Upper Colorado River Endangered Fish Recovery Program

24th Annual Researchers Meeting

January 15–16, 2003

Holiday Inn
Grand Junction, Colorado

24th ANNUAL RESEARCHERS MEETING
JANUARY 15–16, 2003

SCHEDULE OF PRESENTATIONS

WEDNESDAY, JANUARY 15, 2003

7:30 **Registration**

9:00 **Introduction**. MCADA, C.

9:10 **Program Director's Message**, MUTH, R.

9:20 **Upper Basin Activities — Agency Update**

UTAH DIVISION OF WILDLIFE RESOURCES — Moab and Vernal Field Stations
COLORADO DIVISION OF WILDLIFE
FISH AND WILDLIFE SERVICE — Vernal and Grand Junction Field Stations
LARVAL FISH LABORATORY

10:30 **Management of water for endangered fish during the drought of 2002.** SMITH, G.

10:50 **2002 Drought: Information on fish kills in the upper Colorado River basin in Utah.** BADAME, P. J., and J. M. Hudson.

11:10 **Predictions of habitat availability as a function of flow for bluehead and flannelmouth sucker using a 2D model.** ANDERSON, R., and G. Stewart.

11:30–1:00 **Lunch** (on your own)

Moderator — Tom Czapla

1:00 **Selenium remediation efforts in the Gunnison and Colorado rivers, Colorado: a benefit to endangered fish in more ways than one.** KRUEGER, R.

1:20 **Selenium remediation efforts in the middle Green River: a benefit to endangered fish in more ways than one.** DARNALL, N.

1:40 **Growth and survival of hatchery-produced larval razorback suckers (*Xyrauchen texanus*) in a natural floodplain depression inhabited by nonnative fish in the Green River, Utah.** CHRISTOPHERSON, K., and G. Birchell.

2:00 **Comparison of the distribution and recapture rates of acclimated and**

non-acclimated subadult razorback sucker *Xyrauchen texanus* stocked into the Green River. MODDE, T., G. Birchell, and K. Christopherson.

2:20 **Larval razorback sucker sampling in the Gunnison River: first year results, 2002.** OSMUNDSON, D. B.

2:30 – 2:50 **Break**

Moderator — Mike Hudson

2:50 **Status report on Cibola High Levee Pond.** MUELLER, G., J. Carpenter, and C. Minckley.

3:10 **Management of native fish refugia within the lower Colorado River flood plain.** JANN, D. B., and R. L. Simmonds, Jr.

3:30 **Utilization and implications of fish data collected from washes and tributaries flowing into critical habitat of the Grand Valley, 2001–2002.** MARTIN, L.

3:50 **A look at the smallmouth bass scenario in the Yampa River Basin.** MARTINEZ, P.

4:15 **Channel catfish control in the lower Yampa River.** FULLER, M. H.

4:35 **Adjourn**

5:30 **Social**

THURSDAY, JANUARY 16, 2003

Moderator — Dave Irving

8:00 **A genetic evaluation of hybridization among indigenous and non-native Yampa River suckers (Catostomidae).** DOUGLAS, M. R., M. E. Douglas, P. C. Brunner, and M. A. Kwiatkowski.

8:20 **Interrelationships among populations of *Gila cypha* from the Colorado River Basin.** DOUGLAS, M. E., M. R. Douglas, and M. A. Kwiatkowski.

8:40 **Humpback chub population estimate in Desolation/Gray Canyons.** JACKSON, J. A., and J. M. Hudson.

9:00 **Stock assessment and fisheries monitoring activities in the Little Colorado River within Grand Canyon, 2002.** VAN HAVERBEKE, D. R.,

and P. Sponholtz.

9:20 **How baiting with Aquamax fish diet influences *Gila cypha* catch rates in the Little Colorado River**. STONE, D., and B. Galuardi.

9:40 **A feasibility study to augment humpback chub (*Gila cypha*) in Grand Canyon, Arizona.** SPONHOLTZ, P. J., D. R. Van Haverbeke, and R. Simmonds.

10:00–10:20 **Break**

Moderator — Tom Chart

10:20 **Feasibility study to determine the efficacy of using a weir in Bright Angel Creek to capture brown trout**. TRAMMELL, M. A., W. Leibfried, and H. Johnstone.

10:40 **Mechanical removal of non-native fishes in Grand Canyon, Colorado River, Arizona: a proposal.** PAUKERT, C., L. Coggins, and M. Yard.

11:00 **Movement, migration, and habitat use of Colorado pikeminnow in Lodore Canyon.** KITCHEYAN, C.

11:20 – 12:50 **Lunch** (on your own)

Moderator — Chuck McAda

12:50 **Fine sediment dynamics in the upper Colorado River during spring and summer baseflows.** Harvey, M. D., R. A. MUSSETTER, and C. E. Morris.

1:20 **Developing a strategic plan for geomorphic research in the Upper Colorado River Basin as related to endangered fish habitat.** LAGORY, K., J. Hayse.

1:50 **Discussion of strategic plan.**

2:20 Adjourn

Abstracts

Management of water for endangered Colorado River fish during the drought of 2002.

Smith, George.
U. S. Fish and Wildlife Service, Denver, CO.

The Upper Colorado River Endangered Fish Recovery Program is a cooperative partnership created in 1988 to recover four species of endangered fish in the Upper Colorado River Basin relying on the state water right laws, while water development proceeds.

In Colorado, the year 2002 was the driest in more than 100 years, putting a significant strain on the already overtaxed Colorado River system. This river system has a significant amount of reservoir storage water available to mitigate drought conditions for agriculture, municipalities, industry, and endangered fish. The Recovery Program has secured a significant quantity of water in these reservoirs to mitigate drought conditions on endangered humpback chub, bonytail, Colorado pikeminnow, and razorback sucker in Colorado and Utah.

