Colorado River Endangered Fish Recovery Program
Upper Colorado River and San Juan River Basins
January 19-20, 2005, Grand Junction Colorado
ABSTRACTS

1. A Review of Fish Diversion Screens and Water Intakes.

Authors: BECKY EVERS of FOSTCO, Inc. a manufacturing representative agency that specializes in water intake and fish diversion screens will introduce MIKE ISBILL of Hendrick Screen Company

Abstract: An overview of fish and water intake screens is presented. This overview will include descriptions of various wedge wire screen construction, cylindrical screens, flat panel screens, drum screens and exotic screen shapes. Photos of fish diversion sites and intake installations with passive and self cleaning screens are featured.

2. Comparison of Smallmouth Bass in the Yampa and Colorado Rivers, Colorado, and Implications for Their Control.

Authors: PATRICK J. MARTINEZ and K. J. REHDER, Colorado Division of Wildlife, 711 Independent Avenue, Grand Junction, CO 81505; and M. L. SULLIVAN and B. M. JOHNSON, Dept. of Fishery & Wildlife Biology, Colorado State University, Fort Collins, CO 80523

Abstract: Selected population parameters of smallmouth bass *Micropterus dolomuei* in the Yampa and Colorado rivers are compared to document basic life history traits in relation to river discharge and thermal trends. The potential for proliferation of smallmouth bass, their impacts to fish communities, and prospects and strategies for their control in the Yampa, Colorado and Gunnison rivers is discussed. Physical characteristics, mean monthly discharge and temperature, are compared for the Yampa, Colorado and Gunnison rivers from 1996 to 2004. From 1996 to 1999, average mean discharge was accompanied by generally cooler river temperatures. Since 2000, a period of drought in northwest Colorado, lower mean discharge and higher mean temperatures were associated with the expansion of smallmouth bass populations in the Yampa and Colorado rivers. Despite good body condition, particularly among adult bass, recruitment and growth of smallmouth bass in the Yampa River is typically restricted by cool river temperatures, even during recent low flow conditions. Recruitment and growth of juvenile smallmouth bass in the Colorado River is favored by warm river temperatures but it appears that growth and body condition of adult bass declines with increasing size. Diet, by biomass, of smallmouth bass in the Yampa River is dominated by northern crayfish *Orconectes virilis* while the diet of smallmouth bass in the Colorado River is dominated by fish. The availability of abundant crayfish appears responsible for the high body condition of adult smallmouth bass in the Yampa River in contrast to the comparative scarcity of this food resource and declining body condition of adult smallmouth bass in the Colorado River. The incapacity for a compensatory response by smallmouth bass in the Yampa River to removal due to cool river temperatures suggests that focused removal of adult smallmouth bass should hasten their decline. Years with average discharge and cooler water temperatures would further reduce recruitment of smallmouth bass in the Yampa River. Due to warmer water temperatures, smallmouth bass in the Colorado River have the capacity for a moderate compensatory response to removal suggesting that in addition to control of adult smallmouth bass, focused effort targeting reductions of age 0 and juvenile smallmouth bass, including those coming from off-stem sources, is warranted. Additional suggestions to optimize and evaluate smallmouth bass removal efforts are offered.

3. Sources of non-native centrarchids in the Grand Valley reach of the Colorado River: insights from otolith microchemistry and stable isotope analysis.

Authors: GREGORY W. WHITLEDGE and BRETT M. JOHNSON, Department of Fishery & Wildlife Biology, 1474 Campus Delivery, Colorado State University, Fort Collins, CO 80523-1474; and PATRICK J. MARTINEZ and ANITA M. MARTINEZ, Colorado Division of Wildlife, 711 Independent Avenue, Grand Junction, CO 81505

