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Rio Grande silvery minnow winter population-habitat use monitoring project

Summary of Four Trips (December 1995 - March 1996)

by

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prepared for:

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Background and Objectives

Four mainstem cyprinid species have been extirpated from the Rio Grande in New Mexico since 1949. Rio Grande silvery minnow is the only remaining endemic mainstream cyprinid in the New Mexico portion of the Rio Grande and its distribution is currently about 5 % of what it was historically. This species was federally listed as endangered in August 1994 and its proposed critical habitat is comprised of the Rio Grande from NM State Hwy 22 (Sandoval County) and extending 262 km (163 miles) downstream to the railroad crossing of the river near San Marcial (Socorro County).

The U.S. Army Corps of Engineers, Albuquerque N.M. District approved the evacuation of 98,000 acre-feet of water (November 1-March 31, 1995-1996) from Abiquiu Reservoir, through Cochiti Dam downstream to Elephant Butte Reservoir. The five month evacuation of this water was projected increase winter base-flow by 325 cfs. Little data were available on winter habitat use by Rio Grande silvery minnow (*Hybognathus amarus*). This lack of data severely limited assessment of the potential impacts that this additional winter release would have on Rio Grande silvery minnow.

The primary objective of this U.S. Army Corps of Engineers (USACE) funded study was to determine the habitat associations of Rio Grande silvery minnow during the winter carry-over release period. Another purpose was to determine the species composition and abundance of fishes present at eight pre-selected sites between Isleta and Bosque Del Apache National Wildlife Refuge. The information gathered during this investigation will be used to fill gaps in our knowledge of life-history and habitat use by Rio Grande silvery minnow.

Report Summary

Methods

We conducted four sampling trips in the study area between 29 December 1995 and 3 March 1996. The purpose of our first sampling trip (29 December 1995-6 January 1996) was to perform an initial survey of Rio Grande silvery minnow population at the eight pre-selected sites. The next three sampling forays (January 19-26, February 3-5, March 1-3), while focusing on winter habitat use of Rio Grande silvery minnow, provided substantive information on fish abundance.

We followed the sampling protocol employed during our 1993-1995 quarterly Rio Grande silvery minnow population monitoring program. Samples for fish population monitoring were collected using a 2 m x 2 m x 4.76 mm-mesh seine. Only one discrete mesohabitat site was sampled in each seine haul (i.e., each seine haul represented a discrete sample in a discrete mesohabitat). Species composition, number of individuals per taxon, and size (in 10 mm SL bins) were recorded for each seine haul and given a unique alpha-numeric designation (=fish species composition data). Specimens were released alive where captured.

Physical information taken during the first sampling trip were mesohabitat type, length of seine haul and availability of instream cover. The alpha-numeric designation assigned the physical data was the same as recorded on the fish species composition data sheet. Mesohabitat types generally followed those described in Platania (1991; Fishes of the Rio Grande between Velarde and Elephant Butte Reservoir and their habitat associations).

Instream cover (debris) was identified as an important variable in determining winter fish distributions in previous Rio Grande fish-habitat studies. Although instream cover was recognized as a potentially useful variable to characterize the habitats occupied by Rio Grande fishes, it had not been systematically categorized or analyzed in previous Middle Rio Grande fish habitat investigations. We followed the work of several other authors who study fish-habitat use and treated instream cover as a categorical variable with values ranging from 1 to 4 at 0.5 intervals. Higher values indicated an increasing complexity of cover with a 0 value indicating a lack of instream debris. Cover coded as 1 indicated that there was a minimal amount of debris present in the area sampled (i.e. a few pieces of floating or submerged debris). Cover was assigned a value of 2 when it was a small, loosely packed debris pile (< 0.5 m^2). A cover code of 3 was assigned

when a moderate (about 1 m^2) densely packed debris pile was sampled. Cover was coded as 4 when a large densely packed debris pile (about 2 m^2) was sampled.

