ENVIRONMENTAL COMPLIANCE MONITORING ASSOCIATED WITH THE CITY OF ALBUQUERQUE DRINKING WATER PROJECT

Investigations of Rio Grande Silvery Minnow Egg Entrainment, May 2011

Prepared for

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INTRODUCTION

The purpose of this environmental monitoring project is to comply with select elements of the Reasonable and Prudent Measure and Terms and Conditions of the City of Albuquerque Drinking Water Project Biological Opinion (Biological Opinion) (U.S. Fish and Wildlife Service [USFWS] 2004) and the Final Environmental Impact Statement (EIS) for the Albuquerque Drinking Water Project (Bureau of Reclamation 2004). Since the Biological Opinion was issued in 2004, the City of Albuquerque, Water Resource Division, has formally become the Albuquerque Bernalillo County Water Utility Authority (ABCWUA). The ABCWUA is now responsible for implementing the mitigation measures contained in the Biological Opinion.

The Biological Opinion specifies that egg collection activities will be conducted to "reduce the amount of silvery minnow eggs entrained in the diversion structure. This egg collection will consist of 1 egg collector for 2 hours per day from May 1–31 each year of the first 10 years of the project." (USFWS 2004). This report summarizes Rio Grande silvery minnow (*Hybognathus amarus*; silvery minnow) egg collection activities during May 2011 upstream of the diversion structure.

METHODS

MONITORING SILVERY MINNOW EGGS

Monitoring for silvery minnow eggs was conducted in the Rio Grande upstream of the City of Albuquerque Drinking Water Project diversion dam using the sampling protocol developed by the USFWS. The collection area was approximately 150 meters upstream of the fish passage channel inlet along the east bank near the pump house (Figure 1). The Collection site was chosen based on river discharge and where crews could safely set three Moore egg collectors (MECs) (Figure 1). Silvery minnow eggs were identified in the field and then released downstream of the diversion dam. Eggs were distinguished as clear, semi-buoyant, non-adhesive spheres, ranging in size from 2.9 to 3.7 mm (mean 3.2 mm) in diameter (Figure 2).

Sampling for eggs was conducted with three MECs set side by side for two hours each day over 31 days during May 2011. Number of silvery minnow eggs, velocity of water (m/s) flowing through the MEC, and the sample duration (minutes) were recorded for each sample. The number of eggs collected was standardized in two different ways: 1) by the volume of water filtered (eggs/m^3) and 2) as the number of eggs collected per hour (eggs/hour).

The number of eggs passing the Alameda Bridge and the number entrained were calculated by expanding the mean egg density estimates by the volume of water (calculated from USGS Gauge # 8329918) that passed through both areas within a 24-hour period (i.e., total volume in 24 hours (m^3) × eggs/m^3 = total number eggs in 24 hours). The total number eggs passing the Alameda Bridge and entrained into the diversion structure for the month of May were calculated by summing daily egg passage and entrainment amounts. Egg density was used three separate ways for comparison: 1) mean value calculated using zero values, 2) mean value calculated without zero values, and 3) daily estimates of egg density (assumes that zero values represent true egg density and no eggs passed the Alameda Bridge on that day). Methods 1 and 2 assume that eggs pass the Alameda Bridge on each day during the month of May. Method 3 assumes that eggs

collected during the two hour period of sampling in a given day represented the rate at which eggs were transported downstream of the site during that day.

Figure 1. Overview map of the diversion dam and egg monitoring locations.

Figure 2. Silvery minnow egg with developing larvae. (photo by Michael Hatch).

DATA MANAGEMENT

A relational database (Microsoft Access) and a spreadsheet database (Microsoft Excel) were developed for the storage, analysis, and retrieval of fish and environmental data.

RESULTS AND DISCUSSION

In total, 186.5 hours of MEC sampling were conducted upstream of the diversion dam. Fifty four silvery minnow eggs were collected during monitoring. Daily egg collections ranged from zero to 18 eggs per MEC with peak collections occurring on May 31, 2011. Mean egg density ranged from 0.00 to 0.0197 eggs/m^3 while eggs per hour ranged from 0.0 to 6.8 eggs/hour (Appendix B).

