

I. Project Title: NON-NATIVE FISH CONTROL IN BACKWATER HABITATS IN THE COLORADO RIVER

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III. Project Summary

The purpose of this study is to evaluate seining as a method for removing small, non-native cyprinids from backwaters and other low-velocity habitats. This was the final year of field work for this study. The study has progressed on schedule, and is nearly complete. All field work has been completed. Backwaters were sampled within two reaches of the upper Colorado River near Grand Junction, Colorado: the 15-Mile Reach and the 18-Mile Reach. Sampling was conducted in late June and early July in 1999, and in early March and late April, 2000, and in June 2001. Depletion estimates were made of non-native fishes in backwaters, and catch-per-effort was compared among sample passes and with data from the Interagency Standardized Monitoring Program (ISMP) for the same reaches gathered in September 1998, 1999, and 2000. Comparisons will also be made with ISMP data gathered in September 2001, when those data are available. The final report will be completed when the 2001 ISMP data become available. Preliminary analysis suggests that although a total of 196,296 non-natives were removed from backwaters over three years, there was no clear positive biological response from native species.

IV. Study Schedule: Initial Year = 1999; Final Year = 2002.

V. Relationship to RIPRAP: Task Number III.A.5: Remove small non-native cyprinids from backwaters and other low-velocity habitats.

VI. Accomplishment of FY01 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings

## Task 1: Sampling and Removal of Fish

Sampling was conducted from June 5 to 24 in 2001. Five removal passes were made in each reach. During these passes flows in the Colorado River fell from 5,670 to 2,120 cfs at the below Palisade diversion gage, and from 9,260 to 4,220 cfs at the gage near the Colorado-Utah state line (Table 1).

The original sampling design called for sampling in March, before spring runoff; however, results from 1999 and 2000 prompted our recommendation that backwaters should be sampled after runoff. The intent of the original sampling design in March was to precede spawning by Colorado pikeminnow (*Ptychocheilus lucius*) and razorback sucker (*Xyrauchen texanus*) to minimize the risk of killing or injuring the young fish during sampling. This goal was still achieved by sampling in June 2001, after runoff as flows were decreasing. Sampling still preceded the majority of native fish spawning, as evidenced by the paucity of native larvae present in the samples. Only a few native sucker larvae were present. No roundtail chub (*Gila robusta*) larvae were captured, although numerous age 1 and age 2 roundtail chub were captured. No Colorado pikeminnow were captured.

Table 1. Dates and river flow levels (cfs) for Spring 2001 sampling efforts.

Pass	Date (start of each pass)	15-Mile Reach (cfs)	18-Mile Reach (cfs)
1	June 5	5,670	9,260
2	June 8	5,070	7,520
3	June 11	5,380	7,720
4	June 19	2,310	4,580
5	June 22	2,300	4,430

Flow data taken from USGS gauging stations: Below Grand Valley Diversion Dam/Palisade (15-Mile Reach) and Near Colorado/Utah State Line (18-Mile Reach)

Five passes were made in each reach, with each pass taking three days. No sampling was conducted from June 15 to 18. A total of 82 backwaters comprising 31 unique backwaters were sampled during the 2001 study. Fifteen of the unique backwaters were in the 15-Mile Reach and 16 were in the 18-Mile Reach (Table 2). Several were repeatedly seined during the sampling period: five were sampled five times, five sampled four times, three sampled three times, six sampled twice, and twelve sampled once. From one to seven seine hauls were made in each of the 82 backwaters, for a total of 255 samples. Seine samples from 5 backwaters had 50% or more native fishes, and samples from 75 had fewer than 50% native fishes, while samples from only 2 backwaters contained no fish. Only backwaters containing fish (non-zero) and those with greater than 50% non-natives were used in the analysis. An estimated total of 180,379 (96.4%) non-native fish were removed from these backwaters, and 6,663 (3.6%) native fish were identified, counted, and released. Numbers of non-native fish were estimated by weighing the total sample, then weighing a subsample (~10% of total), counting and identifying all fish in the subsample, and extrapolating numbers for the total sample.

Table 2. Number of backwaters sampled with and without a predominance of native fishes in the two reaches of the Colorado River near Grand Junction, Colorado (Spring 2001).

Reach <sup>1</sup>	≥50% Natives	<50% Natives	No Fish	Totals
15-Mile	4	31	2	37
18-Mile	1	44	0	45
Totals	5	75	2	82

<sup>1</sup>15-Mile Reach = River Mile 171.0-185.4 (Gunnison River to Grand Valley Diversion)

18-Mile Reach = River Mile 152.0-171.0 (Loma Boat Launch to Gunnison River)

### Task 2: Interim Progress Report

An interim progress report was submitted to the Colorado Division of Wildlife on September 24, 2001. That report contained a summary of data collected and a preliminary analysis of total numbers and biomass of fish in backwaters. A complete data file was also submitted.