Sampling stations were ordered from upstream to downstream and were located between Isleta Pueblo and the southern boundary of the Bosque del Apache National Wildlife Refuge. A list of collecting localities and their descriptors are attached (Table 1). Note that as per our letter of 30 January 1996 and subsequent discussions with Nathan L. Allan (USACE), the Isleta Pueblo site was eliminated after the first sampling trip because of both limited access of this site and disruption in the continuity of habitat use sampling (i.e. January-March 1996). We did not feel that the elimination of the Isleta Pueblo site would adversely impact the investigation as the site at Tome (about 4.5 miles downstream of NM State HWY 49 Bridge, Valencia County) was similar to the Isleta Pueblo site and provided information on upstream species composition and habitat use. The data collected from the first sampling trip to the Isleta Pueblo site was included in summary tables.

Population monitoring

The population monitoring - habitat use study yielded 11 species represented by 5274 individuals (Table 2). Rio Grande silvery minnow was present in 178 of the 468 seine hauls, at all sampling stations, and comprised 71.3% of the total sample. Silvery minnow numerically dominated the fish community throughout the project. The number of Rio Grande silvery minnow varied considerably between sampling localities and was primarily due to a few seine hauls that contained several hundred individuals. Silvery minnow were most common in the downstream sites near the Bosque del Apache National Wildlife Refuge (Sites 5-7).

Red shiner was the second most abundant fish collected comprising 18% of the total sample. This species was present in 143 samples and at all eight collecting localities (Table 3). Red shiner varied in abundance over the course of the project, but were generally more abundant than other species at the upper-most sites (Sites 1-4). Channel catfish, the third most abundant fish (n=169, 3.2%), was present in 34 samples and at all eight collecting localities. The other seven species were each less than 3% of the total catch and were represented by between 1-143 individuals.

The highest catch rate was at site seven (26.8 fish/10 m^2) and was apparently due to the large number of Rio Grande silvery minnow that were collected in the numerous low velocity

pools with instream debris. Other high catch rates reflective of large numbers of Rio Grande silvery minnow were at sites five (21.2 fish/10 m^2) and six (16.7 fish/10 m^2). Catch rates at the other sites were between 2.2-14.4 fish per 10 m^2 with an overall CPUE of 13 fish/10 m^2. Catch rates varied little between the three habitat-use sampling trips (14.3-19.9) and the variation that did exist was due to a few single seine hauls that contained large numbers of Rio Grande silvery minnow. The cumulative CPUE of the three habitat-use sampling trips was twice that recorded during the December population monitoring trip (6.9 fish/10 m^2). One explanation for this difference was that the habitat-use sampling trips concentrated more on specific habitat types than did the population monitoring trip. Our December effort indicated that fish concentrated in relatively small pockets of preferred habitat (low-velocity with cover). Thus, we did not expend great effort in subsequent trips (habitat association) sampling numerous main or side channel runs (mesohabitats with large surface areas, >20 m^2), but instead concentrated on habitats characterized by small surface areas (debris pools, <6 m^2).

Habitat use

The survey of the winter habitat use of Rio Grande silvery minnow indicated that the majority (72.3%) of silvery minnow were caught in habitats that contained instream debris (Table 4). Areas with little debris (code = 1) were frequently encountered in the stream channel, but contained only 15.3% of the cumulative silvery minnow catch. Areas with moderate levels of debris (code = 2 and code = 3), while less common than code 1, accounted for 55% of the Rio Grande silvery minnow caught. Sites with the greatest level of debris were very rare and only accounted for 2% of silvery minnow caught.

Seine hauls that contained Rio Grande silvery minnow were taken at moderate depths (mean = 37.9 cm), in waters with low velocity (mean = 16.9 cm/sec) (Figure 1). While Rio Grande silvery minnow were found in about equal proportion throughout depths sampled, they occupied disproportionately more lower water velocities than were present (Figure 2). Rio Grande silvery minnow were only present over silt (code = 1) or sand (code = 2) substrata (mean substrate use = 1.3). These values are nearly identical to the values calculated for each habitat sampling foray (i.e. little variation between sampling dates). We excluded areas with debris when comparing types of mesohabitats used by Rio Grande silvery minnow to areas sampled (Table 4). This was done because debris changed the typical conditions found within the mesohabitat (e.g. the

water velocities of main channel run samples with debris were vastly different from those without debris). When areas with debris were excluded, we found that most (63.6%) Rio Grande silvery minnow were caught in backwaters and most of the remainder being taken in main channel or side channel pools (29.4%). Less than 3% of Rio Grande silvery minnow were captured in main channel or side channel runs despite the high availability of these mesohabitats at all sites.