This presentation will describe river basin drought conditions and explain how the Recovery Program cooperatively managed water it secured in basin reservoirs to support fish passage and habitats for endangered fish. The presentation will cover the mainstem Colorado River and its tributaries, including the Gunnison, Green, and Yampa Rivers.

2002 Drought: Information on fish kills in the upper Colorado River basin in Utah.

Badame, Paul J., and J. Michael. Hudson.
Utah Division of Wildlife Resources, Moab, UT.

Drought conditions have persisted in the upper Colorado River basin for at least three years. The effects of the drought on the Price River, Westwater Canyon, and Desolation Canyon during 2002 are presented. The Price River experienced the most severe effects. On four occasions, between in July 17 and August 28, The USGS gauging station at Woodside reported zero CFS. On July 18, we responded to a call reporting dead fish in the lower Price River including Colorado pikeminnow. Investigation revealed large numbers of native sucker remains, however, no dead Colorado pikeminnow were found. Following a large storm event on September 7, reports of fish kills in both Westwater and Desolation Canyon were received. In each instance, witnesses reported observing large numbers of dead fish including chubs and native suckers. Upon further investigation, large amounts of ash and charred wood were observed below these two canyons. It is likely that the flash flood conditions coupled with ash flows from the large wildfire complex in the Bookcliffs was the culprit in these fish kills. It is our intent to gain any knowledge possible from these events. For example, otoliths could be collected from dead humpbacks in Desolation and Westwater canyons to develop length–age relationships and assess the age structures of these populations. The challenge lies in being able to respond quickly enough to make collections.

Pedictions of habitat availability as a function of flow for bluehead and flannelmouth sucker using a 2D model.

Anderson, Rick [1], and Greg Stewart [2]
[1] *Colorado Division of Wildlife, Grand Junction, CO;* [2] *Oregon State University, Corvallis, OR.*

Mark and recapture density estimates for bluehead and flannelmouth sucker were made over multiple years at three sites on the Yampa River (Lily Park, Sevens Ranch and Duffy Tunnel) and two sites on the Colorado River in the 15-Mile Reach. Habitat availability of these sites was determined at each site by using RTK GPS to quantify channel topography. A 2-D flow model was used to produce hydrologic simulations that best matched flow conditions at the time of the electro-fishing sample. Overlapping fishery and habitat data was spatially analyzed to develop a habitat suitability relationship between fish abundance in a polygon and the mean depth and velocity of that polygon. Adult bluehead sucker (>20cm) density and biomass was strongly associated with the mean velocity of the occupied habitat. The 2-D flow model was then used to determine the relationship between flow and the availability of optimal, marginal and unsuitable bluehead sucker habitat. The adult bluehead sucker density estimate was 1,200 fish per km in both 2000 and 2001 for the 15-Mile Reach. Preliminary results indicate flows between 600 and 800 cfs are likely to support a bluehead sucker population size near the 2001 density estimate for the Colorado River sites. Base flows over 1,400 cfs do not appear to increase habitat availability for bluehead sucker, while flows near 200 cfs suggest bluehead population size would drop to less than half that found in 2001. Correlations between optimal habitat surface area and bluehead biomass per polygon may produce higher R values, but is still being determined at the time of this meeting. Bluehead sucker habitat availability and density was found to be very poor on the Yampa River at flows less than 150 cfs. Due to the drought conditions of 2002, this project has elected to resample the five study sites for the next two years to collect empirical data for fish density and biomass in periods of extreme low flows.

Selenium remediation efforts in the Gunnison and Colorado rivers, Colorado: a benefit to endangered fish in more ways than one.

Krueger, Rick.
U.S. Fish and Wildlife Service, Grand Junction, CO.

Since the late 1980s, selenium has been recognized as a potential threat to fish and wildlife resources within the upper Colorado River basin. Efforts have been undertaken by the National Irrigation Water Quality Program (NIWQP), a Department of Interior program made up of the Bureau of Reclamation, Geological Survey and Fish and Wildlife Service, to assess drainwater contamination and related impacts to endangered species and migratory birds. Within the upper Colorado River basin it was determined that selenium concentrations in the Gunnison River from Delta downstream to the confluence with the Colorado River and the Colorado River within the Grand Valley and downstream have selenium concentrations which are potentially harmful to aquatic life. The NIWQP is currently evaluating alternatives to remediate elevated selenium concentrations in the mainstem of the Gunnison River and in backwaters and flooded bottomlands of the Colorado River.

The Gunnison River has selenium concentrations that consistently exceed the State of Colorado instream water quality standard of 5 ppb. This exceedance causes food organisms in the Gunnison River to be three times higher than the safe level for aquatic life. A demonstration project was recently completed in the Gunnison basin to reduce selenium concentrations on the Federal Uncompahgre Project near Montrose and Delta, Colorado. This project replaced 8.5 miles of leaky irrigation ditches with 7.5 miles of buried PVC pipe, resulting in a 27% reduction

of selenium loading within the affected basin. Pending legislation would expand this effort to replace the aging irrigation system within a substantially larger area of the Uncompahgre Project. Associated with this effort is the need to mitigate for riparian and wetland habitat losses created by canal leakage. Depending upon site availability, there may be additional opportunities to mitigate along the Gunnison River with options to modify and improve habitat for endangered fish.

Within the Grand Valley, the NIWQP is planning for remediation at 23 backwater/bottomland sites that are receiving selenium contaminated drainwater and are used by endangered fish. Remediation was completed at Orchard Mesa Wildlife Area in 2000. This property was purchased jointly by the Recovery Program for endangered fish and the Bureau of Reclamation for salinity mitigation. Orchard Mesa drain carries agriculture return flows and associated selenium contaminated ground water onto the property creating a backwater with elevated selenium concentrations (10-20 ppb) that is accessible to endangered fish. Flow from the drain has been rerouted and is now used to irrigate lands on the eastern end of the property. Water infiltrates into the ground and returns to the Colorado River as a diffuse source, reducing the threat to endangered fish. In addition, flushing channels were constructed at three other backwaters to reduce selenium concentrations where endangered fish are known to occur.

