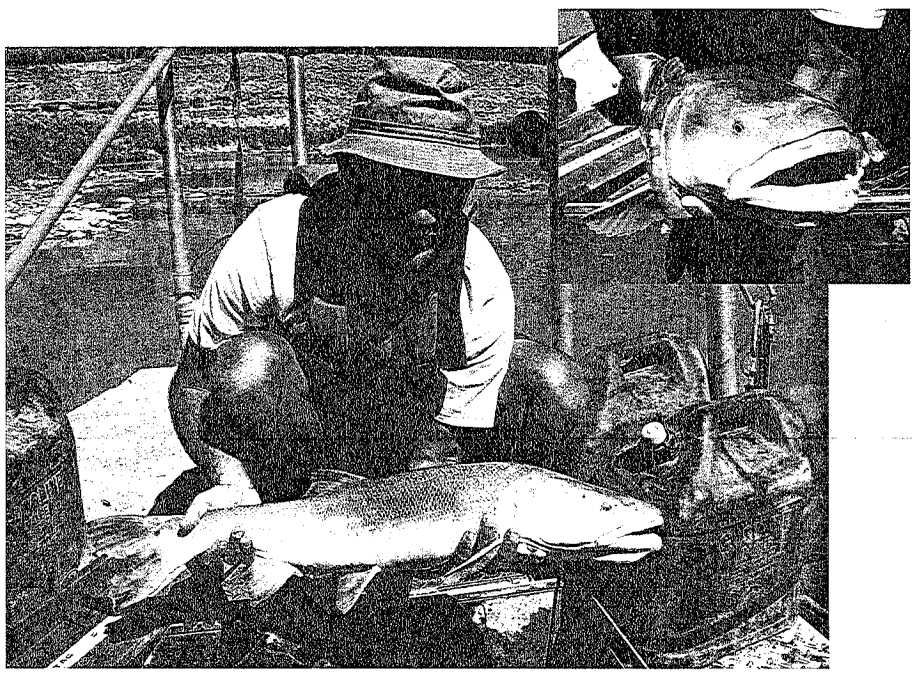
2006 Recovery Implementation Program

CZAPLA 9689

RECOVERY IMPLEMENTATION PROGRAM FOR ENDANGERED FISH SPECIES IN THE UPPER COLORADO AND SAN JUAN RIVER BASINS

27TH ANNUAL RECOVERY PROGRAM RESEARCHERS MEETING

PROGRAM



JANUARY 18-19, 2006

MOAB VALLEY INN
MOAB, UTAH

RECOVERY IMPLEMENTATION PROGRAM
FOR ENDANGERED FISH SPECIES
IN THE UPPER COLORADO AND SAN JUAN RIVER BASINS

27TH ANNUAL RECOVERY PROGRAM RESEARCHERS MEETING

January 18-19, 2006

Moab Valley Inn
Moab, Utah

SCHEDULE

Poster Presentations (posters will remain on display throughout the entire meeting)

A guide and computer interactive keys to native cypriniform fish larvae in the Gila River Basin, several species of which are also found in the Upper Colorado Basin.
Darrel E. Snyder, Colorado State University

Benefits and Risks Assessment for Fish with a Temperature Control Device
Richard A. Valdez, Ph.D.

Wednesday, January 18, 2006

8:00-9:00	Registration
9:00-9:10	Introduction and Welcome Patrick Goddard, Utah Division of Wildlife Dave Speas, U.S Bureau of Reclamation
9:10-9:25	Program overview – Instream Flow Management George Smith, U.S. Fish and Wildlife Service, Denver
9:25-9:40	Program overview – Non-native Fish Control & Habitat Restoration Pat Nelson, U.S. Fish and Wildlife Service, Denver
9:40-9:55	Program overview – Fish Propagation & Research/Monitoring Tom Czapla, U.S. Fish and Wildlife Service, Denver
9:55-10:10	Program overview – San Juan Recovery Implementation Program Chuck McAda, U.S. Fish and Wildlife Service, Grand Junction
10:10-10:35	1. Population dynamics of adult Lost River suckers and shortnose suckers in Upper Klamath Lake and its tributaries, Oregon Eric Janney, U. S. Geological Survey

IRVING

10:35-10:55 Break (refreshments provided)

All presenters will receive 20 minutes with 5 minute reserved for questions.