Results Summary

Two species, Rio Grande silvery minnow and red shiner, collectively comprised nearly 90% of the fish taken during the study. Silvery minnow numerically dominated the samples (n=3760) and were the most abundant species during each of the four sampling trips. There were a total of eleven species (5 native, 6 introduced) collected during the project, but many accounted for <3 % of the total catch.

The large difference in fish catch rates between the sites was relatively consistent throughout the study. Sampling stations 3, 4 and 8 usually had the lowest catch rates. This may be due, in part, to the narrow river channel, lack of moderate-large debris piles, and associated high water velocity at these sites. Conversely, the wide braided river channel at sites 5, 6 and 7 provided substantial habitat heterogeneity and numerous low velocity habitats. The presence of debris in such habitats usually resulted in collections of a large number of fish from a small area (= high CPUE).

Over 70% of samples that contained Rio Grande silvery minnow were associated with some debris. The majority of all silvery minnow were found in level two or three debris. In addition, most other fish taken were associated with low velocity habitats or debris piles. There were no notable differences in habitat use by Rio Grande fishes between the three habitat use forays. Rio Grande silvery minnow were consistently found over small substrata, at moderate depths and in low velocity water throughout the course of the habitat use study (January - March, 1996).

Table 1. Collecting localities for U.S. Army Corps of Engineers funded winter population-habitat use monitoring project.

Station #	Site Locality
1	New Mexico, Bernalillo County, Rio Grande, ca. 1.3 miles downstream of Isleta Diversion Dam, Isleta Pueblo. River Mile 168.0 ISLETA QUADRANGLE 34°53'26.8"N 106°41'45.6"W
2	New Mexico, Valencia County, Rio Grande, ca. 4.5 miles downstream of NM State HWY 49 Bridge, Tome. River Mile 156.8 TOME QUADRANGLE 34°44'35.5"N 106°44'35.4"W
3	New Mexico, Socorro County, Rio Grande, ca. 1 mile upstream of Rio Puerco confluence. River Mile 127.3 ABEYTAS QUADRANGLE 34°22'49.4"N 106°50'06.6"W
4	New Mexico, Socorro County, Rio Grande, ca. 1 mile upstream of Rio Salado confluence. River Mile 120.2 LA JOYA QUADRANGLE 34°17'15.1"N 106°50'18.5"W
5	New Mexico, Socorro County, Rio Grande, ca. 6.0 miles downstream of San Acacia Diversion Dam. River Mile 109.7 LEMITAR QUADRANGLE 34°11'03.2"N 106°53'10.4"W
6	New Mexico, Socorro County, Rio Grande, ca. 2.6 miles downstream of the U.S. HWY 380 Bridge, San Antonio. River Mile 84.5 SAN ANTONIO QUADRANGLE 33°52'30.5" N 106°50'59.01"W
7	New Mexico, Socorro County, Rio Grande, ca. 2.2 miles downstream of the northern boundary of Bosque del Apache National Wildlife Refuge. River Mile 82.0 SAN ANTONIO, SE QUADRANGLE 33°49'09.9"N 106°51'12.1"W
8	New Mexico, Socorro County, Rio Grande, ca. 2.5 miles upstream of the southern boundary of Bosque del Apache National Wildlife Refuge. River Mile 76.5 INDIAN WELL WILDERNESS QUADRANGLE 33°45'52.6"N 106°52'36.2"W

Table 2. Summary of ichthyofaunal composition and collection data from December 1995-March 1996 at eight collection localities in the Middle Rio Grande, New Mexico. Specimens were collected for Rio Grande silvery minnow winter population-habitat monitoring project funded by the USACE.