### Task 3: Annual Progress Report

A total of 187,037 fish comprising 17 different species were captured in backwaters during this study period (includes only backwaters with <50% native fishes). Six native species were collected: flannelmouth sucker (*Catostomus latipinnis*), bluehead sucker (*C. discobolus*), razorback sucker, roundtail chub, bonytail (*Gila elegans*), and speckled dace (*Rhinichthys osculus*). Eleven non-native species and two hybrids were also collected. One razorback sucker was captured in the 18-Mile Reach (RM 155.9, total length 215 mm, PIT tag 5324722C01). This fish had 15 lesions from *Lernaea* spp. infestation, and had several small leeches on its caudal fin. While the razorback sucker is federally listed as endangered, this specimen was reared in captivity and released by the U. S. Fish and Wildlife Service (FWS). The bonytail is also federally listed as endangered, and the 13 bonytail collected were also recently stocked by the FWS and Colorado Division of Wildlife. All suspected bonytail were scanned to detect a coded wire tag (CWT). CWTs were detected in all 13 fish identified as bonytail. As a test of our visual identification, several hundred fish identified as roundtail chub were also scanned for CWTs. No fish identified as roundtail chub contained a CWT.

The most common fishes captured were the ubiquitous non-native cyprinids: red shiner (*Cyprinella lutrensis*, 53.36% of total number captured), sand shiner (*Notropis stramineus*, 27.05%), and fathead minnow (*Pimephales promelas*, 15.36%). The fourth most common fish was the native roundtail chub (2.84 %). Other native fishes comprised less than 1.0% of the total.

The estimated total number of fish per backwater varied from 22 to 20,000 (mean = 2,811), using the ML general removal estimate in program CAPTURE. This was significantly higher than numbers seen in either 1999 or 2000. In March/April 2000, estimated number per backwater varied from 17 to 2,495 (mean=421.6), and in June/July 1999 the numbers varied from 19 to 9,930 (mean=1,015). The total number of fish captured was much higher in 2000 than in the previous years. In 1999, a total of 2,344 native fish were caught and released, and 8,863 non-native fish were removed. In 2000, 342 native fish were released, and 7,054 non-native fish were removed. In 2001,

an estimated total of 6,663 native fish were released, and 180,379 non-native fish were removed. Fish biomass in backwaters was also higher than in previous years (Table 3).

Rather than an absolute increase in fish abundance, the higher fish numbers are more likely attributed to the timing of the sampling, warm water temperatures, and relative stability of the backwater habitats. Out of 31 unique backwaters, 19 were sampled more than once, compared to only 6 sampled more than once in 2000. Seven backwaters were present and sampled during all five sampling passes, although the flows dropped during the sampling period. The total number of fish captured fluctuated between passes (Figure 1).

For the third consecutive year, results of the depletion efforts were not encouraging. Results from 1999, 2000, and 2001 efforts were similar, with only short-term, if any, effects observed. In both 1999 and 2000 catch rates of both native and non-native fishes declined between passes that were 1-3 days apart, while catch rates were much higher in pass 4 which was conducted 5 weeks later in 2000. In 1999, catch rates were also higher on pass 4 in the 18-Mile Reach although pass 4 was conducted only a few days later than pass 3. This might suggest some short-term effect of the depletion effort; however, similar patterns were observed in both native and non-native fish catch rates. Since non-native fish were disposed of and natives were released, the similar patterns observed in both groups more strongly suggest that environmental changes had more effect on catch rates than depletion efforts.

Although large numbers of non-native fish were removed from backwater habitats, these habitats were re-invaded very quickly. Large numbers of non-native cyprinids (NNC) were observed outside backwaters in the shallow, nearshore cobble bars. This type of habitat is so extensive that there is a constant source of NNC available to re-invade the backwaters. Also, several large, deep side channels choked with vegetation proved impossible to effectively seine. These are also havens for the non-natives, and another source of re-invasion to backwaters.