Other sites currently being remediated within the Grand Valley include Walter Walker State Wildlife Area (WWSWA), Adobe Creek and Colorado River Wildlife Area (CRWA). All three sites are heavily used by endangered fish. A number of years of data have been collected at WWSWA documenting high selenium concentrations (1-430 ppb) leaching into the area from upgradient ground water. Recently, a gravel pit was constructed upgradient which has prevented the high selenium groundwater from reaching the backwater. In addition, planing is underway to remove a significant portion of the existing dike to allow the river to meander more naturally and flush selenium as it reaches the river. Adobe Creek is a tributary to the Colorado River with high selenium concentrations (10-40 ppb) that enters a backwater prior to reaching the main river. Planning is underway to put Adobe Creek into a pipe and route it directly to the main stem of the Colorado River and remove the high selenium water from the backwater. CRWA backwater receives irrigation drainwater from Lewis Wash and adjoining ponds and has high selenium concentrations (6-47 ppb). The upper end of the channel is blocked with debris and beaver activity. Irrigation drainwater is ponded, allowing food organisms used by endangered fish to concentrate selenium. Planned remediation at this site will remove the blockage from the upstream end of the backwater and allow Colorado River water to flow through the channel year round, flushing the vegetation-choked backwater to make it more accessible to endangered fish..

All of these planned remediation efforts will reduce the potential for selenium impacts on endangered fish by reducing the selenium concentrations in food organisms. In addition, the efforts are designed to enhance habitats used by endangered fish and other wildlife where

possible. Therefore, selenium remediation is benefitting the endangered fish in more ways than one.

Selenium remediation efforts in the middle Green River: a benefit to endangered fish in more ways than one.

Darnall, Nathan
U. S. Fish and Wildlife Service, Salt Lake City, UT.

Since the late 1980s, selenium has been recognized as a potential threat to endangered fish and migratory birds at Stewart Lake, Ashley Creek, and at Ouray National Wildlife Refuge. In recent years, the National Irrigation Water Quality Program (NIWQP) has been working with great fervor to remediate selenium contamination at Stewart Lake Waterfowl Management Area. Significant progress has been made. The Middle Green core team has used an adaptive management strategy to implement numerous activities designed at reducing selenium in both water and sediments. First, drainage channels were excavated in Stewart Lake to allow the lake to drain completely. This activity was necessary for several reasons, but primarily it facilitated completion of future remediation activities. Next, irrigation return-flow drains (the major sources of selenium) were diverted around the lake, thereby significantly reducing further contamination in the lake. New inlet and outlet structures were constructed to allow flexibility in the filling and draining of the lake. Finally, efforts were undertaken to mobilize and remove selenium from the sediments; these included tilling, and addition of calcium oxide (lime). In addition, the core team has continued to monitor selenium in water, sediments, and biota to identify the effects of remediation activities. Future activities at Stewart Lake include the removal of selenium contaminated seeps from along the north end of the lake, and additional attempts to remove selenium from sediments. The current seasonal flooding of Stewart Lake somewhat mimics a flooded backwater, though on a grand scale. Ideally, these efforts will ultimately restore Stewart Lake to a fully functioning wetland that will provide good nesting habitat for migratory birds, excellent staging, nursery and foraging habitats for endangered fish, and allow the state of Utah to have a productive waterfowl management area.

Growth and survival of hatchery-produced larval razorback suckers (*Xyrauchen texanus*) in a natural floodplain depression inhabited by nonnative fish in the Green River, Utah.

Christopherson, Kevin, and Garn Birchell.
Utah Division of Wildlife Resources, Vernal, UT.

As part of ongoing efforts to recover the endangered species *Xyrauchen texanus* (razorback sucker) hatchery produced larval razorback suckers were experimentally stocked into a natural floodplain depression along the Green River, Utah. This study was designed to evaluate if larval razorback suckers could survive and prosper in a natural floodplain depression that was also inhabited with nonnative fish. Earlier efforts of stocking larval razorback suckers into Green River floodplain depressions containing nonnative fish were unsuccessful. The very large number of nonnative predators were likely the reason for no observed survival of the stocked larval razorback suckers. Floodplains that dry up during drought years and then flood during wet years have much lower densities of nonnative fish for the first year. The fish populations in these depressions are reset to zero during these dry cycles. This study was designed to evaluate if large numbers of razorback sucker larvae that entered a “reset” floodplain depression could overwhelm nonnative fish predation and survive to reenter the river during a future spring flood. This situation was experimentally created by pumping water from the river into a dry floodplain and introducing larval razorback suckers and nonnative fish into partitioned portions of the floodplain depression. The experiment was successful and razorback sucker larvae did survive and grew well reaching lengths of up to 115mm by mid-summer.

Comparison of the distribution and recapture rates of acclimated and non-acclimated subadult razorback sucker *Xyrauchen texanus* stocked into the Green River.

Modde, Tim [1], Garn Birchell [2], and Kevin Christopherson [2].

