2002 Recovery Implementation Program

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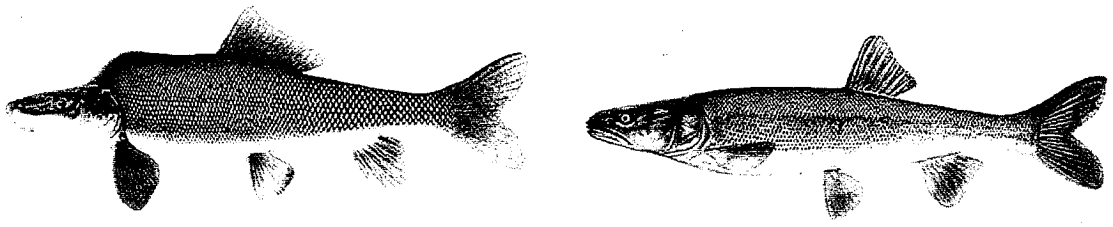


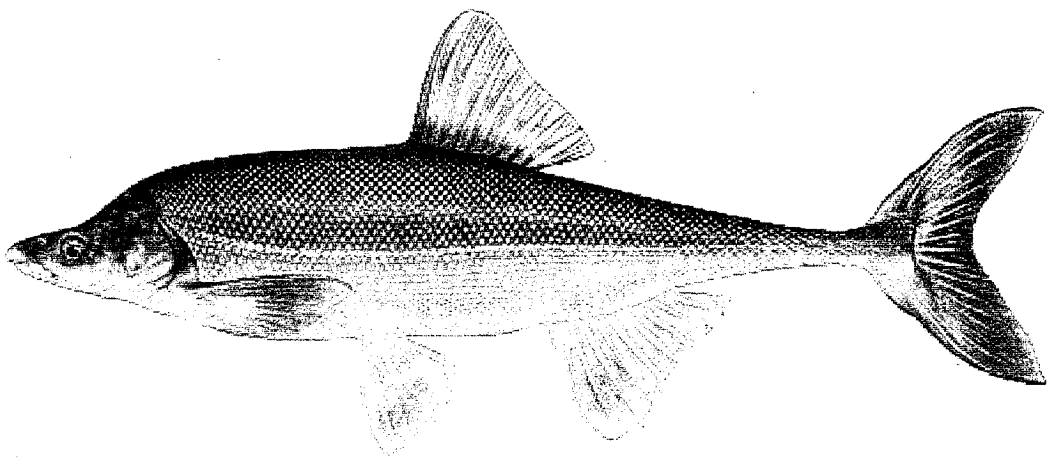
RECOVERY IMPLEMENTATION PROGRAM FOR ENDANGERED FISH SPECIES IN THE UPPER COLORADO RIVER BASIN

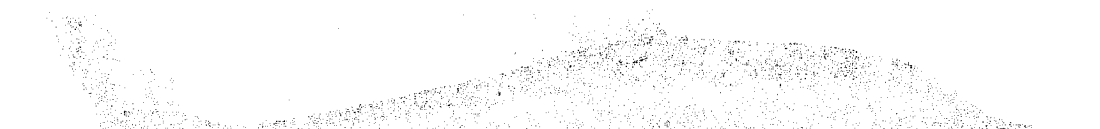
23RD ANNUAL RECOVERY PROGRAM RESEARCHERS MEETING

PROGRAM

JANUARY 16-17, 2002

MOAB VALLEY INN
MOAB, UTAH





The Recovery Program is a joint effort of the U.S. Fish and Wildlife Service, U.S. Bureau of Reclamation, National Park Service, Western Area Power Administration, the states of Colorado, Utah, and Wyoming, Upper Basin water users, environmental organizations, and the Colorado River Energy Distributors Association.

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RECOVERY IMPLEMENTATION PROGRAM
FOR ENDANGERED FISH SPECIES
IN THE UPPER COLORADO RIVER BASIN

23RD ANNUAL RECOVERY PROGRAM RESEARCHERS MEETING

January 16-17, 2002

Moab Valley Inn
Moab, Utah

SCHEDULE

8:30 Registration begins

Wednesday, January 16, 2002

10:00 Introduction and Welcome. Hudson, M.

10:10 Program Director's Message. Muth, R.

Instream Flow

10:25 **Progress on Colorado Division of Wildlife instream flow recommendations for the Colorado River (15-Mile Reach) and the Yampa River, with updates for smallmouth bass and catfish in the Yampa.** ANDERSON, R. *30 min w/ 5 for questions*

11:00 **Update on Geomorphic Effects of Coordinated Reservoir Operations on Habitats in the Upper Colorado River.** PITLICK, J. *15 min w/ 5 for questions*

11:20 - 12:40 Lunch *(on your own)*

Habitat

12:40 **Summary of Habitat Restoration Workshop - One possible scenario for razorback sucker.** NELSON, P. *15 min w/ 5 for questions*

1:00 **Deposition and Erosion on a Razorback Sucker Spawning Baron the Green River near Jensen, Utah.** CARPENTER, M.C., G. R. Smith, E. J. Wick, and J. G. Wullschleger. *15 min w/ 5 for questions*

1:20 **Preliminary Models of Colorado Pikeminnow Movement, Foraging, Growth, and Survival in Green River Nursery Habitat.** LAGORY, K. E., J. W. Hayse, T. Grand, and S. F. Railsback. *15 min w/ 5 for questions*

Nonnative Fish Control

1:40 **Development of a Northern Pike Control Program in the Middle Green River, Utah.** BRUNSON, R., G. Birchell and B. Williams. *15 min w/ 5 for questions*

2:00 **Northern Pike Translocation on the Yampa River, 2001.** HAWKINS, J., C. Walford, and T. Sorenson *15 min w/ 5 for questions*

2:20 **The Channel Catfish Reduction Program in the Lower Yampa River.** FULLER, M. *15 min w/ 5 for questions*

2:40 - 3:00 ***Break*** *(refreshments provided)*

3:20 **Nonnative Fish Control in Colorado 1998 – 2001.** MARTINEZ, A. M. *25 min w/ 5 for questions*

3:50 **Colorado's Fish Stocking Program for Private Landowners: Process and Results of the 2000 and 2001 Stocking Seasons.** MARTIN, L. M. *15 min w/ 5 for questions*

4:20 **Implications and Utilization of Fish Data Collected from Washes and Tributaries Flowing into Critical Habitat of the Grand Valley.** MARTIN, L. M. *15 min w/ 5 for questions*

4:40 **Non-native Fish Control in Backwater Habitats in the Colorado River, 1999-2001.** TRAMMELL, M., and R. A. Valdez. *15 min w/ 5 for questions*

4:20 **A GIS Approach to Evaluate the Effectiveness of Colorado's Nonnative Fish Stocking Regulations.** MARTINEZ, P. J., N. P. Nibbelink, and D. Bennetts. *15 min w/ 5 for questions*