✓ 10:55-11:15 2. The use of remote 125 kHz and 134 kHz PIT tag detection stations to increase recapture probability of Lost River suckers and shortnose suckers in Upper Klamath Lake, Oregon
Brian Hayes and Eric Janney, U.S. Geological Survey

Propagation and Genetics Management

✓ 11:15-11:35 3. Analysis of a preliminary microsatellite dataset for wild and captive populations of humpback chub, *Gila cypha.*
Allan Strand, College of Charleston

General Management

11:35-11:55 4. Lower Colorado River Multi-Species Conservation Program: Overview of fishery projects for 2006
Tom Burke, U.S. Bureau of Reclamation

11:55-1:30 Lunch (on your own)

1:30-1:50 5. Atlas Uranium Mill Tailings Site: Historical Review and Status
Tom Chart, U.S. Fish and Wildlife Service

1:50-2:10 6. Designating Conservation Areas to Prioritize, Publicize, Popularize and Optimize Native Fish Protection and Preservation in Colorado
Patrick Martinez, Colorado Division of Wildlife, Grand Junction

2:10-2:30 7. Influence of human-made instream structures on the management and conservation of three native Colorado River Basin fishes in the Muddy Creek watershed, Wyoming
Bobby Compton, University of Wyoming

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Population Estimates

2:30-2:50 8. Closed Population Estimates of the Humpback Chub (*Gila cypha*) in the Little Colorado River, Grand Canyon, Arizona
Randy Van Haverbeke, U.S. Fish and Wildlife Resources

2:50-3:10 9. Status of native fishes in the Grand Canyon, 2005
Matthew Andersen, Grand Canyon Research and Monitoring Center

3:10-3:30 **Break (refreshments provided)**

3:30-3:50 10. Humpback and Roundtail Chub Population Estimates in Westwater Canyon
Julie Jackson, Utah Division of Wildlife Resources

Nonnative Fish Control

3:50-4:10 11. Evaluation of nonnative fish escapement from Starvation Reservoir
Trina Hedrick, Utah Division of Wildlife Resources

4:10-4:30 12. 2005 Middle Yampa River Northern Pike (*Esox lucius*) Removal and Evaluation
Lori Martin, Colorado Division of Wildlife

4:30-4:50 13. A Preliminary Examination of Crayfish in the Yampa River in Northwestern Colorado
Patrick Martinez, Colorado Division of Wildlife

4:50-5:00 Annual Researcher's Award
Kevin Bestgen, Colorado State University

5:00 **Adjourn**

5:00-6:00 Workshop & Discussion (standardized fish handling techniques)
6:00-? Social (beverages and yummy food served)

Thursday, January 19, 2006

All presenters will receive 20 minutes with 5 minutes reserved for questions.

Nonnative Fish Control Continued

9:00-9:20 How effective are we at reducing smallmouth bass populations in the middle Yampa River?
Abstract available as a separate handout
John Hawkins, Larval Fish Lab, CSU

9:20-9:40 14. Investigations of roundtail chub populations in the presence of nonnative predators in the Yampa River, 2005
Cameron Walford, Larval Fish Lab, CSU

C2APLA

Research, Monitoring, and Data Management

✓ 9:40-10:00 15. Success and failures of trying to actively increase the initial retention of stocked Colorado Pikeminnow in the San Juan River over the past three years.
Mike Golden, BIO-WEST

✓ 10:00-10:20 16. Lake Mead razorback sucker populations along with future attempts to develop new small populations of razorback sucker in Lake Mead and how that may have application basin-wide.
Brandon Albrecht, BIO-WEST

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

10:40-11:00 17. Larval Razorback Sucker drift and floodplain entrainment studies in the Green River, Utah
Kevin Christopherson, Utah Division of Wildlife Resources

cancelled 11:00-11:20 18. Retrospective of the Recovery Program, River Temperature Monitoring
George Smith, U.S. Fish and Wildlife Service

11:20-11:40 19. Response of the Green River fish community to Flaming Gorge Dam flow and temperature regimes, 2002 to 2004
Kevin R. Bestgen, Colorado State University

11:40-12:00 20. Estimating sources of northern pike (*Esox lucius*) recruitment in the Yampa River using otolith microchemistry
Dana Winkelman and Ryan Fitzpatrick, Colorado State University

12:00-1:30 Lunch (on your own)

1:30-1:50 21. Cibola High Levee Pond and Beyond: A Native Fish Sanctuary Initiative
Gordon Mueller, U.S. Geological Survey

1:50-2:10 22. Potential small-bodied predators of larval razorback sucker
Jeanette Carpenter, U.S. Geological Survey

2:10-2:30 23. Comments on strategic approaches to floodplain management for endangered fishes in the Green River subbasin
Tim Modde, U.S. Fish and Wildlife Service

2:30 Adjourn

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ABSTRACTS

1. Population dynamics of adult Lost River suckers and shortnose suckers in Upper Klamath Lake and its tributaries, Oregon

Author: ERIC JANNEY, U. S. Geological Survey, Western Fisheries Research Center, Klamath Falls Field Station, 2795 Anderson Ave, Suite 106, Klamath Falls, OR 97603, 541-273-8689; rip_shively @usgs.gov