[1] *U. S. Fish and Wildlife Service, Vernal, UT;* [2] *Utah Division of Wildlife Resources, Vernal, UT.*

As part of an Upper Colorado River Basin recovery effort, razorback sucker *Xyrauchen texanus* augmentation will increase significantly in the coming years. In an effort to examine efficiency, we compared the capture returns of acclimated and non-acclimated razorback sucker in the middle Green River. We compared riverine recapture rates of fingerling razorback sucker reared for one growing season in offchannel wetlands, that accessed the river voluntarily as subadults, with subadult fish (> 250 mm TL) stocked directly in the Green River from the Ouray National Fish Hatchery. The distribution and recapture rates of approximately 2,000 subadult/adult razorback sucker (>250 mm) stocked directly into the river between 1997 and 2001 were compared with approximately 1,100 acclimated fish that accessed the Green River from offchannel wetlands. The entire reach of the Green River between Split Mountain Canyon (rkm 352) and the confluence (rkm 0) with the Colorado River was sampled with electrofishing boats during the spring of 2001. Three complete passes were made. Despite the fewer fish accessing the river from the floodplain, nearly three times (74) as many acclimated fish (i.e., floodplain reared fish) were recaptured than those stocked into the river directly from the hatchery (29). Although an apparent difference in capture rate was observed, the distribution of fish downstream from the stocking area was approximately equal between the two groups. As expected, the majority of post-stocking movement occurred downstream of the stocking site. Thus, survival, rather than distribution may be the biggest difference between acclimated and non-acclimated individuals. The higher rate of recaptures among acclimated fish suggests that acclimation may be an important element in the reintroduction effort for razorback sucker in the Green River.

Larval razorback sucker sampling in the Gunnison River: first year results, 2002.

Osmundson, Douglas B.
U.S. Fish and Wildlife Service, Grand Junction, CO.

The last captures of wild razorback suckers in the Gunnison River were in 1981 when three were captured near Delta, Colorado. Restoration stocking of razorback suckers began in April 1994 and has occurred annually since that time. As of November 2001, a total of 18,400 razorback suckers of various sizes has been stocked in the Gunnison. About 95% of these were stocked at Delta (rm 57). In recent years, adult-size stocked razorback suckers have been electrofished from the river and six have been caught at the Redlands fish ladder. To determine if stocked razorbacks are successfully reproducing in the Gunnison, a three-year larval sampling effort was begun in 2002. Larval light-trapping at Delta and Whitewater was planned as the primary method for capturing larvae and supplemented with fine-mesh seining in the vicinity of the light traps. However, because of extremely low flows during the anticipated spawning period in 2002, good light-trap sites were unavailable. Weekly fine-meshed seine surveys of shorelines and small backwaters throughout the river from Delta to Redlands Diversion Dam became the primary means to sample larvae supplemented by a small light-trapping effort near Delta and Whitewater. Sampling occurred from May 2 to June 20. On a given day, seining was done at 2-6 sites per 5-mile reach (7-13 total per day), depending on availability of zero-velocity habitat. Seining was conducted 268 times during the spring 2002 sampling period; 168 of these efforts were successful in capturing at least some fish larvae. In addition, eight nights of light-trapping was conducted: six nights at Whitewater and two nights at a site near Delta. From these samples, personnel at the Larval Fish Laboratory at Colorado State University identified eight razorback sucker larvae (five identifications were certain; three were considered tentative). Seven of the eight larvae were collected at various sites in the lower

10 miles of river, downstream of Whitewater. One positively identified larva was found in one of the two light-trap samples taken near Delta at rm 50.2. All eight larvae were collected between May 21 and June 6.

Status Report on Cibola High Levee Pond.

Mueller, Gordon [1], Jeanette Carpenter [2], and Chuck Minckley [3].
[1] U.S. Geological Survey, Denver, CO; [2] U.S. Geological Survey, Fort Collins, CO ; [3] U.S. Fish and Wildlife Service, Parker, AZ.

Cibola High Levee Pond is a 2.4 ha pond located on Cibola National Wildlife Refuge near Blythe, California. USFWS renovated the pond in 1993 for use as a grow-out facility for bonytail and razorback sucker. Fish were initially stocked for 3 years and as they reached a size large enough they were stocked elsewhere. During the 1998 removal effort, biologists discovered both species had successfully produced young. A cooperative study was started last year to determine the populations status and examine factors that led to natural recruitment.

Initial data suggests the community is primarily (99.85%) native and contains approximately 7,800 (5,955-11,630, CL=95%) bonytail and 1,100 (844-1,190) razorback sucker. Estimates do not include thousands of <10-cm bonytail, to small to mark. Carrying capacity of the pond is 4,350 fish/ha (635 kg/ha). Bonytails spawned on rip-rap where both eggs and newly hatched larvae were collected. Schools of fry were routinely found inhabiting tunnel entrances to beaver dens. Razorback sucker appeared to have spawned over gravel but we were unable to collect larvae or any juveniles <35 cm. In April, we observed large schools of small (<15-cm) bonytail aggressively digging routing in spawning substrate for eggs and larvae and when eggs were exposed they were rapidly devoured. Egg and larvae predation by bonytail may be far more detrimental to razorback suckers who deposit their gametes amongst more accessible gravels.

Management of native fish refugia within the lower Colorado River flood plain.

Jann [1], Douglas B., and Rob L. Simmonds, Jr [2].
[1] U. S. Fish and Wildlife Service, Parker, AZ, [2] U. S. Fish and Wildlife Service, Pinetop, AZ.

The U.S. Bureau of Reclamation is currently developing 600 acres of protected habitat in the Lower Colorado River floodplain to mitigate the impacts of their activities on native fishes of the river. The Arizona Fishery Resources Office (AZFRO) of the U.S. Fish & Wildlife Service has been contracted to stock the habitats with endangered razorback suckers *Xyrauchen texanus*, and subsequently monitor their progress. Razorback suckers are endangered largely because predation by introduced fishes on early life history stages interrupts recruitment of juvenile fish to the spawning stock. A benchmark of success for the Native Fish Protected Habitats (NFPH) will be the recruitment of naturally spawned fish to sexually maturity. To facilitate this, AZFRO will remove existing fish communities from the designated habitats. Once a habitat is determined to be fishless, AZFRO will stock it with appropriate numbers and sizes of razorback suckers. After stocking, AZFRO will maintain a monitoring program of population and habitat characteristics. Knowledge gained from monitoring should help to identify an optimal stocking pattern for establishment of self-sustaining razorback sucker populations. Monitoring will also

help identify minimal habitat and water quality standards necessary to maintain those populations over time. To date, two waterbodies totaling 210 acres have been designated as NFPHs. Beal Lake, at the Havasu National Wildlife Refuge in Arizona, was renovated in December 2001, and was stocked with 10,000 fingerling razorbacks in January 2002. Monitoring was conducted in November. Razorback suckers were not contacted in the sample. However, more than 1,300 fish of five other species were collected. The Farm Ponds, at the Imperial National Wildlife Refuge in Arizona, were renovated in October 2002. An evaluation of the renovation was performed in November. Four fish, representing two species, were collected during the evaluation. The ponds were renovated a second time in December. Evaluation monitoring will begin again in January 2003.