Abstract: Non-native centrarchids in the Upper Colorado River are impeding recovery of native threatened and endangered fishes through predation and competition. Identification of centrarchid sources to critical riverine habitats is essential if centrarchid control efforts are to proceed in an ecologically and economically efficient manner. Currently, the extent to which centrarchid populations in riverine habitats are derived from escapement from off-channel floodplain ponds or in-stream reproduction is unknown. We are employing stable isotope and microchemical analyses of water and fish otolith samples to determine origins (off-channel ponds vs. riverine habitats) of centrarchids collected in the Grand Valley reach of the Colorado River and its backwaters. Results of otolith hydrogen isotope analysis to date indicate that about 15% of centrarchids collected are of pond origin; the proportion of pond-origin fish is greater below the Gunnison River confluence than above. Proportions of off-channel pond- versus riverine-origin fish differ with fish size and age, suggesting that relative contributions of pond and riverine habitats to fish populations in the river's main channel and backwaters may vary among years. Additionally, our estimate of the proportion of centrarchids originating from ponds may be conservative if substantial numbers of fish are entering the river from off-channel ponds as larvae; we are assessing new analytical techniques to address this possibility. Analysis of otolith strontium concentration is being used to indicate fish that have resided in high-salinity ponds, washes, and irrigation ditches in the Grand Valley. Otolith analyses are ongoing; final results for this project will be reported at the end of FY 2005. We are also using otolith microchemistry and stable isotope analysis to identify origins of smallmouth bass in the upper Colorado River mainstem and anticipate that these techniques will be useful for addressing questions of non-native fish sources to other locations in the Colorado River basin.

4. An overview of channel catfish removal efforts in the San Juan River: 1996-2004.

Authors: DALE RYDEN - U.S. Fish and Wildlife Service, Grand Junction, CO; JASON DAVIS - U.S. Fish and Wildlife Service, Albuquerque, NM; JULIE JACKSON – Utah Division of Wildlife Resources, Moab, UT

Abstract: Channel catfish have negatively impacted the San Juan River's endangered and other native fishes through aggression, predation, competition, and posing a choking hazard when they are ingested by Colorado pikeminnow. To alleviate these negative effects, opportunistic removal of channel catfish collected during fish community monitoring studies began in 1996. However, it was not until 2001, that multiple-pass mechanical removal (electrofishing) efforts were initiated. Since 2001, mechanical removal studies have removed over 42,000 channel catfish from the San Juan River (over 9,000 of which have been stocked back into area lakes for angling). Supporting removal efforts during three other studies have removed over 31,000 more channel catfish since 1996. Although CPUE for channel catfish riverwide was roughly the same from 2002-2004 as it was during the period 1996-1998, the mean total length of channel catfish in the San Juan River has declined significantly since 1996, indicating that the population is now heavily dominated by juvenile fish. In addition, the CPUE for adult channel catfish riverwide has dropped significantly over the last four years to the lowest value ever observed. These two facts indicate that mechanical removal efforts have significantly changed the San Juan River channel catfish population's size structure and lessened the reproductive potential of those catfish that remain in the river. Several factors make mechanical removal of channel catfish in the San Juan River more effective than similar efforts would likely be in the other UCRB rivers. These include a relatively narrow and shallow channel, a comparatively steep river gradient, which precludes the formation of off-channel habitats such as flooded bottomlands, and fish passage barriers at either end of the San Juan River which preclude upstream movements by channel catfish.

5. Evaluation of nonnative fish escapement from Starvation Reservoir, Utah.

Author: R. BRUNSON – Utah Division of Wildlife Resources

Abstract: The Recovery Program has determined that control of nonnative fishes is necessary for recovery of the endangered fishes. Chronic escapement of nonnative fishes from reservoirs or other impoundments and dispersal in to riverine habitats occupied by the endangered fishes where they potentially pose as significant predatory or competitive threat has been identified as a problem. Control of escapement through screening or other types of fish barriers is costly, and the need for such nonnative fish control measures needs to be evaluated on a case-by-case basis. Starvation Reservoir in northeastern Utah was identified for such an evaluation beginning in 2002. Starvation located in northeastern Utah in the Duchesne River drainage is a 3,310 surface acre reservoir impounding water from the Strawberry River and Duchesne River, which is diverted into the reservoir through the Knight Diversion. Initial filling of Starvation Reservoir began in 1969 and is used primarily for irrigation. The Utah Division of Wildlife Resources manages the reservoir as a walleye, smallmouth bass and brown trout fishery. Escapement rates of sportfish from Starvation Reservoir are evaluated by draining the stilling basins of the spillway and outlet by pumping. An overview of the project and of work done to date will be presented.

6. Investigation of nonnative fish escapement from Elkhead Reservoir.

Authors: WILLIAM J. MILLER, DAVID E. REES, and JONATHAN A. PTACEK, Miller Ecological Consultants, Inc, 1113 Stoney Hill Dr., Suite A, Fort Collins, Colorado 80502.