Estimates of the number of eggs passing the Alameda Bridge and the number entrained into the diversion structure varied depending on use of egg density data (Appendix C). When using mean egg density calculated with zero values, the number of eggs that passed the Alameda Bridge during May was 64,568 and the number entrained into the diversion dam was 6,859 (Table 1). When using mean egg density calculated only from dates when eggs were collected, the number of eggs that passed the Alameda Bridge during May was 400,322, and the number entrained into the diversion dam was 42,523; however, the percentage of eggs entrained (10.6%) was identical between the two extrapolation approaches. During 2010 the same two methods yielded identical percentages of eggs entrained (2.3%); however estimated percentage entrained during 2011 was five times higher. When using the collected field data (i.e. , assuming no eggs passed at Alameda Bridge when eggs were not collected with MEC), the number of eggs that passed the Alameda Bridge during May was 75,389, and the number entrained into the diversion dam was 6,892. This extrapolation method resulted in 9.1% of the total passing at Alameda Bridge entrained into the diversion dam.

Table 1. Estimates of Number of Eggs Passing Alameda Bridge and Entrained in the Diversion Dam

Extrapolation Method	# Eggs Passing at Alameda	# Eggs Entrained	% of Total
1. Mean Value	64,568	6,859	10.6
2. Mean Value (excluding zeros)	400,322	42,523	10.6
3. Daily Egg Density	75,389	6,892	9.1

Fluctuations of mean daily discharge at Alameda Bridge ranged from 825 to 1,124 cfs during May 2011. When using extrapolation methods 1 and 2, the percentage of eggs entrained is equal to the percentage of the total flow diverted. During moderate to low spring discharges ABCWUA diversions are a greater proportion of the overall flow passing Alameda Bridge, therefore the estimated percentage of eggs entrained will be greater than during years of high discharge. When using extrapolation method 3, the number of eggs passing at Alameda Bridge will vary with changes in daily discharge and with the variability of daily estimates of egg densities. Since the rate of discharge into the structure was relatively constant throughout May, the daily number of eggs entrained into the diversion structure was modulated primarily by fluctuations in estimates of egg density. Regardless of how egg density data is used for extrapolation calculations, the estimated percentage of the number of eggs entrained throughout the month of May is similar between all three methods and is approximately a product of the percentage of the total amount of water diverted. The actual number of eggs entrained into the diversion structure would likely be similar to the estimate obtained using method 3 since the daily MEC collections are actual estimates of egg density and reflect day to day fluctuations in silvery minnow spawning activity.

LITERATURE CITED

Bureau of Reclamation. 2004. Final Environmental Impact Statement for the City of Albuquerque Drinking Water Project. U.S. Department of the Interior, Bureau of Reclamation, City of Albuquerque, in cooperation with the U.S. Army Corps of Engineers.

U.S. Fish and Wildlife Service (USFWS). 2004. Biological Opinion on the Effects of Actions Associated with the "Programmatic Biological Assessment for the City of Albuquerque Drinking Water Project." Albuquerque: U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office.

APPENDIX A
PHOTOGRAPHS

Figure A1. Crew sampling for eggs upstream of the drinking water diversion near the pump house.

APPENDIX B
EGG COLLECTIONS BY DATE

Table B.1. Daily Egg Collections by Location. Daily number of sample hours and eggs collected are given, while daily mean values of eggs/m^3 and eggs/hour are given.