Utilization and implications of fish data collected from washes and tributaries flowing into critical habitat of the Grand Valley, 2001–2002.

Martin, Lori, M.
Colorado Division of Wildlife, Grand Junction, CO.

The Colorado Division of Wildlife (CDOW) conducted qualitative fish surveys and collected water chemistry samples at sites along five washes and creeks flowing into critical habitat of the Colorado River in Oct. 2001, Mar. 2002, and Oct. 2002 with assistance from the U.S. Fish and Wildlife Service (USFWS). Qualitative multi-habitat macroinvertebrate samples were also collected in Mar. 2002. Sites were selected based upon close proximity of the site to critical habitat of the Colorado River, access to site locations downstream of Grand Valley irrigation canal laterals, and heterogeneous physical habitat structure.

Native fish community structure did not vary a great deal across irrigation seasons at any site, and appeared to be more stable than nonnative fish community structure, as indicated by results of Jaccards index analyses. The presence of several age classes of the fathead minnow (*Pimephales promelas*), green sunfish (*Lepomis cyanellus*), red shiner (*Cyprinus lutrensis*), and white sucker (*Catostomus commersoni*) over irrigation seasons suggested that these nonnative species may be maintaining resident populations year round. At least 3 native fish species were present at all sites across all seasons. Size distributions of the bluehead sucker (*Catostomus discobolus*), flannelmouth sucker (*Catostomus latipinnis*), roundtail chub (*Gila robusta*), and speckled dace (*Rhinichthys osculus*) indicated that these native species may be reproducing and maintaining self-sustaining, resident populations. Further, extensive movement of native fish within sites across seasons probably is occurring as evidenced by few recaptures of floy-tagged fish.

Overall, 2,968 fish were collected. Four native fish species comprised 47% of the total number of fish collected. Of the 1,383 natives collected, the flannelmouth sucker composed 66.5%, while the roundtail accounted for 14.8%. The speckled dace and bluehead sucker constituted 9.7% and 9%, respectively, of the total native fish collected. Nine nonnative fish species comprised 53% of the total number of fish collected. The red shiner accounted for 63% of the 1,585 nonnative fish collected, while the fathead minnow composed 17.5% of the total nonnative fish collected.

Seasonal fluctuations in water volume influenced water quality. Overall, specific conductance, hardness and sulfate concentrations indicated these waters are highly conductive, alkaline systems. Selenium concentrations exceeded state water quality standards for aquatic life at all sites, ranging from 11.2 ug/L (Oct. 2001) to 56.0 ug/L (Mar. 2002). Ammonia concentrations

varied across seasons and from site to site, and exceeded the unionized ammonia standard for aquatic life at one site, on one occasion.

Three species of midge larvae, Chironomidae (Diptera), dominated the total taxa of aquatic macroinvertebrates collected. Overall, four species of mayflies (Ephemeroptera) and one species of caddisfly (Trichoptera) were collected. One species of aquatic butterfly, *Petrophila* sp., and the bivalve, *Corbicula fluminea*, were also found.

In the future, the CDOW hopes to: 1) improve sampling efficiency by exploring other methods conducive to high specific conductance, 2) measure and evaluate physical habitat parameters/characteristics in comparison to fish species presence and absence, and life history stages, and 3) utilize radio telemetry techniques to evaluate movement of native fishes.

A look at the smallmouth bass scenario in the Yampa River basin.

Patrick J. Martinez
Colorado Division of Wildlife, Grand Junction, CO.

Basic life history information for smallmouth bass *Micropterus dolomieu* is reviewed with regard to local environmental conditions for this species in the Yampa River basin. This presentation also provides a preliminary compilation of some extant and developing data sets from smallmouth bass monitoring and research projects in the Yampa River to examine selected smallmouth bass population characteristics and trends. Recent length, weight, growth and structural indices of the smallmouth bass population are discussed in relation to projected productivity of smallmouth bass in the Yampa River and a predicted response of the population to exploitation. These parameters are further considered in context with commentaries by enthusiasts of the rivers present sport fishery concerning potential relocation of smallmouth bass removed from the lower Yampa River to Elkhead Reservoir.

Channel catfish control in the lower Yampa River.

Fuller, Mark H.
U.S. Fish and Wildlife Service, Vernal, UT

Since 1998 mechanical removal strategies to reduce subadult and adult channel catfish abundance in the lower Yampa River have been successful. In 1998 methodologies were tested and in 1999 electrofishing and volunteer assisted angling resulted in significant population reductions in several test reaches (57.4 -81.5%) . Flow regimes and catfish behavior complimented the two most effective removal methods. Electrofishing at flows between 3000 and 1000 cfs provided the highest catch rates and effectively sampled shallow higher velocity environments (runs and riffles), and volunteer assisted angling provided the most fish per trip when flows were too low to navigate electrofishing rafts through the canyon. Angling effectively sampled the deeper slower velocity habitat (pools) in late summer when water levels were lower and catfish became less mobile.

A length gradient of channel catfish was observed in both Yampa Canyon and the larger tributary-mainstem system. Larger more fecund adults tend to occupy upstream reaches above Dinosaur National Monument. The majority of catfish collected in the canyon were between 200 and 400 mm total length and data show a steady decrease in average length among years.