Abstract: An escapement study was conducted during 2003 and 2004 during periods of high spill rates associated with snowmelt runoff at Elkhead Reservoir near Craig, Colorado. Nets were placed and monitored at strategic locations on the spillway and outlet structure. Fish escapement was confirmed at all locations, but was greatest during periods of high discharge at the spillway. Relative abundance data indicated that bluegill and black crappie are the species that escape with the greatest frequency. A diel pattern of escapement was also observed.

The recommended screening for the reservoir to minimize escapement includes installation of screens on all controlled outlets of the enlarged reservoir. To the extent practicable, the controlled outlets should be used to the maximum release capacity during runoff when flows are released over the spillway. This operational adjustment should shorten the magnitude and duration of flows exiting the reservoir by way of the spillway.

This screening option recognizes that there could be some escapement during highest flows. The species that are of most concern are northern pike and smallmouth bass. Based on the data collected in 2003 and 2004, the majority of the species escaping during the highest flows are small bluegill and small black crappie. These species do not survive well in riverine conditions; however, they have been captured in slackwater habitats downstream from Elkhead Reservoir.

7. Commercial Harvest of Carp in Utah Lake to Benefit Endangered June Sucker.

Authors: R.A. VALDEZ, J.W. SIGLER, L. CURRY.

Abstract: none provided.

8. Population Estimates for Colorado Pikeminnow and Humpback Chub, "Where Do We Go Now?"

Purpose: To convene a panel of the Population Estimates Ad Hoc Committee for presentation and discussion of Colorado pikeminnow and humpback chub abundance estimates.

Objectives:

- To summarize the Ad Hoc Committee's Summary Report on Population Estimates from the 2004 Population Estimates Workshop II,
- To provide researchers with the opportunity to evaluate and discuss population estimates, and
- To identify the direction of research and future population estimates.

Forum:

- 15 Minutes: Moderator will open with a 15-minute summary of the Ad Hoc Committee's Summary Report on Population Estimates of Colorado Pikeminnow and Humpback Chub.
- 1 Hour: Moderator , Panel, Recovery Program Office will develop a list of questions/issues to be presented by the Moderator for response by the Panel.
- 35 Minutes: Moderator will open questions/discussion by the audience.
- 10 Minutes: Wrap-up by Moderator.

Panel Members:

- Rich Valdez – Moderator
- Kevin Bestgen, Tom Nesler, Kevin Christopherson, Ron Ryel

9. Changes to the Upper Yampa River fish community during five years of drought.

Author: RICHARD ANDERSON, Colorado Division of Wildlife, Grand Junction

Abstract: Mark and recapture fish sampling was done on the Yampa River from 1998 to 2004. A drought period began in 2000 with very low flows occurring in 2002 and relatively low base flows in 2001, 2003 and 2004. Predicted impacts to prolonged exposure of low base flows include reduced habitat availability and habitat diversity and warmer water temperatures. These changes to the physical environment could be expressed in the fish community by reduced biomass and species diversity and altered biological interactions. Drastic changes to the fish community were observed in 2003 and 2004. Smallmouth bass greatly increased in species composition at all sites. Total fish and native fish biomass was reduced at all sites. Bluehead sucker, speckled dace and mottled sculpin were very rare in 2003/4, but were common in 1998 and 1999. Warm water temperatures in 2002 and 2003 appeared responsible for improved recruitment of young smallmouth bass and channel catfish.

10. Native Fish Habitat Restoration in Selected Tributaries of the Grand Canyon: A Potential Recovery Effort for Native Fishes.

Authors: KARA HILWIG, BILL LEIBFRIED, and MATT LAURETTA; SWCA Environmental Consultants Inc., Flagstaff, AZ.

Abstract: Grand Canyon National Park has initiated a project to restore native fish habitat in tributaries of the Colorado River within the Park's boundaries. The ultimate goal of this effort is to reduce non-native fish populations from selected streams to restore the habitats and enhance native fish populations. Native fishes that would benefit from this project include humpback chub, flannelmouth and bluehead suckers and speckled dace. In 2004 two field efforts were conducted to sample fish populations in Shinumo, Tapeats, and Kanab Creeks to determine which streams would be the most feasible for non-native fish removal efforts and native fish restoration. Population estimates and non-native fish removal data from these efforts was analyzed and Shinumo and Kanab Creeks were selected for further study. Our results indicate that

non-native salmonids and non-native cyprinids can be effectively removed from Shinumo and Kanab Creeks. Two additional field efforts are planned for 2005 and the potential for repatriation of humpback chub into Shinumo Creek is under consideration by federal agencies.