4:40 ***Adjourn***

6:00 - ? ***Evening Social*** *(refreshments provided)*

Thursday, January 17, 2002

Research Monitoring and Data Management

8:30 **Summary of Population Estimate Workshop.** VALDEZ, R. A., R. T. Muth, and T. Czapla. *15 min w/ 5 for questions*

8:50 **Colorado pikeminnow sampling in the Green, White, and Yampa rivers, 2001.** Kitcheyan, C., G. B. Haines, T. Modde, G. Birchell, R. Brunson, M. Hudson, S. Meismer, J. Hawkins, and K. BESTGEN. *25 min w/ 5 for questions*

9:20 **Seasonal and Daily Movement Patterns of Colorado pikeminnow in Lodore Canyon.** KITCHEYAN, C. *15 min w/ 5 for questions*

9:40 **Age Determination and Life History Aspects of the Roundtail Chub, *Gila Robusta* (Cyprinidae), in the Yampa River Canyon, Colorado.** Ross, S. T., and T. MODDE. *15 min w/ 5 for questions*

10:00 **Computer-Interactive Key to Sucker Larvae and Early Juveniles of the Upper Colorado River Basin.** SNYDER, D. E. *15 min w/ 5 for questions - demonstration of this program will carry into the break*

10:20 - 10:40 Break *(refreshments provided)*

Propagation and Genetics Management

10:40 **Lake Mohave Razorback Sucker Program Update.** BURKE, T. *15 min w/ 5 for questions*

11:00 **Are the Razorback Suckers We're Stocking, Couch Potatoes?** Mueller, G. *15 min w/ 5 for questions*

11:20 **Genetic diversity in suckers (Teleostei, Catostomidae) from the Colorado Plateau.** DOUGLAS, M. E., and M. R. Douglas. *15 min w/ 5 for questions*

11:40 **Genetic variation in speckled dace (Teleostei, Cyprinidae) from the Colorado River Basin.** DOUGLAS, M. R., and M. E. Douglas. *15 min w/ 5 for questions*

12:00 **Lost, a Desert River and Its Native Fishes: A historical perspective of the lower Colorado River.** Mueller, G., and P. Marsh. *15 min w/ 5 for questions*

12:20 ***Adjourn***

Posters and Displays

These will be available for viewing at the back of the room through the entire meeting.

Descriptive Species Account for Larval and Early Juvenile Longnose Sucker, *Catostomus catostomus*. Snyder, D. E.

Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin Display. Colorado River Endangered Fish Recovery Program Office.

ABSTRACTS

Instream Flow

Anderson, R.

Colorado Division of Wildlife, Grand Junction, CO

Progress on Colorado Division of Wildlife instream flow recommendations for the Colorado River (15-Mile Reach) and the Yampa River, with updates for smallmouth bass and catfish in the Yampa. Two-dimensional modeling of five study sites is being used to quantify native fish habitat availability over a range of low flows on the Colorado and Yampa Rivers. Habitat mapping has been completed at one site on the Colorado River (Corn Lake) and one site on the Yampa (Duffy) and is progressing (contract with USU) for the remaining 3 sites. 2-D modeling results show strongly different habitat composition between Duffy and Corn Lake and fish sampling results show strongly different fish population characteristics. At typical base flows (100 – 150 cfs), Duffy is dominated by shallow low- velocity habitats while the Colorado River is primarily riffle or fast run habitats at typical base flows (1000-1500 cfs). Between 1998 and 2001, fish density estimates averaged 384 fish per kilometer at Duffy and 3,993 fish per kilometer at Corn Lake (Colorado River). Native fish are very rare in the Yampa's Duffy reach, but are abundant in the Colorado's 15-Mile Reach. This appears to be a function of the habitat availability at the two sites. Also it appears that habitat availability for native fish was further reduced in the Yampa (Duffy and Sevens) during low flow years. Density for all native fish (flannelmouth and bluehead sucker, roundtail chub, Colorado pikeminnow, speckled dace and mottled sculpin) in all Yampa stations have displayed a strong to mild downward trend between 1998 and 2001. Minimum flows in the Yampa River were much less in 2000 (30 cfs) and 2001 (50 cfs) compared to 1997 (320 cfs), 1998 (116 cfs) and 1999 (166 cfs). Predation by northern pike may not have been as significant in 2000 and 2001 as their numbers were much less than in prior years. In 2001, smallmouth bass was the only species in the Yampa River to display large increases in abundance for both YOY and older fish. YOY smallmouth bass counts for 2001 in the Duffy reach were near 4,000/station compared to 700/station in the earlier three years. Smallmouth bass for fish over 12 cm became the dominated species at Duffy for the first time. Also bass composition strongly increased at Sevens and Lily Park in 2001. This suggests that habitat availability for bass increased during low flow years. In contrast, density and composition of native fish in the Colorado River have been stable between the higher (1999) and lower flow years (2000 and 2001).

Pitlick, J.

Department of Geography, University of Colorado, Boulder, CO

Update on Geomorphic Effects of Coordinated Reservoir Operations on Habitats in the Upper Colorado River. This talk focuses on results from a 4-year study of the effects of reservoir operations on sediment transport and channel change within the 15- and 18-mile reaches of the Colorado River. Field studies have been done at several scales to assess the movement of coarse sediment on gravel bars, and the deposition of fine sediment in backwaters and other areas

of shallow flow. Field measurements have been repeated each year (1998-2001) to coincide with the period of peak runoff from late May through early July. In 1998, 1999 and 2000, snowpack levels were high enough to allow some runoff to bypass the upper basin reservoirs; in 2001 snowpack levels were too low to consider using bypass flows. The effects of these flows are similar to those described in earlier studies (Pitlick et al., 1999; Pitlick and Cress, 2000). Augmentation of snowmelt runoff in 1998, 1999 and 2000, produced peak discharges that generally exceeded the threshold for gravel transport (9800 cfs); however, transport was not widespread, especially in 1999 and 2000. Peak flows in 2001 were the lowest of the 4-year study period, and failed to mobilize much gravel, except in localized areas. Surveys of low-velocity side channels and backwaters reveal minor amounts of deposition in these areas; however, substantial amounts of fines have been deposited in shallow areas along low-lying bars. Repeated monitoring of traps placed within the bed indicates that fine sediment (silt and sand) can fill the void spaces between gravels in only a few days, although this depends on the specific location of the trap. The results, taken together, suggest that coordinated reservoir operations are effective in elevating streamflows to reach potentially important sediment-transport thresholds and maintain existing channel characteristics. There is no reason at this time to suggest changing the recommendations given previously.

Habitat

Nelson, P.