Juvenile catfish (<150 mm) were absent from the canyon. Fyke nets, shoreline electroshocking and seining in the canyon associated with other studies have failed to detect smaller channel catfish. Thus, recruitment (catfish between three and four years of age) may be coming from downstream nursery areas.

Channel catfish growth is slow in the lower Yampa River. Growth data (Tyus and Nikirk 1990) indicates that the most common sized catfish collected from the study area (200 - 400 mm) ranged between five to fourteen years of age. Channel catfish mature between 250 mm and 400 mm (Carlander 1969). Because growth rates are slow, and densities in the canyon are fairly low, it appears that we are removing much of the mature catfish in the canyon. Greater effectiveness in channel catfish control may be attained by sampling larger individuals in the reaches above and below Yampa Canyon. This year, revisions in the SOW include targeting larger individuals by setting trap nets above and below the canyon during the spawn. If recruitment could be lowered by removing broodstock the impacts of catfish removal could be longer lasting.

A genetic evaluation of hybridization among indigenous and non-native Yampa River suckers (Catostomidae).

Douglas, Marlis R., Michael E. Douglas, Patrick C. Brunner and Matthew A. Kwiatkowski.
Department of Fishery and Wildlife Biology, Colorado State University, Fort Collins, CO.

Numerous factors contribute to the decline of indigenous fishes in western North America. Yet, the most serious of these stem from planned or impromptu introduction of alien species. There are several mechanisms by which exotic fishes impact indigenous ones. One mechanism by which exotic fishes gradually eliminate endemics is through introgressive hybridization. It is particularly prevalent in western North America because anthropogenic alterations of habitat and introductions of non-native species characterize this region. Both factors will increase the rate at which species hybridize. The situation becomes exacerbated when the introduced form has evolved allopatrically yet is closely related to the indigenous form. We applied a molecular genetic approach to define the extent and magnitude of introgressive hybridization in the Yampa River involving natives (Flannelmouth Sucker: *Catostomus latipinnis;* Bluehead Sucker: *C. discobolus*), and an introduced non-native (White Sucker: *C. commersoni*). The area of interaction between these species is the 50-mile reach of river between Lily Park and Craig. Species-specific nuclear markers were developed to assess the status (i.e., pure or introgressed) of 400 specimens. Marker development and preliminary results are discussed.

Interrelationships among populations of *Gila cypha* from the Colorado River Basin.

Douglas, Michael E., Marlis R. Douglas, and Matthew A. Kwiatkowski.
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Life history of *G. cypha* in the Colorado River Basin is mostly enigmatic, and interrelationships among subpopulations are virtually unknown. Lack of an historic baseline further complicates understanding of present-day patterns, and causal relationships between physical and biological parameters are merely the source of speculation. The most pressing questions pertain to genetic distinctiveness of local populations in the Colorado River Basin, the interrelationships among these populations, and how the sum can be adaptively managed in a perturbed environment. The objectives of this ongoing study are therefore to (a) infer interrelationships among populations of *G. cypha* within the basin, (b) to identify if possible

genetically distinct units, and (c) to derive a management strategy for this endangered species. In this presentation, we deal with issue (a) through an assessment of genetic interrelationships among 9 populations based on amplification and sequencing of 1,820 base pairs from four rapidly evolving mitochondrial (mt) DNA markers (ATPase 8 & 6, ND2, and D-loop). Analyses revealed low levels of genetic variation, both within and among populations. While this is surprising, given the number of specimens and amount of sequence data generated, it is congruent with findings in other big river fish from the Colorado River basin. Our basin-wide assessment of genetic diversity in Flannelmouth Sucker (*Catostomous latipinnis*) also revealed similar patterns of low genetic diversity. Potential causes for such low genetic diversity and implications for management and recovery are discussed.

Humpback chub population estimate in Desolation/Gray Canyons.

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Sampling in Desolation and Gray canyons on the Green River was conducted in the summers of 2001 and 2002 to obtain population estimates for humpback chub. Three sampling passes were made in 2001 and two in 2002. Low river discharge in 2002 forced cancellation of the third pass. Twelve individual sites were sampled throughout the two canyons. Four of these sites are long term trend sites that have been monitored at least once a year since 1989. Main channel habitats were sampled with trammel nets, boat mounted electrofishers, hoop nets and minnow traps. Trammel nets were set at each site during the evening and morning hours. One pass of electrofishing was conducted through the study area with more intensive sampling at each individual site. All *Gila* were scanned for a PIT tag, measured, weighed and received a PIT tag if one was not present.

Trammel net catch rates increased slightly but not significantly between the two years of sampling. Trammel net catch rates of humpback chub decreased significantly over the three sampling passes in 2001 and remained similar between the two sampling passes in 2002. More juvenile humpback chub were captured in 2002 than 2001 and may be a result of the collection gear used. Length frequency distributions reflect the smaller size class of humpbacks collected in 2002. Average total length of humpbacks captured in 2001 and 2002 were 259 mm and 293 mm, respectively. Recaptured humpbacks (since 2000) evidenced an average yearly growth rate of 8.45 mm. Movements of individual fish up to 13 miles were encountered within a weeks time during the 2002 sampling. Recaptures of humpbacks were lower in 2002 than 2001 and is likely a product of two trips compared to three. Population estimates were slightly higher in 2002 than 2001. However, the values within the 95% confidence intervals consequentially expanded.

Trammel net catch rates at the four long term trend sites were slightly higher in 2002 than 2001. They have remained relatively consistent since 1998 (between 0.19 fish/hr and 0.13 fish/hr) and they are considerably higher than 1992-1996.

Stock assessment and fisheries monitoring activities in the Little Colorado River within Grand Canyon, 2002.