SPECIES	RESIDENCE STATUS[1]	TOTAL NUMBER OF SPECIMENS	% TOTAL	FREQUENCY[2] OF OCCURRENCE	FREQUENCY[3] OF OCCURRENCE
red shiner	N	947	17.96	8	143
common carp	I	9	0.17	5	9
Rio Grande silvery minnow	N	3760	71.29	8	178
fathead minnow	N	143	2.71	5	41
flathead chub	N	56	1.07	6	21
river carpsucker	N	42	0.80	8	27
white sucker	I	1	0.02	1	1
yellow bullhead	I	10	0.19	5	6
channel catfish	I	169	3.20	8	34
western mosquitofish	I	134	2.54	7	27
white crappie	I	3	0.06	1	2
TOTAL		5274			

[1] N = native; I = introduced

[2] Frequency of occurrence in total number of seine hauls for this sampling foray (n = 468)

[3] Frequency of occurrence-presence or absence at the eight sampling localities

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Table 3. Ichthyofaunal composition during December 1995-March 1996 at eight collection localities in the Middle Rio Grande, New Mexico. Specimens were collected for the Rio Grande silvery minnow winter population-habitat use monitoring project funded by USACE.

	SITE LOCALITY								
SPECIES	1	2	3	4	5	6	7	8	TOTAL
red shiner	20	450	170	126	57	15	82	27	947
common carp	0	0	0	1	1	1	5	1	9
Rio Grande silvery minnow	3	84	11	14	1170	1196	1206	76	3760
fathead minnow	1	79	4	9	0	3	47	0	143
flathead chub	8	2	0	24	13	5	4	0	56
river carpsucker	2	2	3	2	11	4	13	5	42
white sucker	1	0	0	0	0	0	0	0	1
yellow bullhead	0	1	0	1	1	0	6	1	10
channel catfish	1	96	12	1	6	1	20	32	169
western mosquitofish	2	8	39	3	35	0	47	0	134
white crappie	0	0	0	0	3	0	0	0	3
TOTAL	38	722	239	181	1297	1225	1430	142	5274
# SPECIES	8	8	6	9	9	7	9	6	11
# OF SEINE HAULS	17	60	60	60	70	72	65	64	468
AREA SEINED (m^2)	173.8	501.2	498.6	400.4	611	733	533.2	613.2	4064.4
FISH PER 10 m^2	2.19	14.41	4.79	4.52	21.23	16.71	26.82	2.32	12.98
RGSM PER 10 m^2	0.02	0.17	0.02	0.03	1.91	1.63	2.26	0.12	0.93

Table 4. Summary of Rio Grande silvery minnow habitat use (debris and habitat type) and areas sampled from December 1995-March 1996 at seven localities in the Middle Rio Grande, New Mexico. Specimens were collected under the USACE funded winter habitat study.

Debris	% of total use	% sampled	Habitat type	% of total [2] use	% sampled [3]
0	27.70	51.92	BW	63.59	6.25
1	15.26	10.03	IP	0.37	0.57
2	36.39	25.96	MCFL	0	6.64
3	18.60	10.03	MCPLPO	0	1.70
4	2.04	2.06	MCPO	6.64	11.93
			MCSHPO	17.34	5.68
			MCRU	0.74	27.84
			MCSHRU	1.11	10.23
			SCPLPO	2.71	2.84
			SCPO	4.43	7.95
			SCSHPO	0.98	2.84
			SCRU	2.09	18.75
			SCSHRU	0	2.84

[1] Habitat types follow those defined in Platania 1993. SH=shoreline IP=isolated pool

[2] These values represent Rio Grande silvery minnow collected in non-debris habitats.

[3] These values represent all areas sampled in non-debris habitats.

Figure 1. Depths-velocities occupied by Rio Grande silvery minnow from December 1995-March 1996 at seven localities in the Middle Rio Grande, New Mexico. Specimens were collected for the winter population-habitat use monitoring project funded by the USACE.