U.S. Fish and Wildlife Service, Upper Colorado River Endangered Fish Recovery Program Office, Lakewood, CO

Summary of Habitat Restoration Workshop - One possible scenario for razorback sucker. Some researchers have speculated that predation by nonnative fishes on razorback sucker larvae is a primary factor that has contributed to the decline of the species. It is unknown at this time if efforts to control nonnative fishes will result in increases in survival and recruitment of razorback suckers. Based on 1995-1996 results at Old Charlie Wash, it may be possible to achieve some level of survival of razorback larvae in the presence of nonnative fishes. Assuming that nonnative fishes will never be eliminated, levee removal evaluation study results and input from Habitat Workshop participants have led to speculation on 'ideal' characteristics of razorback nursery habitats and circumstances under which larval survival may be achieved.

Carpenter, M.C.[1], G. R. Smith[2], E. J. Wick[3], and J. G. Wullschleger[4]

[1]U.S. Geological Survey, Tucson, AZ; [2]U.S. Fish and Wildlife Service, Denver, CO; [3]Tetra Tech, Inc., Fort Collins, CO; [4]National Park Service, Fort Collins, CO

Deposition and Erosion on a Razorback Sucker Spawning Baron the Green River near Jensen, Utah. A liquid-filled, load-cell scour sensor is being used to monitor deposition and erosion on a sand and cobble bar on the Green River in northeastern Utah downstream from Flaming Gorge Dam and the confluence with the Yampa River. The bar is 3 miles downstream from the streamflow-gaging station Green River near Jensen, Utah (09261000), and is used by razorback suckers for spawning in April and May before spring runoff. The monitoring is part of a

study of endangered razorback suckers being done by the U.S. Geological Survey, the National Park Service, and the U.S. Fish and Wildlife Service under the auspices of the Upper Colorado River Endangered Fish Recovery Program. The load-cell sensor weighs the sediment, water, and air above it, and an accompanying pore-pressure sensor weighs the water and air above it. The difference between the two weights is the weight of the sediment overlying the sensor pair. Combined sensitivity and repeatability are ±0.01 foot of sediment thickness or less. A temperature sensor in the pressure-sensor housing provides useful information about the spawning-bed and sensor environment and enables calibration of the pressure sensors to ±0.02 percent of full-scale output. During August 1998, seven sensor pairs were buried in an array across the bar and the adjacent channel and have provided hourly data to a datalogger (Figure 1). The sensors documented (1) deposition of as much as 0.7 foot of sediment on the spawning bar during the historically determined spawning period and within the historically determined spawning-temperature range, (2) subsequent erosion of the deposited sediment, (3) the migration of dunes 0.2 foot in height or less in the channel, (4) passage of a cobble (or other debris) in the bed load with a scour hole in front of and behind the cobble or debris, and (5) ice-dam buildup with ponding of as much as 5 feet over the bar and subsequent erosion of the ice dam. During October 2001, the sensors were replaced with four pairs that were strategically located using recent data from radio tracking of fish. In addition, the cables to the datalogger were enclosed in conduit, and the datalogger, which had been vandalized, was replaced.

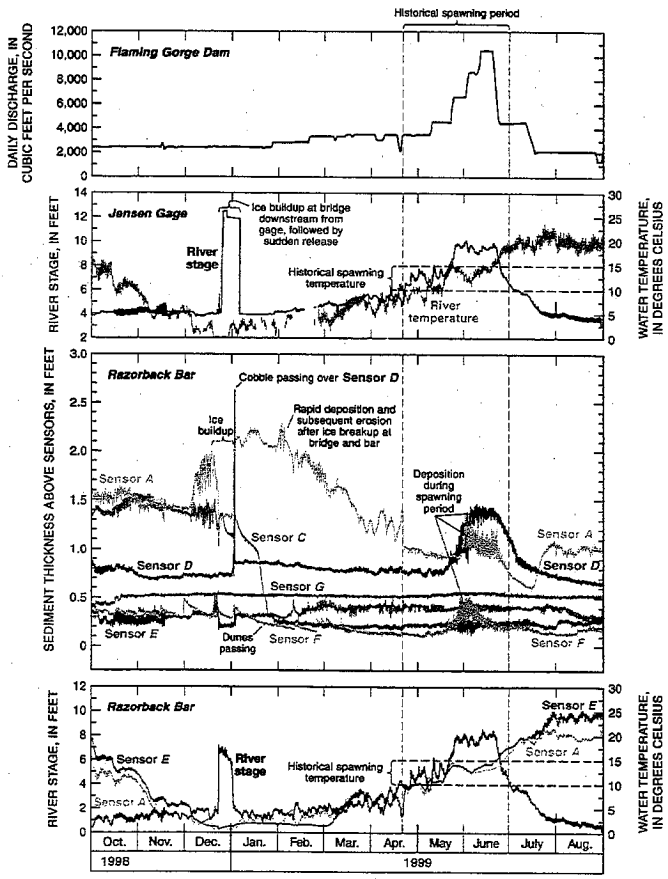

Figure 1. Streambed deposition and erosion, river stage, and substrate temperature at the razorback sucker spawning bar compared with discharge from Flaming Gorge Dam and river stage and water temperature at the Jensen, Utah, streamflow-gaging station.

LaGory, K. E.[1], J. W. Hayse[1], T. Grand[2], and S. F. Railsback[2]

[1]Environmental Assessment Division, Argonne National Laboratory, Argonne, IL; [2]Lang, Railsback, and Associates, Arcata, CA

Preliminary Models of Colorado Pikeminnow Movement, Foraging, Growth, and Survival in Green River Nursery Habitat. Conditions in backwater nursery habitats are thought to play an important role in determining the reproductive success of endangered Colorado pikeminnow (*Ptychocheilus lucius*) in the Upper Colorado River basin. Age-0 fish that use backwaters may be adversely affected by changes in river flow especially those that occur over a short time period such as the daily fluctuations caused by hydroelectric generation at Flaming Gorge Dam. A spatially explicit individual-based model is being developed that consists of two components: a physical habitat simulation and a fish simulation. The preliminary formulation for the latter component is presented in this paper. This model simulates the effects of changes in flow and habitat on the movement, foraging, growth, and survival of individual age-0 Colorado pikeminnow in the Ouray reach of the Green River in Utah. Movement rules predict the involuntary movement of fish in response to changes in flow and voluntary movements to adjacent habitats (mainstem or backwaters) in response to changes in habitat-specific potential fitness. Fish are assumed to swim at an optimal foraging speed, which is used to calculate (1) the quantity of prey encountered and consumed; (2) rate of energy expenditure; (3) daily growth rate; and (4) expected survival. Daily growth is calculated from estimated consumption rate and energy expenditures. Survival probabilities are calculated from the fish's length and condition; density of predators; and habitat conditions. The completed model should be a useful tool for evaluating the impacts on age-0 Colorado pikeminnow of various Flaming Gorge Dam release scenarios. Work supported by Western Area Power Administration under Contract No. W-31-109-ENG-38 with Argonne National Laboratory and EPRI under agreement EP-P3215/C1529 with Lang, Railsback & Assoc.