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In cooperation with the Arizona Game and Fish Department, Grand Canyon Monitoring and Research Center and SWCA, Inc., populations of endangered humpback chub (*Gila cypha*) and other native fishes are monitored in the lower 14 km of the Little Colorado River (LCR) in Grand Canyon National Park. This portion of the LCR is one of the last streams in the southwest that still retains a largely native fish fauna. Using mini hoop nets baited with AquaMax fish food to increase capture rates, native fishes comprised 93% and 88% of the catch during spring and fall 2002 sampling efforts. During spring 2002 we obtained a provisional population estimate of 2,666 (SE = 98) humpback chub ≥150 mm in total length. We estimated that of these fish, there were 2,001 (SE = 461) humpback chub ≥200 mm (i.e. 4+ year old adults). During fall 2002, we obtained a provisional population estimate of 2,774 (SE = 209) humpback chub ≥150 mm. We estimated that of these fish, there were 839 (SE = 89) humpback chub ≥200 mm. In addition, we estimated that there were 2,003 (SE = 284) humpback chub between 100 and 149 mm during the fall of 2002. Results of this ongoing study indicate that despite low catch rates of nonnative fishes in the LCR, humpback chub continue to decline over time and that aging adults are not being replaced in the spawning population.

How baiting with Aquamax fish diet influences *Gila cypha* catch rates in the Little Colorado River

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We compared unique humpback chub (*Gila cypha*) catch rates from miniature hoopnets deployed in the lower 14 km of the Little Colorado River that were unbaited, scented (fish food was enclosed in socks to prohibit fish access), and baited (food in mesh bag was accessible to fish) to provide insight for future monitoring techniques. This portion of the LCR was subdivided into nine subreaches, each one had 20 nets deployed for three 24 h hauls. One of the three baiting techniques was conducted on all nets within each reach so that 60 nets were either unbaited, scented or baited during each haul. Baiting method also varied by haul so that all three methods occurred in each subreach. Because catch rates significantly declined by haul, baiting methods were compared separately for each haul. Our results indicated that humpback chub catch rates were significantly greater in baited than scented or unbaited nets during the first two hauls. Catch rates between scented and unbaited nets never significantly differed. Presumably, the food reward that humpback chub received in the baited nets increased their retention in the nets and ultimately the catch rates. These findings were somewhat disappointing as we were hoping that scent alone would allow us to increase humpback chub captures. Baiting limitations include the possibility that greater numbers of exotic piscine predators are drawn into nets with natives, higher risks of puncturing humpback chub intestinal tracts while inserting PIT tags, and allowing access to unnatural foods. Future monitoring efforts may have to continue using unbaited nets to avoid these issues.

A feasibility study to augment humpback chub (*Gila cypha*) in Grand Canyon, Arizona.

Pamela J. Sponholtz [1], David R. Van Haverbeke [1], and Rob L. Simmonds, Jr [2].
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Population estimates indicate that during the past twenty years of monitoring, humpback chub

(*Gila cypha*) in Grand Canyon have continued to decline. Point population estimates have dropped from around 7,500 (>200 mm) fish during the late 1970s (Kaeding & Zimmerman 1982) to ~4,500 fish (> 150 mm) in the early 1990s (Douglas & Marsh 1996), to 2,090 fish (>150 mm) in 2001 (Van Haverbeke & Coggins 2002). The Adaptive Management Work Group for Glen Canyon Studies has requested a feasibility study for establishing a captive broodstock program for the endangered humpback chub in Grand Canyon. Establishment of a captive broodstock for humpback chub and supplemental stocking has been proposed as a potential conservation action (USFWS 1990), as well as establishing a second population of humpback chub (USFWS 1990, USFWS 1994, USBR 1995). The U.S. Fish and Wildlife Service proposes to: 1) examine the feasibility of establishing a supplemental stocking program for humpback chub (*Gila cypha*) in Grand Canyon using wild caught young of year humpback chub removed from the Little Colorado River and grown out to a large size in captivity, 2) examine the feasibility of developing a captive broodstock to be used for a captive breeding program for humpback chub, and 3) examine the feasibility of establishing a second spawning (or expand the current) population of humpback chub in Grand Canyon. If funded, this feasibility study

could be an important first step in proactive management of humpback chub in the Grand Canyon.

Feasibility study to determine the efficacy of using a weir in Bright Angel Creek to capture brown trout.

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In Bright Angel Creek in Grand Canyon National Park, the fish community has been altered towards non-native salmonids, to the detriment of its native fishes. The National Park Service is charged with preserving and protecting the natural resources within Grand Canyon. Active, hands-on management of resources is at times required to achieve this goal. Construction and operation of a temporary weir in Bright Angel Creek will provide the opportunity to determine if removal of brown trout (*Salmo trutta*) will benefit native fish survival in Bright Angel Creek. In the mainstem Colorado River, maximum brown trout numbers occurred near the confluence of Bright Angel Creek. Bright Angel Creek is thought to be the primary spawning location for brown trout in the Grand Canyon, although mainstem spawning may also occur. Removal of spawning brown trout from Bright Angel Creek may reduce the numbers of brown trout in the mainstem as well, thus potentially benefiting the endangered humpback chub and other native fish in the mainstem. A temporary fish weir was installed in Bright Angel Creek and operated continuously from November 18, 2002 to January 21, 2003. Spawning brown trout were collected in the weir and removed from the creek. Stomach contents were examined for the presence of fish remains.

Mechanical removal of non-native fishes in Grand Canyon, Colorado River, Arizona: a proposal.