Abstract: Lost River suckers *Deltistes luxatus* (LRS) and shortnose suckers *Chasmistes brevirostris* (SNS) are both long-lived species endemic to the Upper Klamath Basin of Oregon and California. Both species were listed under the Endangered Species Act in 1988. We analyzed empirical length data, a relative spawning output index, and survival estimates to assess population dynamics and status of adult sucker populations in Upper Klamath Lake, OR. Length data indicate that at the time of listing, both SNS and LRS populations were comprised mostly of old individuals with no evidence of recent recruitment. An influx of smaller individuals recruited into both spawning populations during the mid 1990's. Relative reproductive index values for LRS indicate a precipitous decline (98%) in spawning output between 1995 and 1998. A 95% decrease in spawning output was observed for SNS. These declines coincide with consecutive summer fish kill events resulting from poor water quality conditions that occurred in 1995 - 1997. Using a random effects model, we estimated mean annual survival probability for the years 1995 - 2004 to be 0.83 for LRS and 0.79 for SNS. Survival modeling efforts indicate fish kill events during the summers of 1995 - 1997, and 2003 were very important sources of LRS mortality and survival probability during those years was markedly lower than in years without observed fish kill events. Shortnose sucker survival probabilities also varied tremendously with time and estimates indicate very poor survival from 1996 - 1998.

2. The use of remote 125 KHz and 134 KHz PIT tag detection stations to increase recapture probability of Lost River suckers and shortnose suckers in Upper Klamath Lake, Oregon.

Authors: BRIAN HAYES and ERIC JANNEY
U.S Geological Survey, Western Fisheries Research Center, Klamath Falls Field Station, 2795 Anderson Ave, Klamath Falls, OR 97603. 541-273-8689; Brian_Hayes@usgs.gov

Abstract: The U.S Geological Survey has monitored endangered Lost River (*Deltistis Luxatus*) and shortnose (*Chasmistes brevirostris*) sucker populations in Upper Klamath Lake, Oregon since in 1995. Population parameter estimates from these data are used to monitor population status and recovery efforts. Prior to 2005, sampling required suckers

to be captured in trammel nets at lakeshore spawning areas and in tributaries during spawning migrations. Each captured sucker was physically handled in order to scan for the presence of a passive integrated transponder (PIT) tag. A difficulty in capture-recapture studies is that parameter estimate precision and effective modeling depend not only on the number of animals captured and released, but also on the number surviving and subsequently captured again. Although sampling effort and sample sizes increased substantially beginning in 1999, recapture probability estimates continued to remain below ten percent. Low recapture probabilities have resulted in consistently poor parameter estimate precision. In addition to trammel net capture methods, efforts were made in 2005 to increase recapture probability using remote PIT tag detection stations and a resistance board weir on the main spawning tributary to Upper Klamath Lake. In the first year of operation, the weir and remote PIT tag antennas dramatically increased detection probabilities of previously tagged fish. In 2005, 5799 individual PIT tags were detected with remote antennas at the weir, compared to approximately 1000 tags detected in 2004 using past capture, handle and release methods.

3. Analysis of a preliminary microsatellite dataset for wild and captive populations of humpback chub, *Gila cypha.*

Authors: ALLAN STRAND, College of Charleston, Grice Marine Laboratory, 205 Ft. Johnson Rd Charleston, SC 29412, stranda@cofc.edu; CONNIE KEELER-FOSTER, USFWS, Dexter National Fish Hatchery and Technology Center, Dexter, NM 88230, Connie_KeelerFoster@fws.gov

Abstract: In this study, we compared a captive stock and three wild-sampled populations of humpback chub using microsatellites, a neutral genetic marker. Our primary objective was to examine the captive population as a potential broodstock. Secondarily, we intend to develop a comprehensive strategy to develop the captive stock as a refugial population genetically synonymous with the Little Colorado River (LCR) population.

First we estimated the power of the wild samples to capture the genetic diversity present in nature. We used a binomial approximation and assumed panmixia for this simple analysis. The results suggest that two of the three wild-caught samples are large enough to ensure a 95% chance of detecting an allele segregating at a frequency greater than 0.10. We then used a suite of six primers developed initially for Bonytail (*Gila elegans*) to genotype the captive and wild-caught samples. Wild caught populations did not have significantly greater levels of genetic diversity than the captive population as measured by Nei's index of gene diversity. Furthermore, the captive population appears to possess the same alleles at similar frequencies: there is no evidence for genotypic differentiation among any of the populations assayed, wild-caught or otherwise. Based upon this preliminary dataset, it appears that the captive population housed at Willow Beach represents a valuable genetic resource for recovery efforts.