11. Westwater Canyon Humpback Chub Population Estimates.

Author: JULIE JACKSON, Utah Division of Wildlife Resources, Moab

Abstract: One of the most robust populations of the federally endangered humpback chub (*Gila cypha*) is located in Westwater Canyon on the Colorado River. This population has been monitored annually since 1988 through trends in catch rates. Revision of recovery goals in 2002 for humpback chub required that a mark-recapture adult population estimate be completed in three of every five years. The first round of population estimates for humpback chub in Westwater Canyon was conducted from 1998 to 2000. Results from 1998 to 2000 indicated a decreasing but statistically non-significant trend. Analysis of catch per unit effort (CPUE) data from this project and historic interagency standardized monitoring indicated an ongoing declining trend in mean CPUE for humpback chub that was significant. In addition to the humpback chub population estimates, roundtail chub (*Gila robusta*) populations also continue to be monitored and estimates for this species is conducted as well. The 1998 to 2000 estimates indicated that the roundtail population was stable. Historical catch rates for roundtail chub indicated a slightly declining trend, but were not statistically significant. The second round of population estimate sampling for humpback chub in Westwater Canyon began in 2003. Results from the 2003 and 2004 sampling seasons for both species will be presented.

12. Closed Population Estimates of Humpback Chub (*Gila cypha*) in the Little Colorado River, Grand Canyon, AZ.

Authors: MARK BROUDER and DAVID R. VAN HAVERBEKE, USFWS, Arizona Fishery Resources Office, 323 N. Leroux, Suite 401, Flagstaff, AZ 86001, 928-226-1289, mark_brouder@fws.gov

Abstract: From 2000 to 2004, a series of two-pass, closed mark-recapture efforts were conducted in the Little Colorado River to determine the abundance of humpback chub (*Gila cypha*). Since 2001, the annual spring abundance estimates of humpback chub ≥ 150 mm TL have ranged from 2,082 (SE = 242) to 3,419 (SE = 480). Spring spawning abundance estimates for humpback chub ≥ 200 (age-4+ adults) have ranged from 1,421 (SE = 209) to 2,002 (SE = 463). A comparison of these numbers with closed mark-recapture studies performed in the early 1990s indicates that there has been a decline in the spring spawning abundance of humpback chub since the early 1990s. This trend has been independently confirmed by open population model assessments. Since 2000, the annual fall abundance estimates for humpback chub ≥ 150 mm have ranged from 1,064 (SE = 33) to 2,774 (SE = 209). These efforts suggest that the annual fall abundances of humpback chub ≥ 150 mm have remained relatively stable since mark-recapture efforts conducted in the early 1990s. Annual fall abundance estimates for humpback chub ≥ 200 mm since 2000 have ranged from 483 (SE = 48) to 973 (SE = 204). Taken together, the data suggest that the observed declines in humpback chub abundance since the early 1990s may be largely in the portion of the population that migrates between the mainstem Colorado River and the Little Colorado River for spawning activities. Abundance estimates for 2004 are provisional until approval by Grand Canyon Monitoring and Research Center.

13. Growth rates for humpback chub (*Gila cypha*) above Chute Falls, Little Colorado River.

Authors: PAMELA J. SPONHOLTZ and DENNIS STONE, U.S. Fish and Wildlife Service, 323 N. Leroux, Suite 401, Flagstaff, AZ 86001