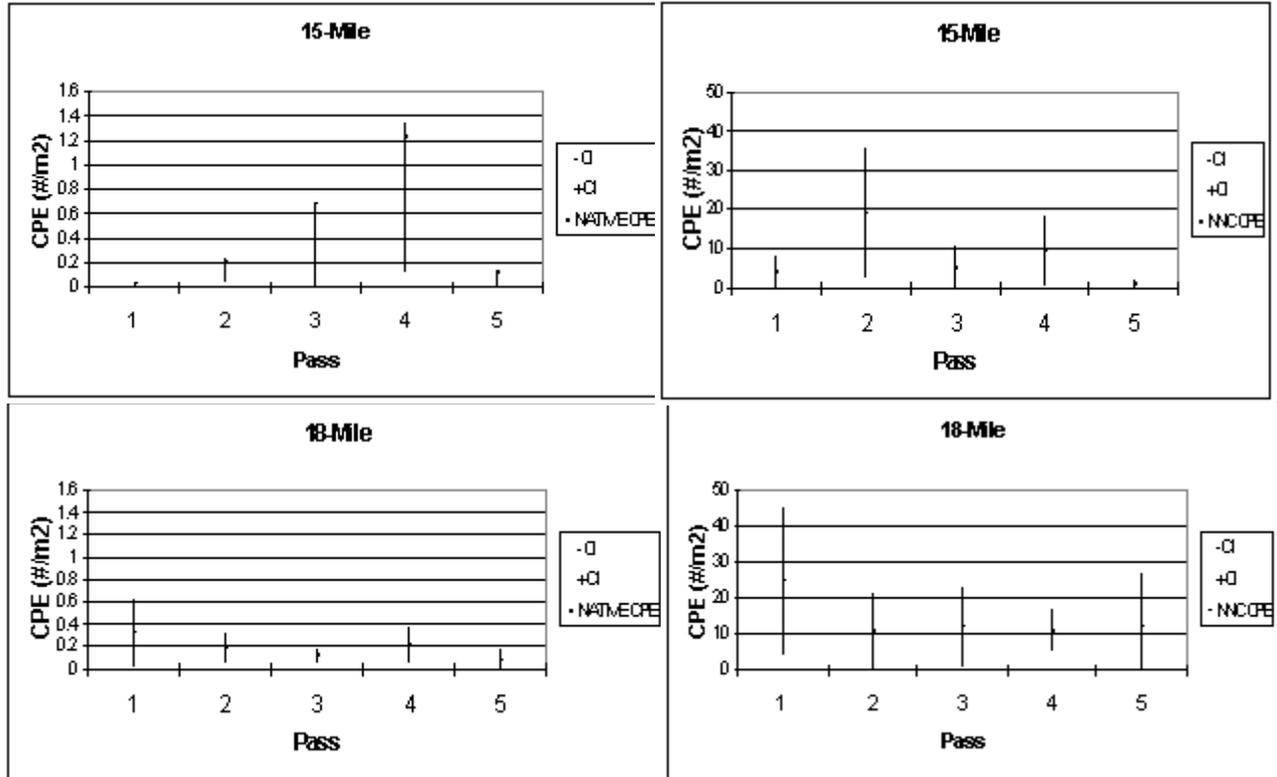
Table 3. Number and biomass of non-native fish removed from backwaters during depletion sampling 1999-2001.

Year	Number	Total Biomass (g)
1999	8,863	63,317.3
2000	7,054	23,687.6
2001	180,379	154,825.7
Total	196,296	241,830.6

NATIVE

NON-NATIVE

Figure 1. Catch rate of native and non-native fishes by sampling pass for backwaters of the 15-Mile Reach and the 18-Mile Reach in 2000. Arithmetic mean catch rates are shown with 95% confidence intervals. Note different scales on native and non-native graphs.



*Update of 2000 Results: Comparison with ISMP*

ISMP catch rate data were evaluated to detect a possible positive biological response to removal efforts. Removal efforts were conducted between the 1998 and 1999 ISMP sampling, and again between 1999 and 2000 ISMP sampling. ISMP results were evaluated between 1998, 1999, and 2000, and from 1986 to present. A positive biological response to this depletion sampling was evaluated using the standard abundance indices estimated from subsequent ISMP seine sampling in late September (Geometric Mean Catch Per Effort [GMcpe] in #fish/m<sup>2</sup>). A positive response is

defined as (1) increases in the total number of native fishes collected via ISMP sampling; (2) increases in the relative abundance of each native fish species as estimated from ISMP sampling; (3) increases in areal seine catch rates (GMcpe) for native fish species as estimated from ISMP collections; and (4) similar increases in numbers collected, relative abundance, or catch rates of age-0 Colorado pikeminnow within ISMP samples. These responses are evaluated individually below.

(1) The total number of native fishes increased between 1998 and 1999, and decreased in 2000. However, the total number of non-native fishes also increased from 1998 to 1999, and decreased only slightly in 2000, for a relative increase in abundance of the three most abundant non-native cyprinids (Table 4).