4. Lower Colorado River Multi-Species Conservation Program: Overview of fishery projects for 2006

Author: TOM BURKE. Bureau of Reclamation, Lower Colorado Region, Boulder City, NV 89006-1470

Abstract: The LCR-MSCP is a coordinated, comprehensive, long-term multi-agency effort to conserve and recover endangered species, and protect and maintain wildlife habitat on the lower Colorado River. The program area extends from the full pool elevation of Lake Mead downstream to the southerly boundary with Mexico. Developed between 1996 and 2005, the 50 year program will develop and implement conservation actions for four native fishes: razorback sucker, bonytail chub, flannelmouth sucker and humpback chub.

The record of decision was signed in April 2005, and 2006 is the first full year of implementation. This report provides an overview of the 16 individual fishery project work plans to be accomplished during 2006.

5. Remediation of the Atlas Uranium Mill Tailings Site, Moab, Utah: Historical Review and Status

Author: TOM CHART, USFWS – Salt Lake City, Utah Field Office

Abstract: September 15, 2005, Department of Energy released their National Environmental Policy Act (NEPA) Record of Decision, which indicated their intent to transport / dispose of 12 million tons of contaminated surface materials from the Atlas Uranium Mill Tailings Site (Moab Site) along the banks of the Colorado River near Moab, Utah to a location near Crescent Junction, Utah. In addition, DOE committed to remediate groundwater contamination until discharge at the site reached protective levels (estimated timeframe = 75 yrs). Milling operations at the Moab Site began in 1956. The milling operation itself and subsequent responsibility for site cleanup has shifted hands several times throughout the past half-century. The USFWS has been involved with remediation at the Moab site, from an Endangered Species Act perspective, since 1979. The USFWS provides a historical review of operations and environmental issues at the Moab Site, all of which leads up to DOE's recent decision.

***6.* Designating Conservation Areas to Prioritize, Publicize, Popularize and Optimize Native Fish Protection and Preservation in Colorado**

Author: PATRICK J. MARTINEZ, Colorado Division of Wildlife, 711 Independent Avenue, Grand Junction, CO 81505, Phone 970-255-6141, FAX. 970-255-6111, E-mail. pat.martinez@state.co.us

Abstract: The public has been made aware of endangered fish recovery efforts via the extensive information and education efforts of participating agencies. However, the need to secure recovery of endangered fish within functioning native fish communities remains obscure. A strategy is proposed to create a refuge/sanctuary in concept and reality to

ensure the long-term perpetuation of native fish communities and their habitat. A challenging component of endangered fish recovery in the Upper Colorado River Basin is nonnative fish control, particularly the removal of popular nonsalmonid sport fishes from rivers. This contentious activity, necessary to reduce competition with, and predation on, endangered and native fish, remains unpopular with many anglers and may be a basis to deny access to private land for any native fish management. Further, identifying a "socially" acceptable balance that retains satisfying sport fishing for some nonsalmonid piscivores, while biologically optimizing riverine native fish communities, is increasingly unrealistic. Given this and other conflicts, it is recommended that waters dedicated to nonsalmonid native fish conservation be established to expedite the recovery of endangered fish and to safeguard the native fish community on which they depend to prevent future listings of additional species. The Yampa River, a key tributary for endangered fish recovery and a former stronghold of native fishes, is offered as the initial candidate to have its lower reaches designated as a "Nonsalmonid Native Fish Conservation Water." Administrative guidance, an agency framework and analogous designations are discussed to facilitate and formalize this designation. Components of the designation would include publicizing the priority of native fish management, informing anglers of possibly reduced angling success, and increasing protection of native fish, including stiffer penalties for their harm. Furthermore, funding easements to guarantee access to private property for native and nonnative fish research and management, and establishing partnerships and providing incentives to protect riparian and riverine habitats are seen as ways to help popularize native fish preservation among private landowners and conservationists. The success of such designation in perpetuating ecologically sound native fish communities relies on the aggressive enforcement and implementation of regulations, policies or strategies to protect riverine habitat and control nonnative fish.

7. Influence of human-made instream structures on the management and conservation of three native Colorado River Basin fishes in the Muddy Creek watershed, Wyoming.

Authors: ROBERT I COMPTON (Presenter), Wyoming Cooperative Fish and Wildlife Research Unit, Biological Sciences Building, Dept. 3166, 1000 E. University Avenue, Laramie, WY, 82071, 307-766-7322 (W), 037-766-5400 (F), bcompton@uwyo.edu; DR. WAYNE HUBERT, Wyoming Cooperative Fish and Wildlife Research Unit, Biological Sciences Building, Dept. 3166, 1000 E. University Avenue, Laramie, WY, 82071, 307-766-5415, whubert@uwyo.edu; DR. FRANK RAHEL, University of Wyoming, Biological Sciences Building, Room 407, Dept. 3166, 1000 E. University Avenue, Laramie, WY, 82071, 307-766-4212, frahel@uwyo.edu; DR. MIKE QUIST, Iowa State University, NREM, 339 Science II, Ames, IA, 50011, 515-294-9682, mcquist@iastate.edu; MIKE BOWER, USDI Bureau of Land Management, Rawlins Field Office, P.O. Box 2407, Rawlins, WY, 82301, 307-328-4272, Micheal_Bower@blm.gov