Abstract: A conservation measure to relocate small humpback chubs (HBC) to upstream areas of the Little Colorado River (LCR) was identified in the December 2002 Biological Opinion on the proposed experimental releases from Glen Canyon Dam and removal of nonnative fish. It was hoped that this translocation effort will increase HBC recruitment to adulthood by allowing them an opportunity to exploit the abundant food resources, warmer water temperatures, and reduced competition/predation by fewer large-bodied fishes associated with this area. Since July 2003, the U.S. Fish and Wildlife Service has translocated 582 small (between 50-100mm) HBC above Chute Falls in the Little Colorado River. Monitoring efforts for HBC translocated in 2003 indicated significant ($T=8.28$, $p<0.05$) growth occurred between the October 2003 and April 2004 monitoring periods. HBC captured in April 2004 had grown 30% larger over the winter (mean size increase = 43.1mm, range 18-83mm) and corresponded to an average of 7.2mm of growth per month. However, growth of fish translocated in 2004, although significant ($T=9.5$, $p<0.05$) during the monitoring period, was 50% less when compared to growth rates of fish translocated in 2003. Slower growth rates of fish from this second translocation could be associated with colder water temperatures or discharge related effects in the LCR. Despite the slower growth rates of fish from the 2004 translocation, survival above Chute Falls is possible and may contribute to a demographic expansion of the species range.

14. Northern Pike Removal Efforts in the Upper Yampa River, 2004.

Authors: SAM FINNEY and BRUCE HAINES (retired), USFWS, Vernal, UT

Abstract: Northern pike are a large aggressive, esocid native in many North American drainages, and that has become well established in the Yampa River, Colorado. In spring of 2004, pike were collected in a 38-mile stretch of the upper Yampa River near Craig, Colorado using a combination of fyke nets and electrofishing. Pike were tagged and released on the first sampling occasion and removed from the river on the next five. One hundred and thirty northern pike were collected in fyke nets, 1,110 by electrofishing. Of the estimated 1883 northern pike in the 38-mile stretch of the Yampa River that was sampled, 1132 were removed. Localized areas of high pike catchability were identified, as were areas of larger average sized pike. We were more effective at removing large pike than small pike. Northern pike in the removal area exhibited a general downstream movement in the spring. Recommendations for the 2005 work included ending the fyke netting effort, focusing on concentration areas, increasing effort, and developing a more rigorous analysis protocol.

15. Smallmouth Bass Control in the Yampa, Whirlpool and Split Mountain Canyons.

Author: MARK H. FULLER, U.S. Fish and Wildlife Service, Vernal, Utah Colorado River Fisheries Project

Abstract: Though nonnative channel catfish *Ictalurus punctatus* were recognized as the principal predator and competitor affecting humpback chub *Gila cypha* populations in the lower Yampa River, a highly prolific and migratory population of smallmouth bass *Micropterus dolomieu* may raise the bar of demise in the Green and Yampa rivers. Anderson (2002) and Fuller (2003) reported that smallmouth bass in the Yampa and Green Rivers have been increasing since 2001. It is thought that an increase in smallmouth bass abundance will severely worsen the adverse effects that nonnative fishes already have on the lower Yampa's distressed native fauna. Concern for susceptible humpback chub and Colorado pikeminnow *Ptychocheilus lucius* to smallmouth bass predation mounted at Upper Colorado River Endangered Fishes Recovery Program's (RIP's) nonnative fish control workshops in 2003 and 2004 when smallmouth bass were recognized to pose the greatest threat to endangered and native fishes in the Green River drainage. The primary focus of this presentation is to report first year results of smallmouth control in Yampa

Canyon and downstream of it's confluence in the Green River through Whirlpool and Split Mountain Canyons.

16. Smallmouth Bass Control in the Middle Green River.

Author: Ben Williams, Utah Division of Wildlife Resources

Abstract: The Upper Colorado River Endangered Fish Recovery Program has determined that control of nonnative fish in the upper Colorado River basin is essential to the recovery of the four endangered fish species. Smallmouth bass abundance in the middle Green River has increased in conjunction with recent low flow years. This information resulted in a recommendation from the December 2003 Nonnative Fish Control Workshop (Grand Junction, CO) to attempt control of this species. Four electrofishing passes were made from Split Mountain boat ramp (RM 318) to Sand Wash boat ramp (RM 215) from May 30 to August 26, 2004. 320 bass were captured on the first pass, tagged with flag tags and released. On the subsequent three passes 1915 bass were captured and removed. There were 5 recaptures made on the second pass, 23 on the third and 19 on the last pass. A Lincoln-Peterson abundance estimate was calculated using passes one and two showing a population of 25,091 bass (95% CI 12,362 - 50,689). Recapture numbers were low during the second pass so a second Lincoln-Peterson abundance estimate was calculated using all passes. It shows a population of 12,813 bass (95% CI 9,772 - 17,237). Other fish removed included 9 walleye, 9 northern pike and 13 black crappie. 59 Razorback suckers (51 recaptures) and 79 Colorado pikeminnow (40 recaptures) were also captured.