(2) The relative abundance of native species increased as an aggregate between 1998 and 1999, but decreased again in 2000 (Table 4). However, the relative abundance of native fish in 1999 or 2000 was not significantly different from the mean relative abundance from 1986 to 1998 ( $5.66\% \pm 4.24$ , range 0.1% to 26.4%) (Figure 2).

(3) Areal seine catch rate (#fish/m<sup>2</sup>) increased for native fish between 1998 and 1999 (from 0.01 to 0.17), but decreased again in 2000, to 0.03. However, catch rates for fathead minnow (FH), red shiner (RS), and sand shiner (SS) similarly increased from 1998 to 1999. From 1999 to 2000, catch rate for FH increased, for RS decreased, and for SS remained the same. The catch rates for these species in 1999 or 2000 were not significantly different from mean catch rates from 1986 to 1999 (Figure 3).

(4) Catch of age-0 Colorado pikeminnow did not increase. No Colorado pikeminnow have been collected during ISMP sampling in the 15- and 18-Mile Reaches since 1992.

Table 4. Change in total numbers and relative percent of native and non-native fish, with non-native cyprinids (NNC<sup>1</sup>) as a subset of total non-natives, collected during ISMP sampling 1998, 1999 and 2000.

Year	Total Numbers			Relative Abundance			
	Native	Non-native	Total	NNC	% Native	% Non-native	% NNC
1998	9	1,876	1,885	1,531	0.48	99.52	81.22
1999	543	6,195	6,738	5,991	8.06	91.94	88.91
2000	41	5119	5160	5022	0.79	99.21	97.33

<sup>1</sup> NNC = fathead minnow, red shiner, sand shiner

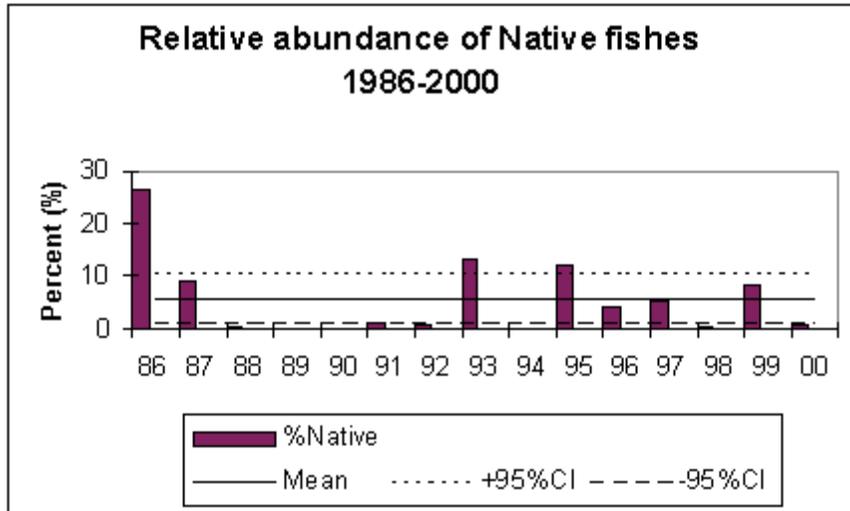
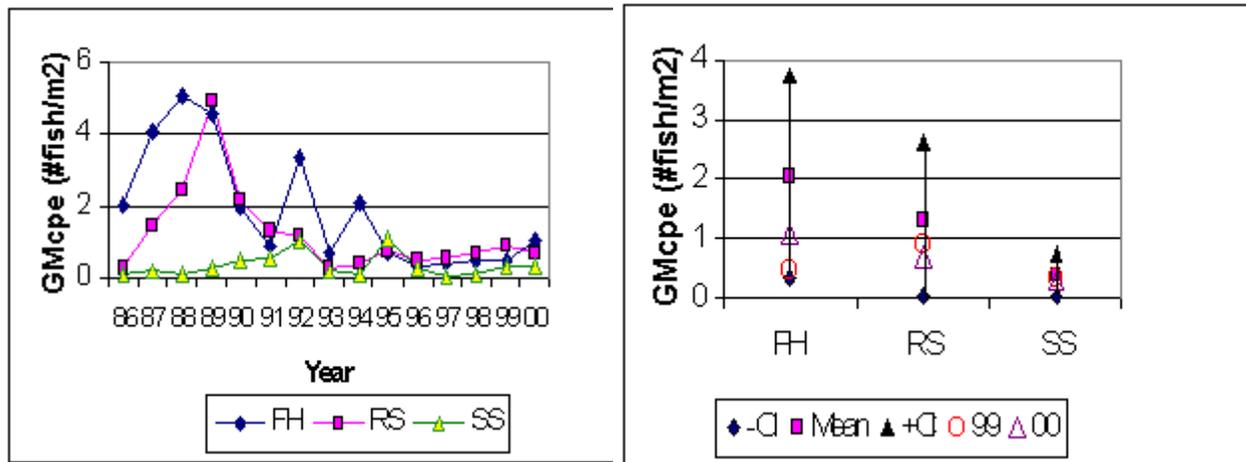


Figure 2. Relative abundance (% of total number of fish) of native fish from 1986 to

2000, with 95% confidence intervals.