Abstract: Bluehead sucker *Catostomus discobolus*, flannelmouth sucker *Catostomus latipinnis*, and roundtail chub *Gila robusta* dominate the upper portion of Muddy Creek,

a tributary to the Little Snake River in south-central Wyoming. Our goal was to examine the effects of human-made instream structures on movements of the three species in the system. Fish were captured and implanted with passive integrated transponder (PIT) tags in three segments of Muddy Creek formed by human-made structures during fall 2004. Movements over structures between April and August 2005 were evaluated using fixed locality monitoring stations that recorded tagged fish upon passage. Reaches throughout the study area were sampled in July and August 2005 by electrofishing. Monitoring stations detected movements of 393 fish through the stations and sampling by electrofishing recovered 200 fish. Bluehead suckers appeared to be the most mobile species. Fish moved downstream, but not upstream, at two instream structures, and both upstream and downstream at a third structure. Probable bluehead sucker and flannelmouth sucker spawning runs up an ephemeral tributary of Muddy Creek were identified in one segment. PIT-tag technology was useful in detecting fish movements, all three native fish species were mobile, human-made structures formed barriers to upstream movements, and source/sink dynamics may be occurring among segments of Muddy Creek formed by human-made structures.

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

Author: DAVID R. VAN HAVERBEKE, U.S. Fish and Wildlife Service, 323 N. Leroux, Suite 401, Flagstaff, AZ 86001

Abstract: From 2000 to 2005, a series of two-pass, closed mark-recapture efforts were conducted in the Little Colorado River (LCR) 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 in the LCR 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 in the LCR 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 897 (SE = 105). Taken together, the data suggest that the observed declines in humpback chub abundance in the LCR since the early 1990s may be largely in the portion of the population that migrates between the mainstem Colorado River and the LCR for spawning activities. Abundance estimates for 2005 are provisional until approval by Grand Canyon Monitoring and Research Center.

9. Status of native fishes in the Grand Canyon, 2005

Authors: L.G. COGGINS, S. ROGERS, C. NELSON, W. PERSONS, D. GWINN, W. VERNIEU, S. HUEFTLE, M. YARD, M.E. ANDERSEN, USGS, Southwest Biological Science Center, Grand Canyon Monitoring and Research Center, Flagstaff, AZ

Abstract: The level of Lake Powell has been dropping over the past few years due to upper basin drought conditions. This resulted in increased Glen Canyon Dam release temperatures and resuspension of sediments with high oxygen demand, resulting in lower release oxygen concentrations. While the reduced oxygen concentrations were corrected by modified dam operations, temperatures remained high. Natural resource managers in the Grand Canyon have been monitoring and managing native and nonnative fishes in the Colorado River below Glen Canyon Dam during the time when these changes have been occurring. Numbers of native fishes in the Colorado River and Little Colorado River in the Grand Canyon appear to have stabilized or increased in 2005. The Age Structured Mark Recapture model results suggest that the humpback chub population appears to have stabilized, albeit at low levels compared to the historic population size. Numbers of other native fishes, including flannelmouth sucker, bluehead sucker, and speckled dace all appear to be increasing as compared with prior years. The proportion of native fish making up the entire sampled fish community is increasing relative to nonnative fishes. While the reasons for these changes are not certain, it appears that warmer river water temperatures and mechanical removal of nonnative salmonids may be influencing these results. Native fish managers in the Grand Canyon are concerned that warming water temperatures may increase the frequency and numbers of nonnative warm water fish and parasite species. A warm water nonnatives workshop was convened in December. Expert advice was solicited to help address this management challenge in the Grand Canyon.

10. Humpback and Roundtail Chub Population Estimates in Westwater Canyon

Author: JULIE JACKSON, Utah Division of Wildlife Resources

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. Revisions to recovery goals in 2002 for humpback chub required that mark-recapture population estimates be completed in three of every five years. The first cycle of population estimates for humpback chub in Westwater Canyon was conducted from 1998 to 2000. Results from 1998 to 2000 indicated a declining but statistically non-significant trend. The second cycle of population estimate sampling for Westwater humpback chub was conducted from 2003 to 2005. Estimates for these three years showed a persistent downward trend. The 2005 estimate was considerably lower than the 1998 estimate and indicated a significant decline. Analysis of catch per unit effort (CPUE) data from this project and historic interagency standardized monitoring (ISMP) 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

continued to be monitored and estimates for this species was conducted as well. The 1998-2000 and 2003-2005 estimates indicated that the roundtail population was stable. Historical catch rates for roundtail chub were variable over the years but overall appeared to be stable.