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The humpback chub (HBC) population in the Little Colorado River (LCR) reach of Grand Canyon has been declining at least over the past decade. One hypothesis for this decline is

predation or competition by the increased numbers of non-native rainbow trout (RBT) and brown trout (BNT) downstream of Lees Ferry. This study will determine if mechanical removal of salmonids is feasible in a large river ecosystem. The objectives of this study are to determine 1) the efficacy of mechanical removal of adult RBT and BNT from the LCR Inflow reach, 2) RBT and BNT predation and diet, and 3) the effect of adult RBT and BNT in the LCR inflow reach on the population dynamics of the LCR HBC population. We will conduct annually for four years, three depletion trips in January-March and three depletion trips in July-September of each year in the area surrounding the LCR (Colorado RM 56.2-65.7), which encloses the majority of the geographic distribution of the LCR humpback chub population. A control reach (where non-native fish will be sampled and released alive) has been established between RM 44 and RM 52. The sampling efforts are scheduled to coincide with the major periods of LCR flooding events (spring runoff and monsoonal storms) that are correlated with juvenile HBC immigration to the mainstem Colorado River. Non-native fishes will be collected and euthanized. All native fishes will be measured, weighed, tagged, and released. Stomach contents will be collected from all non-native fish to determine incidence of predation on humpback chubs. The results of this long-term study will provide insight to the mechanisms surrounding HBC recruitment in Grand Canyon.

Movement, Migration, and Habitat Use of Colorado Pikeminnow in Lodore Canyon.

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Within the last seven years, Colorado pikeminnow have been collected within Lodore Canyon. This indicates that former habitat is being reoccupied, at least by adult pikeminnow. But this habitat is not important to recovery unless these individuals contribute to spawning and recruitment of the Green/Yampa River population. Subsequently many questions arise with presence of pikeminnow in Lodore Canyon such as are these fish long or short term residents in the canyon? Do the same fish occupy the canyon among years? Do these fish migrate to a documented spawning site (Yampa Canyon or Desolation/Grey Canyon) or might they form a spawning aggregation within the canyon? Given the altered hydrological regime in the Green River, what cues trigger emigration/migrate from and to Lodore Canyon or Browns Park? As a result, a four year study was initiated in 2000 to address these questions. During the third year (2002) of this study, 52 Colorado pikeminnow were captured throughout the canyon, 4 times more compared to 2000. Ninety-six percent of these fish were captured by angling while the other four percent were captured with an electrofishing unit. The average size was 553 mm TL and size distribution ranged from 380 to 745 mm TL. Most pikeminnow were captured in reach four (348.8 to 344.9 RM) followed by reach two (359.7 to 354.8 RM). Sixteen fish were implanted with radio transmitters, a combined total of 23 fish. Data logging station at the confluence indicated radio tagged Colorado pikeminnow began dispersing into Lodore Canyon before June and proceeded into July. Pikeminnow occupied the canyon from one day to more than 120 days. These fish were located throughout the canyon and one fish was found in Browns Park. On the five float trips through the canyon, radio tagged pikeminnow were found within the same vicinity on each trip. Daily monitoring showed pikeminnow were sedentary but became active after sunset and at night using various habitat interchangeably. Radio tagged fish were found in runs and eddies and associated with large substrate (i.e. rubble and boulder) and sand. The data logging station showed radio tagged pikeminnow emigrated out of Lodore Canyon in August and continued until late October. Aerial surveys in the fall found pikeminnow in the alluvial reaches in Browns Park and below Split Mountain. Thus far, preliminary data indicates Colorado pikeminnow do not appear to be establishing a permanent residency in

Lodore Canyon, but instead use the canyon opportunistically.

Fine sediment dynamics in the upper Colorado River during spring and summer baseflows.

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Flow recommendations for the listed native fish species in the Upper Colorado River are based, in part, on the hypothesis that removal of fine sediment from the gravel and cobble bed material will increase biological productivity, and thus, the carrying capacity for the listed fish species. Studies in rivers that provide salmonid spawning habitat have shown that flushing of fine (primarily sand- and fine-gravel-sized) sediment to appreciable depths requires mobilization of the framework gravels. On that basis, flow conditions required to mobilize the gravel and cobble bed material has been a significant focus of the physical investigations in the 15-Mile Reach that are relied on to support the flow recommendations. While periodic mobilization of the framework gravels is likely an important process in maintaining a healthy river channel, the frequency at which the mobilization must occur has not been clearly demonstrated. Recent work by the authors in the 15-Mile Reach indicates that the salmonid model of fine sediment infiltration into the framework gravels, and the requirement for subsequent mobilization of the gravels to flush the fines, may not be the appropriate model for the Colorado River system. In contrast to the relatively clean rivers that support salmonid spawning, the Colorado River system carries a high load of fine (silt/clay-sized) sediment, particularly during short-duration thunderstorm events that occur during the late summer baseflow period when the runoff is derived from the lower elevation portions of the basin that are underlain by highly erodible sedimentary rocks. While it is true that most of the annual sediment load in the river is transported during the snowmelt runoff period, the late season storm events and resulting runoff can have a major impact on the dynamics of in-channel fine sediment (silt/clay-sized), and it is probable that they strongly influence the biotic assemblages in the river. A more appropriate physical process model may, therefore, be that fine sediment dynamics during the baseflow season are controlled by the presence or absence of a temporally variable supply of silts and clays that deposits on the bed surface in low energy zones within the channel. Removal of these deposits, or delivery of sufficient water to provide an adequately sized area where the deposits will not occur, may be the key to ensuring biological productivity during the baseflow portions of the year.

Developing a strategic plan for geomorphic research in the Upper Colorado River Basin as related to endangered fish habitat.

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The Recovery Program for Endangered Fishes in the Upper Colorado River Basin is developing a strategic plan for research and monitoring of geomorphic processes related to the formation and maintenance of endangered fish habitats. Key to development of this plan is identification of (1) the location of important fish populations and habitats in the basin; (2) important physical characteristics of these habitats relative to fish needs; (3) the relationship of these characteristics to hydrology and geomorphic parameters; and (4) data gaps and uncertainties associated with these relationships. We developed a linked matrix approach to systematically prioritize locations, habitats, and hydrogeomorphic processes based on existing fish

distributions, population status of species, sensitivity of life stages to environmental variability, relative importance of habitats to species and life stages, and data availability. A workshop involving upper basin researchers was held in December to gather input for populating the matrices. An overview of the workshop results will be presented.