Nonnative Fish Control

Brunson, R., G. Birchell and B. Williams

Utah Division of Wildlife Resources, Vernal, UT

Development of a Northern Pike Control Program in the Middle Green River, Utah. Effort to control Northern pike *(Esox lucius)* in the Middle Green River was initiated in late March of 2001 and continued through mid-June. The purpose of this effort is to develop an effective control program and reduce the density of adults such that predatory and competitive impacts on growth, recruitment, and survival of endangered and other native fishes are minimized. Northern pike were removed from known concentration areas of the middle Green River, including the mouth of Brush Creek, Cliff Creek, Stewart Lake Drain, Ashley Creek, Sportsman Drain and the mouth of the Duchesne River. Other habitats sampled were large, relatively deep backwaters and shoreline areas. Sampling gear used included fyke nets, trammel nets and electrofishing. Trammel nets were regularly used in conjunction with electrofishing as a productive sample method. A total of 251 northern pike were removed from the middle Green River from March through June 2001.

Lengths of northern pike ranged from 175 mm to 950 mm with an average of 612 mm. Age analysis using cleithra indicates the presence of all year classes one through ten. Most northern pike collected were from the 2 through 4 year age classes and ranged from 400 to 800 mm in length.

Hawkins, J., C. Walford, and T. Sorenson

Larval Fish Laboratory, Colorado State University, Ft. Collins, CO

Northern Pike Translocation on the Yampa River, 2001. Northern pike *Esox lucius*, are a nonnative species that escaped from a reservoir in the Yampa River basin in the late 1970s. They have established a reproducing population in the Yampa River and expanded their range downstream into the middle Green River. We will present results from 2001, the third year of a removal and translocation project for northern pike in the Yampa River, and compare this year's results with those of previous years. We will also discuss potential methods for evaluating the effectiveness of removal. In the spring of 2001, northern pike were captured from a 75-mile long reach of the Yampa River between Craig, Colorado and Dinosaur National Monument. Pike were captured by electrofishing both shorelines along the entire reach and by electrofishing and fyke nets in backwaters. Effort included 177 hours of electrofishing and 279 hours of fyke-net sets on four primary sampling occasions. A total of 268 northern pike were captured, including 94, 84, 60, and 30 individuals on trips one through four, respectively. All northern pike were transported alive to an off-stream reservoir in the White River drainage. Northern pike often co-occurred with Colorado pikeminnow *Ptychocheilus lucius*. Of 121 Colorado pikeminnow captured, 18 % had noticeable pike-bite injuries and another 6 % had injuries that were potentially caused by pike. About 60% of the Colorado pikeminnow injuries were healed at capture and the remaining 40% were open wounds of varying severity.

Fuller, M.

U.S. Fish and Wildlife Service, Colorado River Fish Project Office, Vernal, UT

The Channel Catfish Reduction Program in the Lower Yampa River. The findings of a study to assess capture methods and to determine the feasibility of mechanically reducing the abundance of channel catfish in the lower Yampa River (initiated in 1998-99) serves as the basis for this large scale channel catfish reduction program. The previous study resulted in significant reductions in channel catfish abundance along several relatively short reaches of river. Beginning in 2001; this three year removal effort includes the entire river from Deerlodge Park to Echo Park (rm 46-0) and utilizes the most efficient methods of capture as determined in 1998. Other components of this study include monitoring fish community responses to catfish removal, and channel catfish reproduction and recruitment. Program objectives and design as well as this years resulting efforts will be presented.

Martinez, A. M.

Colorado Division of Wildlife, Grand Junction, CO

Nonnative Fish Control in Colorado 1998 – 2001. The purpose of nonnative fish removal and control in Colorado and Gunnison River floodplain ponds is to reduce the number of chronic sources contributing nonnative fishes into riverine habitats. Of 744 ponds located within the 100 year floodplain or having direct connection to the Colorado or Gunnison rivers 290 ponds were sampled to determine their fish species composition and nonnative fish control measures were applied in 82 ponds from 1998 through 2001. Of the 20 fish species sampled, totaling 11,600 fish, only three species were native. Nonnative non-sport and nonnative sport fish comprised 80% and 17% of the total number of fish sampled, respectively. Green sunfish (30%) was the most common fish species sampled followed by fathead minnow (13.3%) and black bullhead (13.2%). Native fish, including flannelmouth sucker (1.6%), roundtail chub (1.0%), and bluehead sucker (0.4%), comprised only 3% of the total number of fish sampled. No threatened or endangered fish were collected. Treatments to control nonnative fish were applied in 75 ponds. Of these 75 ponds 54 were sampled one to four years following treatment. Followup inspection and fish sampling showed that 31 (57%) of these 54 ponds had reinvaded with nonnative fish, six (11%) were dry, and 17 (32%) had not re-invaded by the date sampled. Of the 31 ponds that reinvaded, 24 received water via irrigation, while ten of 17 ponds that did not re-invade received water via irrigation. The remaining seven ponds that did not re-invade received water from seepage and/or springs. Additional effort to control invasion or escapement by nonnative fish was attempted by the installation of 11 screens that functionally treated 27 ponds. Enforcement of fish stocking regulations is another method of controlling nonnative fish. On January 14, 1999 the Colorado Wildlife Commission enacted a nonnative fish stocking regulation for the Colorado River Basin of Colorado, excluding the San Juan drainage. It was revised January 11, 2001. A survey was sent in 2001 to 50 District Wildlife Managers (DWM's) on the western slope, excluding the San Juan drainage, to identify the level of enforcement of this regulation. Of 50 surveys sent 29 DWM's responded. Ten (34%) of the 29 responses discussed the new regulation with landowners. Two (7%) of the 29 DWM's wrote four citations and one warning for violations of this regulation since its inception. Two (7%) of the 29 DWM's checked five fish trucks prior to stocking fish in the last three years. Nine (31%) of the 29 DWM's checked 23 outlet screens and four berms. One officer noted that an outlet screen was not in place when inspected.

Martin, L. M.