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

Author: R. BRUNSON, U.S. Forest Service

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 a 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 sucks nonnative fish control measures needs to be evaluated on a case-by-case basis. Starvation Reservoir, located in northeastern Utah and within the Duchesne River drainage, was identified for such an evaluation beginning in 2002. It is a 3,310 surface area 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. Sampling results indicate that target species (smallmouth bass and walleye) are escaping, though in low numbers. These species are not found immediately downstream of the reservoir in the Strawberry River; however, smallmouth bass are established in the Duchesne River and Green River and walleye are encountered, though not often, in the Green River.

12. 2005 Middle Yampa River Northern Pike (*Esox lucius*) Removal and Evaluation

Authors: LORI M. MARTIN[1] and JOHN A. HAWKINS[2]. [1]Colorado Division of Wildlife, 711 Independent Ave., Grand Junction, CO 81505, Phone: 970-255-6126, FAX: 970-255-6111, Email: lori.martin@state.co.us. [2]Larval Fish Laboratory, Dept. of Fishery and Wildlife Biology, Colorado State University, Fort Collins, CO 80523, Phone: 970-491-2777, FAX: 970-491-5091, Email: John.Hawkins@ColoState.EDU

Abstract: A self-sustaining, nonnative population of northern pike (*Esox lucius*) is established in the Yampa River of Colorado, coexisting with federal- and state-listed Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), bonytail (*Gila elegans*), and razorback sucker (*Xyrauchen texanus*). Colorado Division of Wildlife and Colorado State University crews used boat-mounted electrofishing gear and trammel nets to capture northern pike in approximately 77 miles of critical habitat downstream of Craig, Colorado. A total sampling effort of 415 hours was expended in the middle Yampa River reach from April 22 through July 21, 2005. Northern pike were

marked and released on the first pass, and removed on subsequent passes. Removal success was evaluated using program MARK to generate a capture-recapture abundance estimator. Seven hundred and one (701) northern pike were estimated to occupy the critical habitat reach (573-891 95% CI; SE=80.3; CV=0.115). Capture probability was 22%, similar to that observed in 2004 (23%). The number of northern pike captured in 2005 was less than the number reported by Hawkins for the same reach in 2004. Hawkins estimated 974 northern pike occupying the study area in 2004 (769-1279 95% CI; SE=128.5; CV=0.132). In 2005, 59% of the estimated population of northern pike was removed from the middle Yampa River. Nearly 90% of the northern pike removed were translocated to Loudy Simpson ponds and Rio Blanco Lake to provide angler sportfishing opportunities. No clear patterns were observed with catch rates (numbers of northern pike per hour and per river mile). A large number (112) of northern pike handled and released on the first pass were never recaptured. The average total length of northern pike captured increased in a downstream direction. Recaptured northern pike traveled considerable distances over a relatively short time period of less than two months; two fish traveled more than 40 river miles. Ninety three percent (93%) of the northern pike recaptured had moved more than one river mile downstream. Recommendations for future efforts include: standardizing electrofishing equipment and operating protocol; exploring other potential metrics for population assessment; increasing backwater sampling effort; exploring baiting, trapping, and chumming options; and continuing contacts with Yampa River landowners and stakeholders.

13. A Preliminary Examination of Crayfish in the Yampa River in Northwestern Colorado

Authors: PATRICK MARTINEZ, MICHAEL CARILLO, ELLEN HAMANN, KELLEN KEISLING and MARIO SULLIVAN, Colorado Division of Wildlife, 711 Independent Avenue, Grand Junction, CO 81505, Phone 970-255-6141, FAX. 970-255-6111, E-mail. pat.martinez@state.co.us

Abstract: No crayfish species are native to the Colorado River Basin, but several introduced species have become established. The verile crayfish *Orconectes virilis* has a wide distribution in the Colorado River Basin and is its most common crayfish species. This species is established in many waters in western Colorado where it has been widely introduced into reservoirs to improve the prey base for sport fish. This species also occurs in many streams, including western Colorado's "big rivers". While crayfish were known to occur in the Yampa River, there appeared to be an abrupt increase in their numbers in recent years as perceived by fishery biologists. This apparent explosion in verile crayfish numbers coincided with extreme drought conditions and the onset of an increasingly abundant population of nonnative smallmouth bass *Micropterus dolomeiu.* Crayfish density was estimated at three stations in the middle reach of the Yampa River in 2005 using 1-m^2 square plots along randomly selected transects perpendicular to the channel. The sampling resulted in an estimated standing crop of 90 kg of verile crayfish per hectare. Despite decimation of the small-bodied component of the fish community in reaches of the middle Yampa River, smallmouth bass maintain high relative weights and their diet is dominated by crayfish. Available historic diet data for channel catfish