17. Smallmouth bass control in the middle Green River, Desolation and Gray Canyon, Utah.

Presenter: Patrick Goddard, Utah Division of Wildlife Resources (Author/grunt: Patrick Badame, UDWR)

Abstract: The purpose of this project is to minimize the expansion of smallmouth bass in the Green River. The objectives to meet this goal are 1) Calculate an annual population estimate of smallmouth bass in the middle Green River. 2) Remove smallmouth bass from the middle Green River from Echo Park (RM 344) to Swasey's Rapid (RM 132). This was the first year for this removal evaluation effort.

Four electrofishing passes were completed between Sand wash (RM 216) and Swaseys Rapid (RM 132) between August 16 and October 1, 2004. Sampling was conducted using two boats shocking continuously on each shoreline. Smallmouth bass were found only in the upper 40 miles of Desolation Canyon, marking the lower end of the Green River distribution. During the first pass 178 smallmouth bass were tagged with yellow flag tags and released. Over the three subsequent passes, a total of 937 bass were removed. Lincoln-Peterson population estimates were calculated using the first two passes and using all passes combined. Mean initial estimates ranged from 3,234 (2-pass) to 5,089 (all-passes). Our overall exploitation rate was 29% or 18% of the population respectively. The appropriate method of population estimate calculation is still being discussed, and will effect how we interpret our ability to reduce this species.

18. Mechanical removal of non-native fishes from the Colorado River in Grand Canyon.

Presenter: DAVID WARD, Arizona Game and Fish Department, Flagstaff (Authors: LEW COGGINS and MIKE YARD, Southwest Biological Science Center, Grand Canyon Monitoring and Research Center)

Abstract: In 2003 an experiment to improve recruitment of humpback chub was initiated in Grand Canyon by mechanically removing non-native fish from a large section of the Colorado River. Four pass electrofishing depletions are being conducted on 6 trips per year to evaluate if non-native fish can effectively be removed using electrofishing in a large river system. Estimates of abundance from depletion samples are calculated for non-native fishes at the beginning and end of each sampling trip. Mechanical removal shows a persistent annual reduction in rainbows trout numbers but not in brown trout. Approximately one half of the rainbow trout within the removal area are removed during each 4 pass

depletion, with over 18,000 rainbow trout having been removed to date from the 5 mile area around the confluence of the Little Colorado River. Immigration of rainbow trout into the removal reach is occurring at a rate of about 800 fish per month. CPUE trends for juvenile humpback chub caught in hoopnets within the removal reach do not give a clear indication of whether or not the removal effort is allowing for increasing humpback chub recruitment. The real metric for evaluation of the mechanical removal project and its effect on humpback chub recruitment is stock assessment models based on mark-recapture. Unfortunately the stock assessment models are not likely to detect improvements in HBC recruitment until 2006 or 2007 when fish are large enough to be PIT tagged and be seen by the model.

19. Factors responsible for increased stocking success of Colorado pikeminnow in the San Juan River: stocking protocols or habitat changes?

Authors: M.E. GOLDEN, P.B. HOLDEN, and S.K. DAHLE - BIO-WEST, Inc.; A.L. KINGSBURY and D.L. PROPST - New Mexico Game and Fish Department; W.H. BRANDENBURG and M.A. FARRINGTON - University of New Mexico; JULIE JACKSON - Utah Division of Wildlife Resources

Abstract: As populations of threatened and imperiled fishes of the southwestern United States continue to decline, the recovery goals for these species become more dependent on successful supplementation of populations with hatchery-reared fish. Unfortunately, while biologists and managers may be able to increase the number of stocked fish, they are frequently unable to enhance the recruitment of these fish to the adult population in the wild. Colorado pikeminnow (*Ptychochelius lucius*) have been stocked throughout their historic range at a variety of sizes. The majority of these stockings have been plagued by poor retention and survival. The San Juan River Basin Recovery Implementation Program (SJRIP) drafted a Colorado Pikeminnow Augmentation Plan (Plan) that calls for stocking 200,000-300,000 young-of-the-year (YOY) Colorado pikeminnow over a period of 8-9 years. The goal of the Plan is to produce a population greater than 800 adult (age 7 +) Colorado pikeminnow in the San Juan River. In October 2002, as the plan began, more than 210,000 YOY Colorado pikeminnow were stocked. Follow-up monitoring indicated retention of the Colorado pikeminnow stocked in 2002 was poor, especially in reaches of the upper San Juan River, an area believed critical to achieving recovery goals.

To increase post-stocking retention and survival for approximately 180,000 YOY Colorado pikeminnow stocked in 2003, the SJRIP authorized and funded changes in stocking protocols, acclimation studies, and a habitat manipulation study. Acclimation studies showed substantial mortality of YOY Colorado pikeminnow within the 36-72 hours following stocking. Despite the apparently high post-stocking mortality, monitoring efforts indicated that the YOY Colorado pikeminnow stocked in 2003 had higher retention and survival than the YOY Colorado pikeminnow stocked in 2002. While some of the increased retention may be attributable to changes in stocking protocols or to the acclimation studies, a difference in the amount of nursery habitat available between the 2 years may have also played a substantial role. Continuing experimentation with different stocking procedures over a number of years may reveal what factors are most important to the retention and survival of hatchery-reared Colorado pikeminnow, which in turn could help us move closer to recovery for this species in the San Juan River.

20. Larval razorback sucker and bonytail survival and growth in the Baeser floodplain, Green River, Utah.

Authors: K. CHRISTOPHERSON, R. BRUNSON, and B. WILLIAMS, Utah Division of Wildlife Resources.

Abstract: Despite successful reproduction by razorback suckers (Xyrauchen texanus) in the middle Green River, recruitment beyond the larval stage has rarely been observed. Bonytail (Gila elegans) are essentially extirpated in the wild and nearly all bonytail present in the Green River are hatchery-stocked fish. Floodplain wetlands may provide important rearing habitat for both species. However, survival of larval razorback has not been observed in floodplains since 1997, even when large numbers of larvae are introduced directly into the floodplains. This is likely due to the large number of nonnative fish predators that invade and then reproduce in these systems. These wetlands periodically dry up and the fish

community is reset resulting in much lower numbers of nonnative fish the year after a reset episode. This study is part of ongoing research to determine if floodplain wetlands can be managed to improve larval razorback sucker and bonytail survival. A threshold of larval fish numbers was observed that suggests larval razorback sucker and bonytail can overcome predation at levels present in reset systems.

21. Downstream dispersal of beads and marked razorback sucker larvae released in the middle Green River, Utah, spring 2004.

Authors: K. BESTGEN, CSU Larval Fish Laboratory, K. CHRISTOPHERSON, and R. BRUNSON, Utah Division of Wildlife Resources.

Abstract: Dispersal rates and patterns of downstream transport of razorback sucker larvae from spawning areas are important to understand the likelihood of entrainment of larvae into the flood plain of the middle Green River. Successful entrainment of larvae into managed flood plain areas inundated by high spring flows are thought crucial to successful production, recruitment, and recovery of razorback suckers. A pilot study was undertaken in spring 2004 with a goal of furthering understanding of dispersal of larvae from spawning areas. On May 26, about 69,688 hatchery-reared razorback sucker larvae (8 to 11 mm total length) marked with tetracycline antibiotics, and about 1,517,748 near-neutrally buoyant gelatinous beads, were simultaneously released across the Green River channel at the Escalante razorback sucker spawning bar. Drift samples were collected 1.6 and 8 km downstream of the release point on each side of the river for about four hours to detect downstream transport rates and spatial distribution of beads and larvae. A total of 4,506 beads (0.30% of those released) and 253 marked larvae (0.36%) were captured in samples collected at both upstream and downstream sites. About 0.14% of river flow was sampled with drift nets during the period (about 0.10% in right bank samples). Most beads (72%) and marked larvae (74%) were captured at the upstream sampling station. The first large pulse of beads was detected at the most upstream sampling site about 62 minutes after release (about 0.48 m/sec transport rate) and the first large pulse of marked larvae was detected within 37 minutes of release (about 0.81 m/sec transport rate); each pulse passed the station relatively quickly. The largest pulse of beads and marked larvae was detected at the most downstream sampling site about 255 minutes after release (about 0.53 m/sec). Beads (99.9%) and marked larvae (99.0%) were captured almost exclusively on the right river bank at both upstream and downstream sampling sites, even though beads and larvae were released across the channel. Based on absence of tetracycline marks in some otoliths, we apparently also captured a large number of unmarked, and presumed wild, razorback sucker larvae (N = 232) during sampling. We feel confident in the determination of unmarked larvae as wild because tetracycline marks were easily detected in laboratory-reared larvae 100% of the time, there was no ambiguity in mark determination from sampled fish, and unmarked fish had otoliths that differed in appearance and were smaller than otoliths of marked larvae. That number of wild larvae, taken in just a few hours of sampling, exceeds that typically taken in an entire season of sampling low-velocity areas with light traps. More wild larvae were collected in downstream (81%) than upstream samples and were distributed more evenly across the river channel than marked larvae, with 61% collected on the left bank and 39% on the right bank. Implications of these findings for additional entrainment and monitoring studies are discussed.