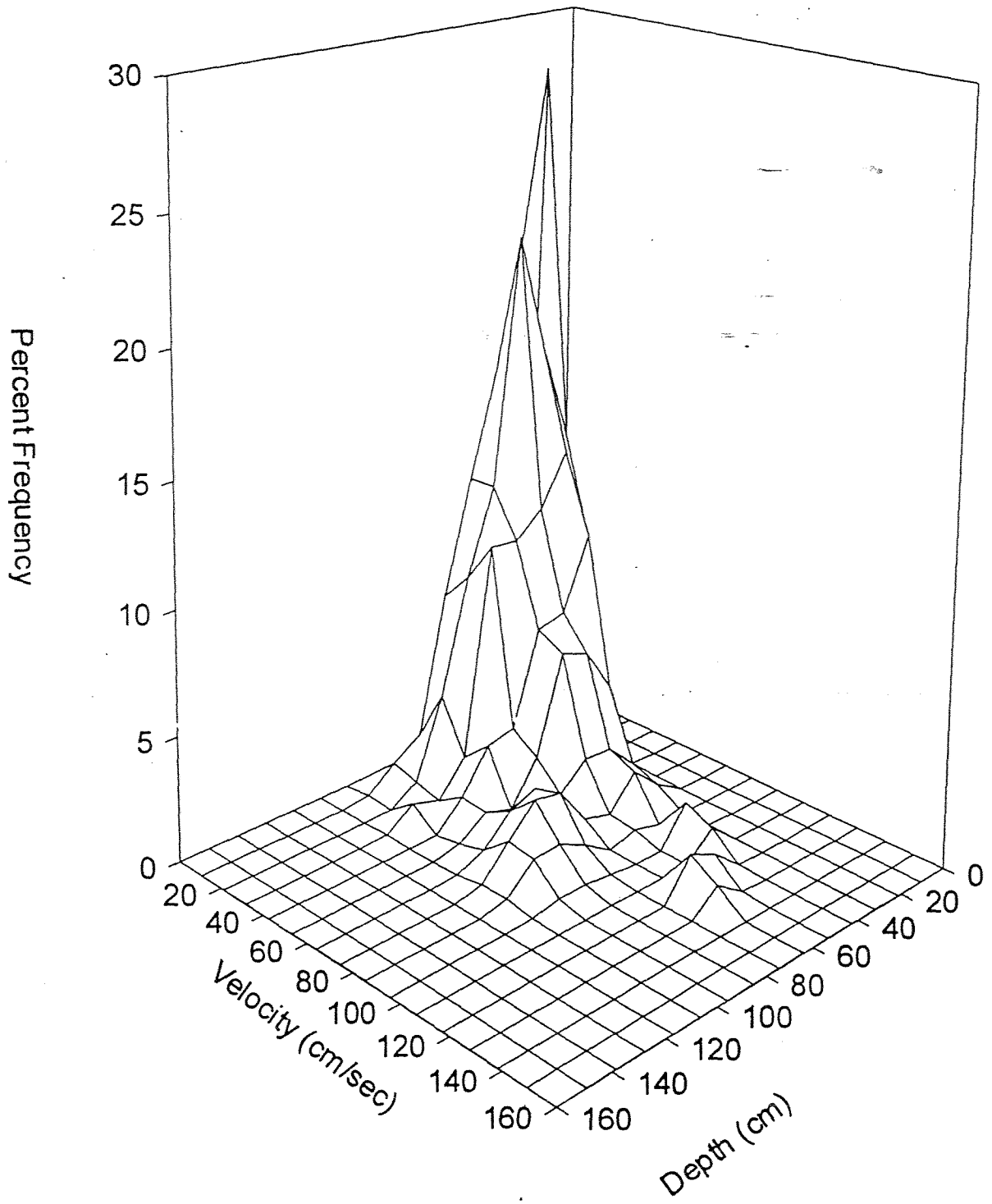