Ictalurus punctatus and northern pike *Esox lucius* suggested minimal consumption of crayfish, but diet analyses in 2005 revealed increased consumption of crayfish by these nonnative piscivores. The present high density of crayfish in the Yampa River, potentially attributable to a bioenergetic response to elevated summer stream temperatures during the drought, has provided an abundant alternate prey source for nonnative piscivores. Nonnative crayfish in general and verile crayfish in particular should be of further concern to native fish managers given their potential to prey upon native suckers or compete with them for food in the Colorado River Basin. A review of crayfish stocking activity, policies and regulations is recommended to slow the spread of these nonnative crustaceans and to prevent the inadvertent, illicit or intentional introduction of additional new crayfish species into Colorado's western rivers.

14. Investigations of roundtail chub populations in the presence of nonnative predators in the Yampa River, 2005.

Authors: CAMERON WALFORD (presenter) and JOHN HAWKINS, CSU Larval Fish Laboratory.

Abstract: Native, roundtail chub (*Gila robusta*) populations in the middle Yampa River, western Colorado, are threatened by competition and predation from abundant nonnative fish. Roundtail chub might serve as an ideal indicator species to monitor the response to nonnative fish control. We used data collected during northern pike (*Esox lucius*) and smallmouth bass (*Micropterus dolomieu*) removal studies to begin a status assessment of roundtail chubs in the Yampa River. Sampling occurred in the spring of 2005, in smallmouth bass study reaches, which included a 5-mile long site in Lily Park (RM 50.5—55.5) and two, 12-mile long sites in Little Yampa Canyon (RM 100-124). Smallmouth bass were captured by boat electrofishing and removed from the Lily Park site (LP-Treatment) and from one of the Little Yampa Canyon sites (LYC-Treatment). The other Little Yampa Canyon site served as a control (LYC-Control) and all bass were returned alive. Northern pike were removed river-wide, including all three study sites. Roundtail chub were also captured and measured for total length (TL, mm), weighed (g), scanned for a PIT tag, tagged if not previously marked, examined for pike bites and reproductive condition, and returned to the water. A total of 195 roundtail chub was tagged including 46 in LYC-Control, 79 in LYC-Treatment, and 70 in LP-Treatment. Using a capture-recapture abundance estimator, we estimated that 119 roundtail chub resided in LYC-Control (76-228 95% CI; SE=36.1; CV=0.303) and 226 resided in LYC-Treatment (137-425 95% CI; SE=69.1; CV=0.306). A population estimate for roundtail chub in LP-Treatment was not possible because no fish were recaptured. Catch per unit effort of roundtail chub in LP-Treatment (2 fish/hr) was about twice the catch per unit effort in LYC-Control (1 fish/hr) and LYC-Treatment (1 fish/hr). There was a distinct difference in the size of roundtail chub in LP-Treatment compared to those in the two upstream sites in LYC. Roundtail chub in both LYC-Treatment and LYC-Control were larger (>350 mm TL) and those in LP-Treatment were smaller (<350 mm TL).

Movements of recaptured roundtail chub indicated a small home range from April through mid June and greater movements in June and July during apparent spawning migrations. Seventy-one percent of recaptured roundtail chub moved short distances of

less than 2.5 miles and the other 29% moved between 2.5 and 7 miles. Most (71%) of the roundtail chub that moved over 2.5 miles were recaptured in a spawning aggregation.

Percentage of roundtail chub that exhibited pike bites was low (1%) in LP-Treatment and high in LYC-Control (13%) and LYC-Treatment (20%). The low pike-bite percentage observed in LP-Treatment may be due to higher predation success rates by northern pike due to smaller length classes and therefore lower escape rates of roundtail chub. Conversely, the high pike-bite percentage observed in LYC-Control and LYC-Treatment may be due to lower predation success by northern pike on larger roundtail chub and therefore higher escape rates. Some of the differences we observed in roundtail chub attributes among study sites were may be attributed to densities and sizes of nonnative predators. Continued monitoring of roundtail chub abundance and size structure in these reaches will give insights into response of native fish to removal of piscivorous nonnative fishes.

15. Trial and error: Efforts to improve retention of stocked Colorado pikeminnow in the San Juan River

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

Abstract: Since November 2002, the San Juan River Recovery Implementation Program (SJRIP) has funded a cooperative effort to monitor the retention, growth, and survival of hatchery-reared young-of-the year (YOY) Colorado pikeminnow (*Ptychocheilus lucius*) stocked into the San Juan River. One of the ancillary goals of this effort is to provide insights and recommendations to the SJRIP on what can be done to increase the retention and survival of stocked Colorado pikeminnow in order to facilitate achieving the goals of the SJRIP's Augmentation Plan for Colorado pikeminnow. When monitoring after the initial 2002 stocking yielded what we perceived to be poor retention, when compared to similar stockings in the mid- to late 1990s, the cooperating agencies recommended a series of stocking protocol changes and experiments designed to increase the retention of stocked YOY Colorado pikeminnow. The changes included, stocking Colorado pikeminnow directly into preferred habitats, acclimation experiments, and habitat manipulations.