Colorado Division of Wildlife, Grand Junction, CO

Colorado's Fish Stocking Program for Private Landowners: Process and Results of the 2000 and 2001 Stocking Seasons. The Colorado Division of Wildlife (CDOW) administers a fish stocking program for private landowners who desire to stock fish in waters of Colorado. Landowners may legally stock fish by either obtaining a private landowner fish stocking permit, or a commercial or private lake license. The statewide aquaculture stocking permit may apply in certain situations, so landowners may not need to obtain a private landowner fish stocking permit. Specific restrictions apply in order to stock grass carp, and nonsalmonids into waters of the Upper Colorado River Basin (UCRB). Berms and/or pond inlet and outlet screens may be required to stock grass carp and other nonnative, nonsalmonid species in locations below 6500 feet elevation,

and within critical habitat of the Green, Yampa, White, Colorado, and Gunnison sub-basins of the UCRB. In situations where pond inlet/outlet screens are required, landowner compliance has been difficult to determine and assess. In 2000, 180 private landowner fish stocking permit applications were processed for waters west of the Continental Divide, compared to 136 applications processed in 2001. During 2000 and 2001, less than 5% of the 316 total private landowner fish stocking permit applications were disapproved or voluntarily withdrawn by the landowner. In 2000, 65% of these applications were for "trout only," while "triploid grass carp only" accounted for 16% of the applications. Of the remaining applications, 5% included "warmwater fish only" and 14% included any one of four possible combinations (i.e., "trout and triploid grass carp," "trout and warmwater fish," "trout, warmwater fish, and triploid grass carp," or "triploid grass carp and warmwater fish"). In 2001, "trout only" and "triploid grass carp only" accounted for 34% and 41% of the applications, respectively. The remaining 25% of the applications were for "warmwater fish only" (7%), while 18% constituted any one of the four previously mentioned possible combinations. A total of 55 lake license applications (32 private and 23 commercial) were processed for waters west of the Continental Divide during 2000. Sixty-nine percent of these applications were for "trout only," while 25.5% included warmwater fish and either trout and/or triploid grass carp. The remaining 5.5% included applications for "triploid grass carp only" and "trout and triploid grass carp." A total of 20 lake license applications (11 private and nine commercial) were processed during 2001. Seventy percent of these applications were for "trout only," while 25% included triploid grass carp and either warmwater fish or trout. "Warmwater fish only" applications accounted for the remaining 5%. The CDOW recognizes that improving relations with the general public, private aquaculturists, and other agencies is critical for successful implementation of the CDOW's fish stocking regulations. CDOW personnel have organized mailing lists of potential "fish stockers," prepared articles for printing in local newspapers regarding fish stocking guidelines, met with private aquaculturists, and conducted presentations for CDOW law enforcement personnel, as well as biologists of other agencies, to increase awareness and understanding of the CDOW's fish stocking program.

Martin, L. M.

Colorado Division of Wildlife, Grand Junction, CO

Implications and Utilization of Fish Data Collected from Washes and Tributaries Flowing into Critical Habitat of the Grand Valley. The Colorado Division of Wildlife (CDOW), U.S. Fish and Wildlife Service, and the City of Grand Junction cooperatively conducted fish surveys at six sites along Persigo Wash in March 2001, during the irrigation off-season. The presence of multiple age classes of the flannelmouth sucker (*Catostomus latipinnis*) and speckled dace (*Rhinichthys osculus*) throughout most of Persigo Wash suggested that these native species may be maintaining self-sustaining, resident populations in this irrigation-influenced tributary to the Colorado River. This finding provided impetus for the CDOW to initiate a more intensive, long-term, seasonal project to qualitatively monitor the fish community structure, and assess the water chemistry of ephemeral tributaries flowing into critical habitat of the Colorado River within the Grand Valley of Colorado. The CDOW conducted qualitative fish surveys and collected water chemistry samples at seven sites along other intermittent washes and creeks flowing into critical habitat of the Colorado River, in mid- to late October 2001. Five of the seven sites were selected based upon proximity of the site to critical habitat of the Colorado River, access to site locations

downstream of the three major irrigation canals of the Grand Valley, and habitat structure. Fish surveys were difficult to complete at several sites due to increased agricultural return flows. Native fish exceeding 170 mm total length were floy tagged. Overall, 1,895 fish were collected. Thirty-two percent of these fish consisted of the four native fish species collected; the bluehead sucker (*Catostomus discobolus*), flannelmouth sucker, roundtail chub (*Gila robusta*), and speckled dace. Flannelmouth and bluehead suckers were collected at all seven sites sampled, while roundtail chub and speckled dace were each collected at five sites. Size distributions of the native fishes collected suggested that the bluehead and flannelmouth suckers, along with the roundtail chub may be reproducing and maintaining self-sustaining populations within several of these intermittent, irrigation-influenced tributaries. Eight nonnative, nonsalmonid fish species constituted 68% of the total fish captured. The fathead minnow (*Pimephales promelas*), red shiner (*Cyprinus lutrensis*), and green sunfish (*Lepomis cyanellus*) accounted for 94% of the total nonnative fish species collected. Species composition fluctuated from site to site, and may be influenced by habitat structure and flow. Water chemistry results indicated that during the irrigation season, these tributaries were highly conductive alkaline systems, with elevated total phosphorus (maximum of 620 ug/L) and suspended solids concentrations. Instream metal concentrations did not exceed state water quality standards for aquatic life. Dissolved selenium concentrations ranged from 3.1 to 13.1 ug/L. The CDOW will increase monitoring efforts in 2002, assessing variability of fish community structure, habitat, and water chemistry in relation to changes across irrigation seasons. Such studies may help determine what role, if any, these irrigation-influenced waters play in the life cycles of native and nonnative fishes of the Grand Valley.

Trammell, M.[1], and R. A. Valdez[2]

[1]SWCA Inc., Environmental Consultants; [2]R. A. Valdez and Associates

Non-native Fish Control in Backwater Habitats in the Colorado River, 1999-2001. Predation and competition between small, non-native cyprinid species and young endangered fishes has been demonstrated in laboratory experiments (Ruppert et al. 1995; Muth and Beyers, unpublished data), and is perceived to be influential in limiting survival and recruitment of the endangered razorback sucker (*Xyrauchen texanus*) and Colorado pikeminnow (*Ptychocheilus lucius*) in the wild. The objectives of this study were to significantly reduce the abundance of small, non-native cyprinid and centrarchid fish species present in backwaters in the Colorado River, significantly increase the survival and abundance of native and endangered fish species using backwater habitats, and evaluate backwater seining as an effective field method for controlling the abundance of small, non-native cyprinid and centrarchid fish species and for inducing a positive biological response within the native fish communities. Response to depletion was evaluated using Interagency Standardized Monitoring Program (ISMP) catch data. Depletion sampling was conducted on the Colorado River in the 15- and 18-mile reaches in June-July, 1999, March-April, 2000, and June 2001. Four to five depletion passes were made in each year. In 1999, 8,863 non-native fish were removed from 65 backwaters. In 2000, 7,054 non-native fish were removed from 58 backwaters. In 2001, 180,379 non-native fish were removed from 82 backwaters. Catch and catch rate of all fish initially declined after the first pass in all reaches and years, but increased by the fourth pass in most cases. The effects of depletion by seining were thus temporary at best. Comparison of ISMP fall catch rates prior to, and after, depletion efforts were

inconclusive. Catch rates and relative percentage of native fishes did increase from 1998 to 1999, but catch rate of non-native fishes also increased. Catch and relative percentage of native fishes fell again in 2000. Catch rates of both native and non-native fish were not significantly different from mean catch rates seen from 1986 to 1998.