Figure 3. Comparison of GMcpe in 1999 and 2000 with mean GMcpe of fathead minnow, red shiner, and sand shiner collected during ISMP sampling from 1986 to 1998 (adapted from McAda et al. 1998, and McAda, unpublished data).



Comparison of ISMP results from 1998 to 1999 and 2000 were inconclusive. Although some increases in native catch and catch rate were seen in 1999, catch decreased again in 2000, and these values were not significantly different from mean values from 1986 to 1998. The 2001 depletion sampling removed significantly more fish than previous years' sampling. Analysis of the 2001 ISMP sampling data may reveal some positive biological response. This analysis will be done when those data become available. The ISMP sampling was conducted in late September, and fish

samples are being identified and processed at the Larval Fish Laboratory at Colorado State University, Fort Collins, Colorado. Results are expected to be available early in the year 2002.

## VII. Recommendations

1. Two alternative schedules were recommended in 2000 to increase the removal of non-native fishes. The second alternative (restated below) was successfully implemented. Significantly more non-native fish were removed from backwaters in 2001. If removal efforts are continued in the future, this schedule should be followed:

Removal efforts should be conducted prior to, but as close as possible to, the time native fish begin hatching and occupying backwaters. The appropriate time period would be on the descending limb of the hydrograph when the flows approach base flow, before peak spawning of native fish, particularly Colorado pikeminnow. This time period would vary by year, depending on the pattern of snowpack and snowmelt. The time period would be early June to early July. Earlier sampling may be required to precede spawning by razorback sucker.

2. Seining as a removal method of small non-native cyprinids may be ineffective in broad, alluvial, cobble-lined channels. The Colorado River near Grand Junction is a broad, cobble-lined channel that is characterized by large expanses of shallow-water habitats. This habitat mosaic allows fish to occupy many alternative habitats, making effective removal virtually impossible. Other river reaches, where backwaters are more defined with fewer alternative habitats, may be more conducive to this removal method.

3. If removal efforts are continued in the future, the scale of effort should be increased. To increase the removal of non-native fish, several teams should be employed, a variety of gear types used, and more removal passes conducted.

4. If removal of non-native cyprinids from backwaters by seining is determined to be ineffective, removal efforts should be redirected to other non-native fishes.

## VIII. Project Status

All field work associated with this project has been completed. The project is on track. All analyses and reports have been submitted, except for the analysis described in Task 3, which will compare catch rates from this study with catch rates from ISMP sampling for the same river reaches in 2001. The ISMP data are expected to be available early in 2002 and will be analyzed and compared as quickly as possible; a comprehensive Final Report will be submitted when all analyses are completed.

## IX. FY02 Budget Status:

Tasks	Budgeted	Expended <sup>1</sup>	Balance Remaining <sup>1</sup>
Task 1:	\$36,523.00	\$36,523.00	\$ 0.00

Task 2:	\$ 5,495.00	\$ 5,495.00	\$ 0.00
Task 3:	\$10,000.00	\$10,000.00	\$ 0.00
Totals:	\$52,018.00	\$52,018.00	\$ 0.00

<sup>1</sup>Amount expended and balance remaining include the expected amount to be expended in analysis to compare data of this study with data from the 2001 ISMP, when available in 2002.

X. Status of Data Submission: Data have been submitted to the contracting agency (CDOW) with the submission of the interim progress report. The data included a spreadsheet with field-specific data entries taken from field data sheets similar to the ISMP field data sheets.

XI. Signed: Richard A. Valdez 11/20/2001  
Richard A. Valdez, Principal Investigator Date

XII. References

McAda, C.W., W.R. Elmblad, K.S. Day, M.A. Trammell, and T.E. Chart. 1998. Interagency Standardized Monitoring Program: Summary of results, 1997. Annual Report. Recovery Program for the Endangered Fishes of the Upper Colorado River Basin, U.S. Fish and Wildlife Service, Denver, Colorado.