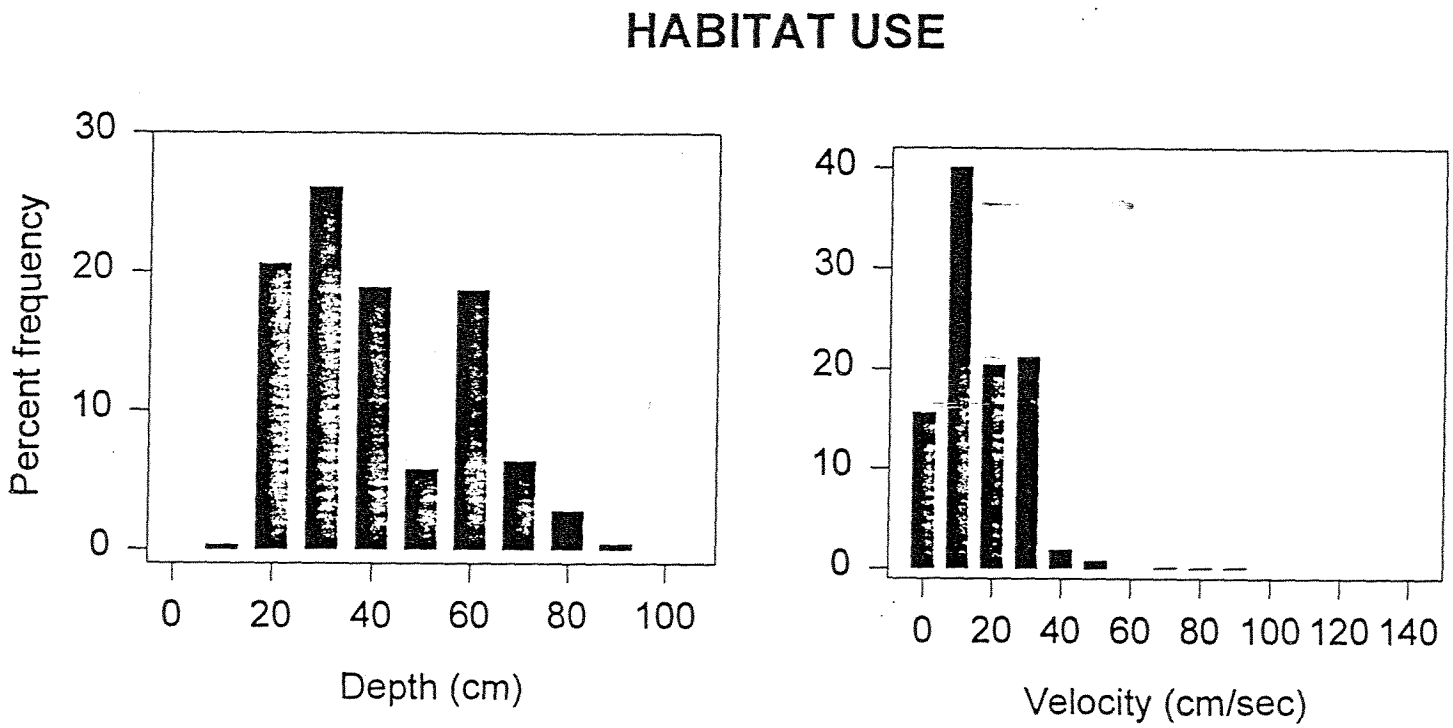
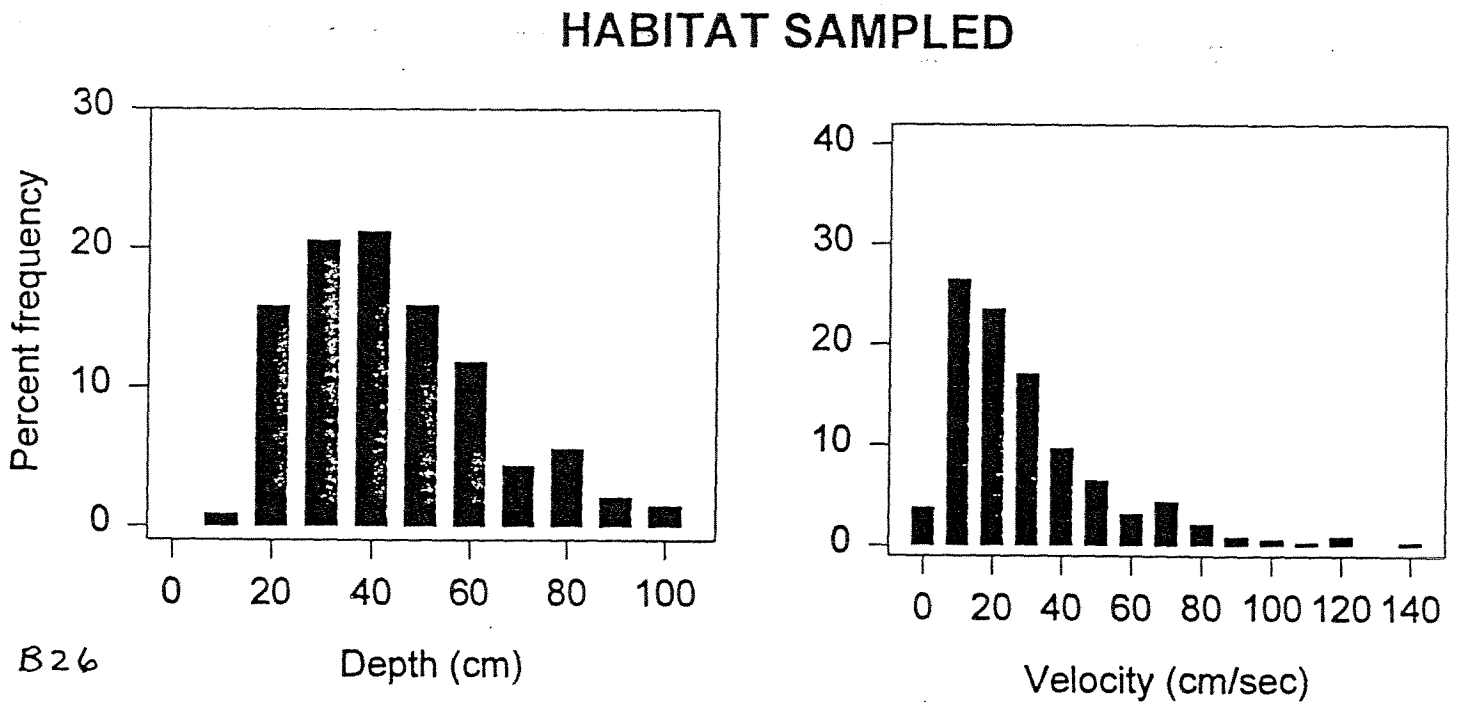