Martinez, P. J.[1], N. P. Nibbelink[2], and D. Bennetts[3]

[1]Colorado Division of Wildlife, Grand Junction, CO; [2]Wyoming Geographic Information Science Center, University of Wyoming, Laramie, WY; [3]Colorado Division of Wildlife, Ft. Collins, CO

A GIS Approach to Evaluate the Effectiveness of Colorado's Nonnative Fish Stocking Regulations. A Cooperative Agreement, signed 6 November 1996 by the Directors of the state wildlife agencies for Colorado, Utah and Wyoming, and the U.S. Fish and Wildlife Service, Region 6, committed these parties to participate in and implement the Procedures for Stocking Nonnative Fish Species in the Upper Colorado River Basin. Among the agreed upon components was a requirement to ensure that all stocking of nonnative fishes in the Upper Colorado River Basin is in compliance with the Procedures, including enacting/clarifying appropriate regulations for stocking of public and private waters. In January 1999, the Colorado Wildlife Commission adopted regulatory language restricting the release of fish in waters located below 6,500 feet in elevation surrounding critical habitat portions of the Colorado, Gunnison, White, Yampa, and Green Rivers. These new stocking regulations, and subsequent modifications in conjunction with existing lake license/stocking regulations, serve to meet the intent of the Procedures. The Commission conditioned their approval of these stocking regulations, taking into account input from the private aquaculture industry in Colorado, by requiring an evaluation of their effectiveness in achieving a biological response. The Commission instructed the Colorado Division of Wildlife (CDOW) to perform this evaluation and will review the overall effectiveness of the regulations and consider their continuation or replacement after three years. Pursuant to this regulation review the CDOW initiated a Geographic Information System (GIS) project to map and analyze data leading to an understanding of the effectiveness of the stocking regulations. CDOW has contracted with Wyoming Geographic Information Science Center to build the GIS database and perform statistical analyses. Fish stocking and sampling data from 1998 to 2001 will be used in maps and analyses of nonnative, nonsalmonid stocking frequency and locations and their spatial and temporal relationships to fish distribution and abundance in selected river reaches. Inputs for this evaluation include digital raster graphics (digital topo maps), aerial photographs, elevation and floodplain designations, pond location/fish sampling information, backwater/mainstem fish monitoring, research and removal data, and stocking records/permits for nonnative, nonsalmonid fishes in western Colorado. Progress to date includes discussions with and written requests to members of Colorado's Fish Health Board, the Colorado Aquaculture Association, and individual fish vendors encouraging voluntary submission of stocking records. This presentation primarily describes the study's methods, using grass carp as an example.

Research Monitoring and Data Management

Valdez, R[1]. Al., R. T. Muth[2], and T. Czapla[2]

[1]R. A. Valdez and Associates; U.S. Fish and Wildlife Service, [2]Colorado River Endangered Fish Recovery Program Office, Lakewood, Co

Summary of Population Estimate Workshop. The U.S. Fish and Wildlife Service (Service) released draft recovery goals for the four Colorado River endangered fishes for public review through a Notice of Availability in the Federal Register (66 FR 47033-47034) on September 10, 2001. These recovery goals provide site-specific management actions and objective, measurable criteria for downlisting and delisting the Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), razorback sucker (*Xyrauchen texanus*), and bonytail (*Gila elegans*). Demographic criteria include numbers of populations and individuals necessary for recovery. Reliable, precise population estimates are needed to monitor population status and trends, to determine if downlisting and delisting demographic criteria are met, and to ensure demographic and genetic viability. The Service has determined that mark-recapture models provide the best available population estimates. A workshop was held in Fort Collins, Colorado, on December 6-7, 2001, to solicit input from experts on the statistical validity and precision of population and recruitment estimates for Colorado pikeminnow and humpback chub necessary to meet the demographic criteria of the draft recovery goals; razorback sucker and bonytail will be addressed at a later date. The purpose of the workshop was to provide guidance to the Service in determining acceptable population and recruitment estimates for Colorado pikeminnow and humpback chub. The workshop was attended by 35 researchers, statisticians, and representatives of the Biology Committee of the Upper Colorado River Recovery Program, the Biology Committee of the San Juan River Basin Recovery Implementation Program, and representatives of the Grand Canyon Monitoring and Research Center. Presentations were made by individual researchers for respective regions of river where population estimates are being conducted. Following the presentations, a moderator solicited input from the attendees, and all information was recorded on flip charts and electronically on a word processor. The results of the workshop are presently being assimilated into a working document that will provide guidance for statistically valid and precise population and recruitment estimates.

Kitcheyan, C.[1], G. B. Haines[1], T. Modde[1], G. Birchell[2], R. Brunson[2], M. Hudson[3], S. Meismer[3], J. Hawkins[4], and K. Bestgen[4].

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Colorado pikeminnow sampling in the Green, White, and Yampa rivers, 2001 Sub-adult and adult Colorado pikeminnow *Ptychocheilus lucius* were sampled on at least three occasions in sections of the Green, White, and Yampa rivers in spring 2001. The goal of that sampling was to gather capture-recapture information to generate abundance estimates of Colorado pikeminnow in each river reach. The U. S. Fish and Wildlife sampled the Green River in Desolation Canyon and the White River, Utah Division of Wildlife Resources sampled the lower and middle Green River

reaches and the lower Duchesne River, and the Larval Fish Laboratory at Colorado State University sampled the Yampa River. About 500 miles of river were sampled prior to and during spring runoff from late-April through mid-June. About 1,191 hours (149 8-hr days) of boat or raft electrofishing time was expended in all reaches. A substantial amount of effort was also devoted to fyke- and trammel-net sampling of backwaters in the Yampa River. A total of 1,295 Colorado pikeminnow were captured in all passes; 358 from the middle Green River, 256 from the Desolation Canyon reach of the Green River, 209 from the lower Green River, 212 from the White River, and 120 from the Yampa River. A total of 140 Colorado pikeminnow were recaptured once and eight individuals were recaptured twice. Size structure and preliminary abundance estimates of Colorado pikeminnow from each reach will be presented.

Kitcheyan, C.

U.S. Fish and Wildlife Service, Colorado River Fishery Project Office, Vernal, UT

Seasonal and Daily Movement Patterns of Colorado pikeminnow in Lodore Canyon. Colorado pikeminnow have been described as having fidelity to a home range and traveling as far as 360 km to one of two spawning sites in the Green River subbasin. Over the last two years (2000 and 2001), data obtained from aerial surveys and telemetry (i.e. data logger and ground surveys) have showed adult Colorado pikeminnow from Lodore Canyon display a great deal of mobility and flexibility in habitat use. Between 2000 and 2001, fourteen Colorado pikeminnow were implanted with transmitters in Lodore Canyon. In 2000, fish emigrated out of the canyon from August to October and did not overwinter in the canyon. An aerial survey found pikeminnow ranging from Horseshoe Bend and extending upstream into the Yampa River. In 2001, radio tagged fish began dispersing back into the canyon as early as March and continued on into the month of July. Fish passage by the telemetry logger, above the Yampa River confluence, occurred during midnight and early morning hours. Aerial surveys in the spring and summer, found pikeminnow throughout the canyon and upstream into Browns Park National Wildlife Refuge. Diel observations in Lodore Canyon, concluded pikeminnow were very mobile or remained stationary, occupying an eddy or pool. Two fish displayed a great deal of mobility, moving long distances (i.e. 1.9 and 2.2 km) in the late afternoon. Combined information from the data logger and aerial contacts implied radio tagged fish did not overwinter in the canyon, two fish were located above the Gates of Lodore. Nine other fish were found below the confluence, from the Yampa River extending downstream into the Green River to Horseshoe Bend. Colorado pikeminnow do not appear to be establishing a permanent residency in Lodore Canyon, but instead use this area opportunistically.