22. Survival and growth of stocked razorback sucker and bonytail larvae in multiple floodplain wetlands in the middle Green River under reset conditions.

Authors: Tim Modde and Bruce Haines, Vernal Colorado River Fish Project, USFWS, Vernal, Utah

Abstract: Over a two year period the concept of initializing floodplain wetlands to remove residual nonnative fishes was tested in the middle Green River to determine if larval razorback sucker and bonytail could grow and survive in newly flooded floodplains. Six different floodplains were examined over the two year period, with three examined during both years. Little survival was observed in the small two floodplains during the first year of the study, but survival ranging between 0.1%-0.7% and 0% to 13.6% for razorback sucker and bonytail, respectively, was observed in the larger floodplains on the Ouray National Wildlife Refuge. Age-0 growth rates ranged between 0.4 - 0.8 mm/d for razorback sucker and 0.4 - 0.7

mm/d for bonytail. Given the small sample size, it was difficult to correlate environmental factors with survival of razorback sucker and bonytail. No correlation of age-0 razorback sucker survival was observed with nonnative biomass (within the range observed) or submerged aquatic vegetation. Conversely, survival of bonytail may be related to nonnative fish biomass and submerged vegetation. The differing relationship may be the result of growth patterns observed among potential age-0 predators in floodplains. While razorback sucker do not appear to be vulnerable to predation by any of the potential age-0 predators in floodplains, a portion of age-0 bonytail are vulnerable to predation to young-of-the-year predators.

23. Overview of research and monitoring activities for razorback sucker and bonytail chub along the lower Colorado River.

Author: TOM BURKE, USBR – DOI, PO BOX 61470, Boulder City, NV 89006-1470, (702) 293-8711

Abstract: The Lower Colorado River Native Fish Work Group was formed in June 2004 as an information forum and clearing house for research and monitoring actions on native fishes along the lower Colorado River downstream of Grand Canyon. At its inaugural meeting in Laughlin, NV, more than a dozen separate, ongoing, actions involving razorback sucker and/or bonytail were identified and discussed. An overview of these monitoring, rearing and research actions are surveyed herein and contact information is provided to further collaboration and information sharing.

24. Managing Peak Flows in the Middle Green River to Benefit Native Fishes: Consideration of Floodplain Inundation Thresholds.

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Abstract: Information in the recent *Green River Subbasin Floodplain Management Plan* indicates that flows of about 396 m^3/s (14,000 cfs) would maintain connectivity with an area of priority floodplain depression habitat that is equivalent to that provided by 527 m^3/s (18,600 cfs), the lowest connecting flow identified in the existing flow recommendations for the Green River downstream of Flaming Gorge Dam. We used this current information about floodplain habitats to identify a peak flow management strategy that (1) is consistent with the objectives identified in the existing flow recommendations, (2) that may provide additional benefits to endangered fishes that utilize floodplain habitats, and (3) that would reduce the need for bypass and spillway use at Flaming Gorge Dam. The proposed management strategy would provide the same instantaneous peaks as the existing flow recommendations, but would lower the minimum targets for floodplain connecting flows from 527 m^3/s (18,600 cfs) to approximately 396 m^3/s (14,000 cfs). The lower connecting flow would inundate the same amount of priority depression floodplain habitat (approximately 1,027 ha) as would be inundated by the higher connecting flow, but would allow the duration of connections between priority depression floodplains to be extended by approximately 1 to 3 weeks. We believe that extending the duration of connecting flows may benefit endangered fishes by improving opportunities for entrainment of native fish larvae, especially razorback sucker.