Figure 2. Depths and velocities occupied by Rio Grande silvery minnow compared to the areas sampled from December 1995-March 1996 at seven localities in the Middle Rio Grande, New Mexico. Specimens were collected for the winter population-habitat use monitoring project funded by the USACE.





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30 January 1996

Nathan L. Allan
Albuquerque District, Corps of Engineers
4101 Jefferson Plaza, NE
Albuquerque, NM 87109-3435

Dear Nathan,

Thanks for the copy of the 24 January letter from Lt. Colonel Wagner (USACE) to Governor Lucero of Isleta Pueblo requesting permission to collect fish on Isleta Pueblo as part of the winter release project. Last week we completed the first Rio Grande silvery minnow habitat sampling effort (second sampling foray) and were able to access all sites except the one located on Isleta Pueblo. Blane Sanchez was not available late last week (when were sampling) to approve our request. His absence and the fact that the Corps had not received formal permission from Isleta Pueblo to conduct this work convinced me not to pursue this matter further.

As you can see in my letter of 22 January 1996 to Blane Sanchez, we had planned to sample on the Pueblo (as part of the second Rio Grande silvery minnow habitat sampling effort) during this or next weekend. I spoke with Blane today and he informed me that Isleta Pueblo is closed during the next week for cultural reasons. This effectively eliminates the possibility of a second habitat sampling effort at Isleta Pueblo.

Given the unpredictable nature of access to Isleta Pueblo and that we have missed two of the three opportunities to sample that site, I suggest that we eliminate it from the sampling regime. I do not feel it will adversely influence the outcome of the study as we see very little difference between that locality and the one at Tome (11 miles downstream). This will still leave us with seven sites between Tome and the Bosque del Apache National Wildlife Refuge.

Please don't think this is an inditement of Isleta Pueblo or Blane Sanchez. They have always been extremely helpful and have given us relatively unrestricted access. The problem is that we have very little flexibility, in regards to sampling dates, with this project. I suggest that you still pursue the matter of access with Blane as this will be beneficial for future endeavors on Isleta Pueblo (i.e. population monitoring). Let me know what you think.

All else is going extremely well and I think you will be pleased with the data we are generating from the project. Our second report will be submitted around 12 February.

Sincerely,

Steven P. Platania

cc: R.K. Dudley

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22 January 1996

Blane M. Sanchez
Pueblo of Isleta
P.O. Box 1270
Isleta, NM 87022

Dear Blane,

I wanted to let you know a little about the U.S. Army Corp of Engineers winter (1995-1996) Rio Grande silvery minnow population-monitoring and habitat association study. The first sampling (=December population monitoring) was conducted between 29 December 1995 and 19 January 1996. This initial collecting foray, designated as a population monitoring trip, had two principal goals. Our first charge was to locate and characterize the suitability of eight pre-selected sites for fish studies. Afterwards, we were to perform the initial winter Rio Grande silvery minnow population monitoring. We followed the sampling protocol employed during our 1993-1995 quarterly Rio Grande silvery minnow population monitoring program (funded by the U.S. Bureau of Reclamation).

Fish samples for population monitoring were collected using a 2 m x 2 m 4.76 mm-mesh seine. Only one discrete mesohabitat site was sampled in each seine haul (i.e., each seine haul represented a discrete sample in a discrete mesohabitat). Species composition, number of individuals per taxa, and size (in 10 mm SL bins) were recorded for each seine haul and given a unique alpha-numeric designation (=fish species composition data). Specimens were released alive where captured.

Physical information taken during this portion of the survey were mesohabitat type, length of seine haul and availability of instream cover. The alpha-numeric designation assigned the physical data was the same as recorded on the fish species composition data sheet. Mesohabitat types generally followed those described in Platania (1991. Fishes of the Rio Grande between Velarde and Elephant Butte Reservoir and their habitat associations). We found, based on previous Rio Grande fish-habitat studies, that instream cover was an important variable in winter fish distributions. While instream cover was identified, it had not been selected as a habitat variable in previous Middle Rio Grande fish habitat investigations. Following the work of several other authors who study fish-habitat use, we treated instream cover as a categorical variable with values ranging from 0 (none) to 4. Higher values indicate increasing complexity of cover.

Sampling stations were ordered from up-to downstream and were located between Isleta Pueblo and the southern boundary of the Bosque del Apache National Wildlife Refuge. A list of collecting localities and their descriptors are attached (Table 1). The next three sampling forays (January 19-27, February 2-10, March 1-9) will require physical habitat data collection (=habitat use) in addition to the information on fish abundance. We anticipate sampling on the Pueblo of Isleta on 27 January, 10 February, and 9 March 1996 (all three of these dates are Saturdays).

We have also tentatively planning our next Population Monitoring trip (not=to the USACE winter work) for the week of 5 February 96. There are three population monitoring sites on the Pueblo of Isleta (I-25 Bridge, below Isleta Diversion Dam, and near the southern boundary of Isleta Diversion Dam).

I will call you to find out about the possibility of accessing these sites during the dates provided.

Thanks for your help.

Sincerely,

Steven P. Platania

cc: N.L. Allan, USACOE