Ross, S. T.[1], and T. Modde[2]

[1]University of Southern Mississippi; [2]U.S. Fish and Wildlife Service, Colorado River Fishery Project Office, Vernal, UT

Age Determination and Life History Aspects of the Roundtail Chub, *Gila robusta* (Cyprinidae), in the Yampa River Canyon. The *Gila* complex includes three large,

morphologically variable cyprinid species native to the Colorado River drainage. All three members of this complex, *G. cypha*, *G. elegans*, and *G. robusta* occur (or occurred) in the Yampa River Canyon. Both *G. elegans* and *G. cypha* are federally listed as endangered, with the former likely extirpated from the Yampa River; only *G. robusta* is still unlisted and relatively common although it is a candidate for listing. Growth rates based on valid age determinations, as well as other life history aspects, are poorly known for *G. robusta*, and indeed for all three species. Consequently, in addition to providing information directly on *G. robusta*, this species may be considered a surrogate to better understand growth patterns of *G. elegans* and *G. cypha*. *Gila robusta* have been collected during July in 1998, 1999, and 2001 by angling (1998) and electrofishing (1999, 2001) in the Yampa River Canyon in Dinosaur National Park. Presumed ages determined from otoliths, opercle bones, and scales all show significant correlations. However, otoliths and opercles show the highest correlations. Compared to both otoliths and opercle bones, scales underestimate ages for fish greater than seven years. Based on data from 1999 (n=28), median ages were 6, 6, and 5, and maximum ages were 18, 11, and 8, based on otoliths, opercles, and scales, respectively. Using otolith data, growth trajectories of males and females diverge for fish older than 10 years, with females showing greater increases in length and mass than males.

Snyder, D. E.

Larval Fish Laboratory, Colorado State University, Ft. Collins, CO

Computer-Interactive Key to Sucker Larvae and Early Juveniles of the Upper Colorado River Basin. The detailed descriptions and 60 pages of keys in the Colorado Division of Wildlife (CDOW) guide to Upper Colorado River Basin sucker larvae and early juveniles (Snyder and Muth 1990) have served the Recovery Program and research community well, but they need to be updated with character range extensions observed since publication and expanded to include longnose sucker. However, intricate printed keys such as these are very difficult to prepare, correct, update, or expand to cover additional species because each change cascades through most subsequent portions of the key. Also, users of the very long and intricate keys have found it formidable and inflexible. As a modern alternative, I've decided to replace the printed key with a computer-interactive key because it is much easier to prepare, update, and expand, and users will find it a much more flexible and user-friendly taxonomic tool. Among other advantages, users can limit consideration to a subset of species when appropriate and bypass characters that are unfamiliar, difficult to accurately measure or observe, or that happen to be damaged on the specimen of concern. With this presentation I will discuss and demonstrate a preliminary version of the new key.

Propagation and Genetics Management

Burke, T.

Bureau of Reclamation, Boulder City, NV

Lake Mohave Razorback Sucker Program Update. During the late 1980's, over 90% of the wild, adult razorback sucker population left in the world, roughly 63,000 fish, resided in Lake Mohave. Despinte annual spawning along the lake's shoreline, natural recruitment of new fish into the population was almost nonexistent due to predation from nonnative fishes. Razorback suckers live about 40-45 years, and Lake Mohave was formed in the early 1950's. Without help, this population was expected to die off around the turn of the century. The Native Fish Work Group has been working since 1991 to replace this stock. The NFWG is a team of fishery biologists representing Arizona Game and Fish, Nevada Division of Wildlife, National Park Service, Geological Survey, Fish and Wildlife Service and Bureau of Reclamation. The team collects young fry from the early spring spawning and transfers them to a local hatchery where they are raised to approximately 4 inches. The young fish are then moved to lakeside ponds for further rearing. When the fish reach 10-12 inches in length, they are tagged and released into the main body of the reservoir. The Native Fish Work Group's goal is to build up the spawning population to 50,000 adult fish. To date, over 52,000 juvenile fish have been repatriated to the lake, and an additional 117,000 are at some stage of rearing to target release size. An overview of the program is presented, along with results to date.

Mueller, G.

U.S. Geological Survey

Are the razorback suckers we're stocking, couch potatoes? Post stocking drift and low survival of razorback sucker continues to plague reintroduction efforts. The author discusses environmental, behavioral, and physiological factors that influences fish performance and survival. Stocking dispersal (30 d) of 8 test groups (15 fish each) of razorback sucker was examined using telemetric equipment. Fish were released in three different locations: (1) a reservoir (Lake Powell), (2) a small seasonal backwater (Green River) and (3) a large backwater (>10 ha) on the lower Colorado River, near Laughlin, Nevada. Subgroups were also released (1) immediately, (2) site acclimated 3 to 7 days prior to release, and (3) large backwater subgroups included fish physically conditioned to flow. Post-stocking dispersal was rapid and declined with time for all tests. Most movement was detected 3 weeks following release. Dispersal in the Green River was pronounced ($\bar{x}$=69.5 k/month) and significantly (Kruskal-Wallis $P<0.01$) greater than either the reservoir ($\bar{x}$=3.73 k/month) or large backwater ($\bar{x}$=7.72 k/month) groups. Fish were found in slack water habitats that provided adequate cover. Site-acclimation tests were inconclusive but downstream dispersal was significantly (Wilcoxon $P<0.05$) less for flow-conditioned fish ($\bar{x}$=1.89 k/month) compared to unconditioned fish ($\bar{x}$=7.73 k/month). Data suggests razorback sucker dispersal can be significantly reduced if fish are preconditioned to flow and stocked in moderately large (>10 ha) backwater habitats.