Short-term habitat manipulations near the time of stocking in 2003 and 2004 appeared to have little impact on Colorado pikeminnow retention, primarily because relatively small flow fluctuations had dramatic impacts on the suitability of low-velocity habitats. Beginning in 2003, the U.S. Fish and Wildlife Service's Grand Junction Field Office began stocking Colorado pikeminnow directly into backwaters and other low velocity habitats, instead of *en masse* at one or two locations in the main river. While habitat availability and other environmental factors have clouded the interpretation of our results, we believe that part of the observed increase in retention and survival seen from 2003 -2005, versus what was seen in 2002, is attributable to this change in stocking protocols.

From 2003-2005, we have also attempted to acclimate a marked subset of 20,000 Colorado pikeminnow to river conditions by holding them in low velocity areas with net

pens or block nets for 6-7 days after stocking. The 2003 acclimation experiments were unsuccessful because nearly 80% of the fish died from what appears to have been acute stress. Furthermore, the calcein dye used to mark these fish failed to be visible in the field. Subsequently, Dexter National Fish Hatchery and Technology Center used this information to change hatchery harvesting and transport techniques, in hopes of avoiding stress-induced mortality in future stockings. We also eliminated the use of calcein dye, as it remains suspect in the mortality we saw, and failed as a visible field mark. Acclimation experiments in 2004 were plagued by a paucity of good habitat to hold fish. The one good habitat we did find showed early signs of success, but we were unable to trace that success throughout the remainder of the year. In 2005, instead of trying to use 10-20 acclimation areas, we scoured 18 miles of river to find what appeared to be the best areas to hold fish for a full 7 days after stocking. Early results from 2005 indicate that initial retention of acclimated fish appeared to be better than the main group of stocked fish. We have plans for additional experiments, including stocking fish at warmer water temperatures and stocking exercised fish, but are seeking input from other researchers on ways to increase the initial retention and survival of hatchery-reared YOY Colorado pikeminnow.

16. The importance of small populations as a different approach to species recovery: ideas, potential approaches, and lessons learned from Lake Mead razorback sucker investigations.

Authors: BRANDON ALBRECHT and PAUL B. HOLDEN, BIO-WEST, Inc.

Abstract: Historically, recovery efforts for razorback sucker in the Colorado River have revolved around the paradigm that remnant populations of razorback sucker are small, comprised exclusively of adult fish, and demonstrate little to no recruitment. In the absence of natural recruitment, recovery efforts have focused on rearing large numbers of razorback sucker for stocking. Once these fish reach a certain size, they are stocked, en masse, back into the river or reservoir. Some of the stocked fish then integrate into the wild population, if one exists, with the goal being to develop a population of 5,000 adults or more.

Studies of the Lake Mead razorback sucker populations over the past 9 years have found two small populations (100-200) individuals. A non-lethal aging technique has shown that these small populations are unlike other populations in the Colorado River in that they are relatively young, and are apparently self-sustaining. Recruitment in these populations has occurred in most years since about 1970, but some years, those with higher lake levels, appear to have higher levels of recruitment. We hypothesize that the limited recruitment seen in the two small Lake Mead populations is the result of large amounts of inundated vegetation, created by long-term lake level fluctuations, along with turbidity in several key areas of the Lake. Even though lake level fluctuations affect the entire lake, and razorback sucker once spawned in many areas in the lake, recruitment has occurred in only two or three places in the lake. We believe the vegetation and turbidity provides increased protective cover for larval and juvenile razorback sucker, allowing them to avoid predation by large numbers of nonnative sport fish present in the system.

Interestingly, these factors are only found in relatively few and/or small locations in the lake.

We suggest that Lake Mead is providing us a look at what naturally recruiting razorback sucker populations may look like in the real world of nonnative predators. Small areas that provide the components for recruitment may be an alternative "recovery solution" rather than large populations that rely on large sections of river or habitat that need to be intensively managed to achieve minimal recruitment. If small populations are an answer and deemed as important, we need to understand how to develop small populations of a species that appears to home into natal spawning areas, in locations with suitable recruitment habitat.

17. Larval Razorback Sucker Drift and Floodplain Entrainment Studies in the Green River, Utah.

Authors: KEVIN CHRISTOPHERSON, Utah Division of Wildlife Resources, RON BRUNSON, U.S. