FY-2001 PROPOSED SCOPE OF WORK for: **Project #:** 87A

Nonnative cyprinid removal in the Lower Colorado and Green rivers

Lead Agency: Utah Division of Wildlife Resources

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Date: April 21, 2000

Category:
_x_ Ongoing project
___ Ongoing-revised project
___ Requested new project
___ Unsolicited proposal

Expected Funding Source:
_x_ Annual funds
___ Capital funds
___ Other (explain)

I. Title of Proposal:

Pilot Project - Cyprinid removal in the Lower Colorado and Green rivers.

II. Relationship to RIPRAP:

General Recovery Program Support Action Plan

III. Reduce negative impacts of nonnative fishes and sportfish management activities (nonnative and sportfish management).

III.A. Reduce negative interactions between nonnative and endangered fish.

III.A.2. Identify and implement viable active control measures.

III.A.2.a. Identify options (including selective removal) to reduce negative impacts of problem species and assess regulations and options (including harvest) to reduce negative impacts on native fishes from nonnative sportfish.

III.A.2.c. Implement and evaluate the effectiveness of viable control measures.

Green River Action Plan: Mainstem

III. Reduce negative impacts of nonnative fishes and sportfish management activities (nonnative and sportfish management).

III.A. Reduce negative interactions between nonnative and endangered fish.

III.A.4 Remove small nonnative cyprinids from backwaters and other low velocity habitats.

Colorado River Action Plan: Mainstem

III. Reduce negative impacts of nonnative fishes and sportfish management activities (nonnative and sportfish management).

III.A. Reduce negative interactions between nonnative and endangered fish.

III.A.4 Remove small nonnative cyprinids from backwaters and other low velocity habitats.

III. Study Background/Rationale and Hypotheses:

Developing and implementing management options for controlling nonnative impacts in the upper basin has recently become a high priority within program management. Because of this, a strategic plan has been developed to help guide nonnative control actions (Tyus and Saunders 1996). Of the nonnative fishes in the UCRB, cyprinids (primarily red shiner and fathead minnow) are species of concern because they are the most abundant. These cyprinids have been implicated in having detrimental impacts on native fishes by predation on native fish larvae (Rupert et al. 1993; Bestgen 1997; Muth, unpublished data) and competition (Deacon and Bradley 1972; McAda and Tyus 1984; McAda and Kaeding 1989a; Karp and Tyus 1990; Muth and Snyder 1995).

If the abundance of nonnative cyprinids could be reduced in nursery backwater habitats before and during the arrival of native fish larvae, predation and competition with native fishes would be reduced. This result should lead to local increases in native fishes and potentially stronger year classes for these fish. We propose to remove nonnative cyprinids 1) on the receding limb of the hydrograph in 30 miles of the lower Colorado River and 2) pre-runoff through the first part of the ascending limb of the hydrograph in 50 miles of the lower Green River. The State of Colorado is planning to remove cyprinids in the mainstem Colorado and Gunnison rivers. Different circumstances led us to choose different times of the hydrograph to remove cyprinids. On the Colorado River, we are attempting to benefit Colorado pikeminnow larvae by removal of nonnative cyprinids. We feel that removing cyprinids in the Lower Colorado River pre-runoff will likely be futile. After spring runoff, cyprinids from upstream will move down into the study reach habitats in pre-removal densities. Colorado in 1999 will be removing cyprinids towards the upper limit for these species, therefor cyprinids moving down into their study area during runoff is not as great of a concern. Also, many of the habitats in the Lower Colorado River are not formed until runoff, therefore we do not consider removing cyprinids from habitats that do not exist when native fish larvae are drifting a worthwhile effort. In the lower Green River, we are attempting to remove nonnative cyprinids for the benefit of razorback sucker larvae that drift into flooded tributary habitats. We feel that cyprinids will be in all low-velocity habitats, not be concentrated in backwater, therefor their removal would be difficult. We need to concentrate a significant portion of our effort in this river reach during the rising limb of the

hydrograph when tributary/wash mouths will likely concentrate cyprinids (because these will be the main low-velocity habitats).

Cyprinids also may be controllable (reduced in abundance) through the management of flow regimes. In fact, reducing cyprinids abundance through the management of flow regimes may be the most effective method for controlling these species. Correlative evidence has demonstrated that relative abundance of red shiner, sand shiner, fathead minnow, and redside shiner is negatively affected by high river discharges and associated lower water temperatures (McAda and Kaeding 1989b; Osmundson and Kaeding 1989, 1991; Valdez 1990; Muth and Nesler 1993; McAda and Ryel 1999). Although these studies were not specifically designed to address the question of cyprinid abundance and flow, the findings suggest that management of flow regimes to approximate natural hydrographs and periodically providing above average magnitudes in spring and summer discharges would suppress nonnative cyprinid abundance. Muth and Nesler (1993) also found that moderate-high daily mean discharges were associated with later initiation of spawning and a shorter spawning season for the red shiner, sand shiner, and fathead minnow. Higher discharges resulted in an earlier initiation of spawning for the redside shiner, probably due to the redside shiner's preference for cooler water. We propose to reexamine previous databases/collections to determine cause and effect relationships between discharge and cyprinid abundance.

This study will quantify the time, effort, feasibility, and native fish response of mechanically removing nonnative cyprinids, as well as determining if there is a cause and effect relationship between discharge/temperature regimes and cyprinid abundance. If successful, recommendations will be made on the timing, effort, and type of backwaters and river reaches to target for mechanical cyprinid control, as well as flow regimes that will reduce cyprinid abundance. Our working hypotheses are:

1. Cyprinid removal by seining (mainly pre-spawn) all backwaters in a river reach will deplete cyprinid abundance at a backwater level.

2. Cyprinid removal by seining (mainly pre-spawn) all backwaters in a river reach will deplete cyprinid abundance at a river reach level.

3. Cyprinid removal by seining (mainly pre-spawn) all backwaters in a river reach will shift the species composition to more native fishes.

4. Fall YOY ISMP sampling will be able to detect changes in cyprinid abundance (backwater and reach levels) and species composition from cyprinid removal the previous spring.

5. Management of flow regimes to approximate natural hydrographs and periodically providing above average magnitudes in spring and summer discharges will suppress nonnative cyprinid abundance.

6. Exclusion of nonnative cyprinid adults from portions of flooded tributaries will increase available area for larval native fishes and reduce area available for nonnative cyprinids.

IV. Study Goals, Objectives, End Product:

Goal: Remove nonnative cyprinids from the lower Colorado and Green rivers to benefit native fishes (primarily Colorado pikeminnow and razorback sucker) and determine flow regimes that may suppress cyprinid abundance.

Objectives:

1. Remove nonnative cyprinids in 3, 10 miles river reaches on the lower Colorado River and in a 50 mile river reach in the lower Green River.

    a) Reduce cyprinids at a backwater level from pre-runoff through the summer. We do not know what level of cyprinid reduction will constitute a "success" (e.g., what level of reduction may produce a response with the native fish community), therefore we are not providing measurable objectives. We will determine the "success" of cyprinid removal when we answer our working hypotheses at the conclusion of this study.

    b) Reduce cyprinids at a reach level from pre-runoff through the summer. We do not know what level of cyprinid reduction will constitute a "success" (e.g., what level of reduction may produce a response with the native fish community), therefore we are not providing measurable objectives. We will determine the "success" of cyprinid removal when we answer our working hypotheses at the conclusion of this study.

2. Determine if flow and temperature regimes affect on the abundance of nonnative cyprinid populations in the Lower Green River (RM 0-100).

    a) Review, tabulate, summarize and re-examine all data previously collected on nonnative cyprinids as it is related to flow and temperature regimes for this reach.

    b) Determine if seasonal, annual or intra-annual flow/temperature regimes affected the overall population dynamics of nonnative cyprinids in this reach.

    c) Determine if flow/temperature regimes could be managed in a way that would decrease nonnative cyprinid effects on native fishes.

End Product:

Objective 1. A final report that quantifies the time, effort, feasibility, and native fish response of mechanically removing nonnative cyprinids. If successful, recommendations will be made on the timing, effort, and type of backwaters and river reaches to target for mechanical cyprinid control.

Objective 2. A final report on the effects that different flow/temperature manipulations have had on cyprinid abundance. If this relationship can be quantified, recommendations will be made for the flow/temperature regimes to reduce cyprinid abundance. If data is insufficient to quantify this relationship, the final report will detail a study design to determine the relationship.

V. Study area (river miles, if appropriate):

Colorado River

Cyprinids will be removed from 3 disjunct 10 mile river reaches. In 1996, UDWR caught over 650 YOY Colorado pikeminnow in the lower Colorado River, demonstrating the importance of this reach as a nursery area. We chose the 30 miles of river to correspond with UDWR nursery habitat reaches, consequently, we have several years of pre-data on fish abundance/densities in these river reaches. These reaches are UDWR nursery habitat reaches and offer the opportunity to evaluate removal efforts in three different geomorphic reaches. These reaches are:

Fish Ford reach RM 110-100 or Moab Canyon reach RM 90-80. Fish Ford is a 10 mile, slow-flowing stretch of river that meanders through shallow canyons and rolling foothills. The stretch is characterized by several large islands supporting mature stands of cottonwood. The main channel substrate is primarily cobble and sand with cobble-gravel and sand-silt in the low-velocity habitats. This stretch contains some backwaters but runs and eddies predominate. This stretch of river is similar to that of the Middle Colorado River, where the State of Colorado is going to conduct cyprinid control. Therefore, we have chosen an alternate site for consideration, Moab Canyon. The river meanders throughout Moab Canyon, a steep-walled canyon with intermittent open valleys. This stretch is characterized by deep, slow-flowing runs and pools over cobble/sand substrate. There are several swift runs or small rapids where the channel is constricted by side canyon alluvium. Backwaters are relatively scarce through the canyon.

Near Moab RM 65-55. Gradient decreases noticeably as the river leaves Moab Canyon and enters the small open valley near Moab, Utah. The river is bordered by the extensive Scott Matheson Wetland Preserve and picks up flows from the La Sal mountains via Mill Creek, the last permanent tributary upstream of the confluence. Fine sediments (sand and silt) are the primary substrate type and the sandy banks are overgrown with tamarisk. Runs are the predominant habitat type, but backwaters are common.

Lower Colorado reach RM 20-30. This stretch is within the boundaries of Canyonlands National Park. The river here meanders across a broad floodplain deeply entrenched in sandstone. The substrate is sand and sand/silt with the occasional cobble bar found at the mouth of a side canyon wash. Banks are overgrown with tamarisk and backwaters are abundant.

Green River

The 50 miles of the Green River were chosen because of the densities of larval razorback sucker that have been found since 1993. Close to 400 larval razorback suckers have been caught in the lower Green River in the last four years.

Cyprinids will be removed from a 50 mile reach starting at the confluence with the San Rafael River downstream to Mineral Bottom, RM 97-47. The upper portion of this 50 mile reach is dominated by cobble substrate changing to sand as the reach extends downstream. The San Rafael River enters the Green River at RM 97.0 and is the only major tributary in the entire reach. Habitats are ephemeral washes that flood as the river rises. Banks are often steep at the mouths of habitats, and shallower at the top. Habitat banks and bottoms are often lined with tamarisk and willow.

VI. Study Methods/Approach:

Colorado River

A four person crew will seine all low-velocity habitats/backwaters in the 3 study reaches as soon as these habitats start forming on the receding limb of the hydrograph. During most years, there is approximately a 2-3 week window that exists before drifting Colorado pikeminnow larvae will begin filtering into these habitats. We will seine these habitats weekly during this window (2-3 trips). We also will continue to seine all low-velocity habitats/backwaters for approximately 2-3 weeks (2-3 trips) following the finding of Colorado pikeminnow larvae in these habitats. This will constitute approximately 5 weeks of sampling or 5 sampling trips. At least 1 low-velocity habitat/backwater will be sampled above and below each of the 3 study reaches; these habitats will constitute controls for this removal study. We feel that sampling these controls is critical for us to determine if we are having an effect (e.g., reducing nonnative cyprinids).

A 3/16" mesh seine will be used for sampling. Initial sampling in FY-1998, suggested that 1/4" mesh was allowing adult nonnative cyprinids to pass through the seine. Subsequently a 1/8" seine was used for the remainder or FY-1998. Researchers determined that using the 1/8" mesh seine resulted in high mortality of larval and early juvenile suckers because of high ambient air temperatures. Since this project is concerned with minimizing impacts on native sucker, Gila spp., and Colorado pikeminnow larvae, we will be returning to this slightly larger mesh size in 1999 and 2000. This mesh seine will target fishes that are approximately >30 mm TL (mainly subadult and adult cyprinids). These are the spawning cyprinids, therefore removal of these fishes on the descending limb of the hydrograph should reduce the number of offspring that these fish would produce in early summer. By doing this, there should be a 4-6 week window for larval native fish. Competition and predation should be reduced because of the numbers of cyprinids that will be removed.

Seining of extremely large backwaters will be attempted. If large numbers of these backwaters are encountered during trip 1 and/or effort becomes too great to remove cyprinids in these habitats during trip 1, the field crews will need to consider alternate removal methods or alternate reaches.

The following methods will be used for seining individual low-velocity habitats/backwaters: A large fine-mesh seine will be used to block the entire habitat from the river, if possible. As much of the habitat as possible will be seined, starting in the deeper end and working shallower. When the first seine haul is completed, the fish will be processed (identified and counted). If native fishes are abundant (this will be a judgement call on the part of the field

investigators), all fish will be immediately returned to the habitat and the crew will proceed to the next habitat. This will help minimize mortalities of native fish from by-catch. Seining will be conducted to maximize area sampled, to effectively reduce nonnative cyprinid populations throughout the habitat. Information on length and width of seine hauls will be collected to allow the calculation of total area seined. At least 2 habitats/reach/trip will be seined with a fine-mesh (1/8“) mesh seine to collect total fish community information. This also will allow determination of the presence of native fish larvae in the habitats. Subsamples will be taken or entire samples preserved from these fish community sites.

The following methods will be used for processing fishes caught in low-velocity/backwater habitats: Each seine haul will be visually scanned for native fish, so that these fish can be quickly processed and returned to the habitat. If seine hauls produce relatively few fish, all fish will be processed (identified and counted) in the field. If seine hauls produce too many fish to process, subsamples of fish will be collected and preserved. These samples will be processed in the laboratory after sampling has ended. Samples will likely need to be collected in the 2 backwaters/reach/trip to provide information that will allow us to identify larval native fishes and to describe nonnative cyprinid population using a length frequency analysis. These samples will provide a representative look at species abundance and composition for the entire reach. We anticipate samples from approximately 10 habitats/trip will be preserved. Nonnative cyprinids not kept for samples will be buried on site. Control habitats will be sampled as described above, except that fish will be returned to the backwater when seining is completed.

Green River

A four person crew will seine all tributary/wash mouths and low-velocity habitats/backwaters in the 50 mile study reach. Removal will begin 1-2 weeks pre-runoff and continue for 3-4 weeks during runoff (mainly on the ascending limb of the hydrograph). This sampling regime will partially minimize overlap between seining low-velocity areas and the arrival of larval razorback sucker. There will likely be 1-2 weeks at the beginning of the runoff (rising limb) before drifting razorback sucker larvae will begin filtering into these habitats. We will discontinue seining 1-2 weeks after UDWR begins seeing sucker larvae in the light trap samples for the basinwide monitoring for larval razorback sucker program. We feel that we need to be in these habitats for a couple of weeks when larval razorback sucker also will be using these habitats because cyprinids will be the most concentrated in these habitats during this time (tributary/wash mouths will be the main low-velocity habitats available). This will constitute approximately 5 weeks of sampling or 5 sampling trips. At least 2 low-velocity habitats/backwaters will be sampled above and below the 50 mile study reach; these habitats will constitute controls for this removal study. We feel that sampling these controls is critical for us to determine if we are having an effect (e.g., reducing nonnative cyprinids).

The same methods (including using a 3/16" mesh seine) described above will be used for seining individual tributary/wash mouths and processing fishes caught in these habitats. Differences include: 1) the collection of samples from approximately 10 habitats/trip and 2) the seining of at least 2 habitats/reach/trip with a fine-mesh seine to collect total fish community information.

Statistical analyses will likely include the use of ANOVA to compare densities of nonnative cyprinids and the structure of the nonnative cyprinid populations in control versus treatment backwaters/reach (with similar testing of the native component of the fish communities).

VII. Task Description and Schedule:

FY-2001

Task 1. Prepare field season summary report for UDWR by 10/15/00 for FY-2000 season.

Task 2. Complete draft completion report by 3/31/01. Final completion report to program 6/1/01.

VIII. FY-2001 Work:

- Deliverables/Due Dates:
  Field season summary report from FY-2000 season due to UDWR 10/15/2000.
  Draft completion report due to UDWR 3/31/2001, to RIP 6/30/2001.

- Budget estimate.

Task 1		
Labor	2 weeks for 1 biologist ($4,860/month)	$ 2,430
Task 2		
Labor	1.5 month for 1 biologist ($4,860/month)	$ 7,290
	Seasonal for 1 month ($2,920/month)	$ 2,920
Total		$12,640

IX. Budget Summary:

FY-2001	$12,640
Total	$12,640

X. References:

Bestgen, K. R. 1997. Interacting effects of physical and biological factors on recruitment of age-0 Colorado squawfish. Doctoral dissertation. Colorado State University, Fort Collins.

Deacon, J. E. and W. G. Bradley. 1972. Ecological distribution of fishes of Moapa (Muddy) River in Clark County, Nevada. Transactions of the American Fisheries Society 101:408-419.

Karp, C. A. and H. M. Tyus. 1990. Behavioral interactions between young Colorado squawfish and six fish species. Copeia 1990:25-34.

McAda, C. W. and L. R. Kaeding. 1989a. Relations between the habitat use of age-0 Colorado squawfish and those of sympatric fishes in the Upper Colorado River Basin. U.S. Fish and Wildlife Service, Final Report, Grand Junction, Colorado.

McAda, C. W. and L. R. Kaeding. 1989b. Relations between maximum-annual river discharge and the relative abundance of age-0 Colorado squawfish and other fishes in the upper Colorado River. U.S. Fish and Wildlife Service, Final Report, Grand Junction, Colorado.

McAda, C. W. and H. M. Tyus. 1984. Resource overlap of age-0 Colorado squawfish with other fish species in the Green River, fall 1980. Proceedings of the Bonneville Chapter of the American Fisheries Society 1984:44-54.

McAda, C. W. and R. J. Ryel. 1999. Distribution, relative abundance, and environmental correlates for age-0 Colorado pikeminnow and sympatric fishes in the Colorado River. U. S. Fish and Wildlife Service, Final Report, Grand Junction, Colorado.

Muth, R. T. and T. P. Nesler. 1993. Associations among flow and temperature regimes and spawning periods and abundance of young of selected fishes, lower Yampa River, Colorado, 1980-1984. Larval Fish Laboratory, Colorado State University, Final Report, Fort Collins.

Muth, R. T. and D. E. Snyder. 1995. Diets of young Colorado squawfish and other small fish in backwaters of the Green River, Colorado and Utah. Great Basin Naturalist 55:95-104.

Osmundson, D. B. and L. R. Kaeding. 1989. Studies of Colorado squawfish and razorback sucker use of the "15-mile reach" of the upper Colorado River as part of conservation measures for the Green Mountain and Ruedi Reservoir water sales. U.S. Fish and Wildlife Service, Final Report, Grand Junction, Colorado.

Osmundson, D. B. and L. R. Kaeding. 1991. Recommendations for flows in the 15-mile reach during October-June for maintenance and enhancement of endangered fish populations in the upper Colorado River. U.S. Fish and Wildlife Service, Final Report, Grand Junction, Colorado.

Ruppert, J. B., R. T. Muth, and T. P. Nesler. 1993. Predation on fish larvae by adult red shiner, Yampa and Green rivers, Colorado. Southwestern Naturalist 34:397-399.

Tyus, H. M. and Saunders. 1996. Nonnative fishes in the Upper Colorado River Basin, a strategic plan for their control.

Valdez, R. A. 1990. The endangered fishes of Cataract Canyon. BIO/WEST, Report 134-3, Logan, Utah.