Douglas, M. E., and M. R. Douglas

Department of Fishery and Wildlife Biology, Colorado State University, Ft. Collins CO

Genetic diversity in suckers (Teleostei, Catostomidae) from the Colorado Plateau. Populations isolated for reasonable periods often diverge quite rapidly from one another at the genetic level. In the Tertiary of western North America, drainage patterns were dramatically shifted due to tectonism and aridity. Headwaters became isolated and fluvial habitats fragmented, thus separating biotas. Later, more pluvial periods, interconnected drainages and optimized potential for stream capture and exchange of fishes. Did this earlier geographic fragmentation promote divergence of fishes? To answer this question, we will invoke a landscape perspective, employ molecular genetic techniques, and use non-T/E species as model organisms, specifically two species of freshwater sucker found on the Colorado Plateau and immediately south, plus a third that is believed distinct but is undescribed. Minckley (Fishes of Arizona, 1973) examined populations of flannelmouth sucker (*Catostomus latipinnis*) in Grand Canyon and concluded that their morphological variation was greater than expected for a single species. He further argued that a distinct form of the flannelmouth sucker in the upstream Little Colorado River could represent an undescribed species. This form was given a manuscript name (*C. "crassicauda"*) by R.R. Miller during the early 1960s. We attempt to corroborate and extend the observations of both Minckley and Miller by amplifying and sequencing 1,231 base pairs of three rapidly evolving mitochondrial (mt) DNA genes (ATPase 8, 6, and ND2) in 9 basin-wide populations of *C. latipinnis,* 10 widespread populations of the Sonora sucker (*C. insignis*), and four populations of the Little Colorado River form. Results indicated that the LCR and flannelmouth suckers are virtually identical from the standpoint of mtDNA. In addition, a haplotype of the Little Colorado River sucker was also found in the Sonora sucker clade. The Sonora sucker also contained an undescribed "Sonora-like" sucker that was found in the Gila River (NM), Virgin River (NV), San Juan River (NM), and mainstem Colorado in Grand Canyon (AZ). These results add more confusion to the already enigmatic status of the LCR form. Its management and distinctness are discussed.

Douglas, M. R., and M. E. Douglas

Department of Fishery and Wildlife Biology, Colorado State University, Ft. Collins CO

Genetic variation in speckled dace (Teleostei, Cyprinidae) from the Colorado River Basin. The speckled dace (Rhinichthys osculus) is widespread throughout western North America. However, it is neither endangered at the national level, nor listed by resource agencies as a "species of concern". Yet, understanding the basin-wide distribution of genetic diversity in this fish is of interest in that it could serve as a model against which other species in the basin could be compared, particularly those now greatly restricted in abundance and distribution. In this sense, it could provide a pre-development perspective on the relationships of drainages, basins, and the biota contained therein. However, such a study requires sampling of numerous populations and individuals throughout western North America. We have elected to complete this task by evaluating drainages and regions separately and in a piecemeal fashion, so that sample sizes of both populations and individuals can be optimized. Last year we reported on levels of genetic variation found in 13 populations of speckled dace from the Virgin River drainage of Arizona, Nevada, and Utah. Here, we coalesce these data with 18 populations from the upper and lower Colorado River basins. We amplified and sequenced three fast-evolving mitochondrial genes

(ATPase 8, 6, and ND2) to serve as our genetic marker. Preliminary results indicate three major clades. The largest consists of the mainstem Colorado, Virgin, Sevier, Bill Williams, and upper Little Colorado rivers. Relationships within this large clade are relatively unresolved, but three distinct Virgin River haplotypes are diagnosed. Furthermore, mainstem Colorado populations are undifferentiated from WY to southern Grand Canyon. The second large clade represents the Gila River, and is quite distinct from the mainstem Colorado. The third clade, the Lahontan, is most divergent of all. Management implications are discussed.

Mueller, G[1]., and P. Marsh[2]

[1]U.S. Geological Survey; [2]Arizona State University

Lost, a Desert River and Its Native Fishes: A historical perspective of the lower Colorado River. The authors describe historical conditions of the lower Colorado River through old photographs and records. Few people appreciate the magnitude of change that has occurred in the lower basin, especially through the loss of the Colorado Delta. Before high dams and storage reservoirs, the river periodically flooded hundreds of square kilometers of floodplain and desert playa. W. L. Minckley once suggested the core populations of razorback sucker *(Xyrauchen texanus*), bonytail (*Gila elegans*), and Colorado pikeminnow (*Ptychocheilus lucius*) emanated from the broader floodplain and oxbow habitats, much of that being found in the delta. The Colorado delta and lower 125 miles of river has been lost to upstream water diversions and to the plow. The river that remains more closely resembles the upper Mississippi or Missouri rivers both physically and biologically. Ecological conditions and biotic communities from which native fish evolved have been totally lost. In fact, the lower Colorado River has the dubious distinction of being among the few major rivers of the world with an entirely introduced fish fauna. Regardless, both Federal and state agencies are reintroducing endangered fish into these waters. It should not come to anyone's surprise these traditional approaches are proving ineffective.

Posters and Displays

Snyder, D.E.

Larval Fish Laboratory, Colorado State University, Ft. Collins, CO

Descriptive Species Account for Larval and Early Juvenile Longnose Sucker, *Catostomus catostomus.* The current guide to larval and early juvenile suckers of the Upper Colorado River Basin (UCRB; Snyder and Muth 1990) covers six of the seven species found in the basin. Longnose sucker (*Catostomus catostomus*) was not included because of budgetary limitations and the improbability of encountering its larvae or early juveniles in Recovery Program collections. However, with the collection of a significant number of juvenile longnose sucker and many larvae suspected to be longnose sucker or hybrids in the lower Gunnison River in 1993, confidence in identification of those and other suckers was compromised, and the need to comparably describe and incorporate the last of the UCRB suckers in the guide and key became evident. Accordingly,

previously reared, newly reared, and collected series of certain identity are being studied to provide the needed descriptive data and generate a comparable species account for longnose sucker. This poster presentation is an enlarged replica of the latest draft of the species account (December 2001). Yet to be added are minor corrections to the distribution map, descriptive data from a newly reared developmental series, and photographs of selected skeletal features (and related data) that have proven diagnostic for the metalarvae and early juveniles of other UCRB suckers.

Colorado River Endangered Fish Recovery Program Office

Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin Display

Restaurants

Arby's	202 S. Main
The Branding Iron	2971 S. Hwy 191 (about 4 miles south of town on the east side of hwy)
Burger King	606 S. Main
Denny's	989 N. Hwy 191
Hogi Yogi	396 S. Main
La Hacienda	574 N. Main
Szechuan Rest.	105 S. Main
McDonalds	640 S. Main
Moab Brewery	686 S. Main
Moab Diner	189 S. Main
Mondo Café	59 S. Main (in McStiff's Plaza)
Pizza Hut	265 S. Main
Poplar Place	11 E. 100 North (NE corner of Main and 100 North)
The Rio	2 S. 100 West (corner of Center and 100 West; not sure if open)
Subway	299 S. Main (in gas station)
Teriyaki Stix	396 S. Main

Taverns

Moab Brewery	686 S. Main
The Outlaw	44 W. 200 North
Poplar Place	11 E. 100 North
The Rio	2 S. 100 West
Woody's	221 S. Main