092	380	31	103	237	341
Shannon Weiner	1.46	1.16	1.32	1.36	1.37	1.42

Table 6. Rio Grande fish species and common names.

Species Name	Common Name
Ameiurus melas	Black Bullhead
Ameiurus natalis	Yellow Bullhead
Carpoides carpio	River Carpsucker
Catostomus commersoni	White Sucker
Cyprinella lutrensis	Red Shiner
Cyprinus carpio	Common Carp
Dorosoma cepedianum	Gizzard Shad
Gambusia affinis	Mosquito Fish
Hybognathus amarus	Silvery Minnow
Ictalurus furcatus	Blue Catfish
Ictalurus punctatus	Channel Catfish
Ictiobus bubalus	Small Mouth Buffalo
Lepomis cyanellus	Green Sunfish
Lepomis macrochirus	Bluegill Sunfish
Micropterus dolomeiui	Smallmouth Bass
Micropterus salmoides	Largemouth Bass
Morone chrysops	White Bass
Morone saxatilis	Striped Bass
Oncorhynchus mykiss	Rainbow Trout
Perca flavescens	Yellow Perch
Pimephales promelas	Fathead Minnow
Platygobio gracilis	Flathead Chub
Pomoxis annularis	White Crappie
Pomoxis nigromaculatus	Black Crappie
Pylodictis olivaris	Flathead Catfish
Rhinichthys cataractae	Longnose Dace
Salmo trutta	Brown Trout
Sander vitreus	Walleye