Date	Sample Hours	Number Eggs	Egg/m^3	Eggs/Hour
5/1/2010	5.85	0	0.0000	0.0000
5/2/2010	6.00	2	0.0024	0.3333
5/3/2010	6.00	0	0.0000	0.0000
5/4/2010	6.25	0	0.0000	0.0000
5/5/2010	6.10	0	0.0000	0.0000
5/6/2010	6.20	0	0.0000	0.0000
5/7/2010	6.15	0	0.0000	0.0000
5/8/2010	6.00	0	0.0000	0.0000
5/9/2010	6.00	0	0.0000	0.0000
5/10/2010	6.00	0	0.0000	0.0000
5/11/2010	6.00	0	0.0000	0.0000
5/12/2010	6.00	0	0.0000	0.0000
5/13/2010	6.00	0	0.0000	0.0000
5/14/2010	6.00	0	0.0000	0.0000
5/15/2010	6.00	3	0.0022	0.5000
5/16/2010	6.00	0	0.0000	0.0000
5/17/2010	6.00	0	0.0000	0.0000
5/18/2010	6.00	0	0.0000	0.0000
5/19/2010	6.00	0	0.0000	0.0000
5/20/2010	6.00	0	0.0000	0.0000
5/21/2010	6.00	0	0.0000	0.0000
5/22/2010	6.00	0	0.0000	0.0000
5/23/2010	6.00	0	0.0000	0.0000
5/24/2010	6.00	6	0.0038	1.0000
5/25/2010	6.00	0	0.0000	0.0000
5/26/2010	6.00	0	0.0000	0.0000
5/27/2010	6.00	0	0.0000	0.0000
5/28/2010	6.00	2	0.0011	0.3333
5/29/2010	6.00	0	0.0000	0.0000
5/30/2010	6.00	0	0.0000	0.0000
5/31/2010	6.00	41	0.0197	6.8333
Total/Mean	**186.55**	**54**	**0.0009**	**0.2903**

APPENDIX C
ESTIMATES OF THE TOTAL NUMBER OF EGGS

Table C.2. Daily estimates of Eggs Passing the Alameda Bridge (USGS # 8329918) and Entrained into the Diversion Structure

Date	m^3 of Water Passing at Alameda Bridge	m^3 of Water Diverted	Method 1		Method 2		Method 3	
			# Eggs Passing at Alameda	# Eggs Entrained Into Diversion Structure	# Eggs Passing at Alameda	# Eggs Entrained Into Diversion Structure	# Eggs Passing at Alameda	# Eggs Entrained Into Diversion Structure
5/1/2010	2066439	238435	1946	225	12068	1392	0	0
5/2/2010	2157676	230541	2032	217	12601	1346	5178	553
5/3/2010	2107445	219044	1985	206	12307	1279	0	0
5/4/2010	2111701	234587	1989	221	12332	1370	0	0
5/5/2010	2067968	220771	1948	208	12077	1289	0	0
5/6/2010	2083361	223929	1962	211	12167	1308	0	0
5/7/2010	2059227	239644	1940	226	12026	1400	0	0
5/8/2010	2041718	238732	1923	225	11924	1394	0	0
5/9/2010	2019970	222103	1903	209	11797	1297	0	0
5/10/2010	2065470	232132	1946	219	12062	1356	0	0
5/11/2010	2074110	223201	1954	210	12113	1303	0	0
5/12/2010	2121716	257642	1999	243	12391	1505	0	0
5/13/2010	2173477	251265	2047	237	12693	1467	0	0
5/14/2010	2272435	242235	2140	228	13271	1415	0	0
5/15/2010	2185353	238189	2058	224	12762	1391	4808	524
5/16/2010	2187927	232490	2061	219	12777	1358	0	0
5/17/2010	2210685	239213	2082	225	12910	1397	0	0
5/18/2010	2173730	235709	2048	222	12695	1377	0	0
5/19/2010	2145953	237103	2021	223	12532	1385	0	0
5/20/2010	2157013	232921	2032	219	12597	1360	0	0
5/21/2010	2374809	230010	2237	217	13869	1343	0	0
5/22/2010	2239916	232847	2110	219	13081	1360	0	0
5/23/2010	2214846	233427	2086	220	12935	1363	0	0
5/24/2010	2278998	238670	2147	225	13309	1394	8660	907
5/25/2010	2270728	235019	2139	221	13261	1373	0	0
5/26/2010	2281330	237621	2149	224	13323	1388	0	0
5/27/2010	2318079	233526	2183	220	13538	1364	0	0
5/28/2010	2345648	238411	2209	225	13699	1392	2580	262
5/29/2010	2383551	238682	2245	225	13920	1394	0	0
5/30/2010	2607642	237510	2456	224	15229	1387	0	0
5/31/2010	2749339	235808	2590	222	16056	1377	54162	4645
Total	**68548260**	**7281416**	**64568**	**6859**	**400322**	**42523**	**75389**	**6892**
% of Total		**10.6**		**10.6**		**10.6**		**9.1**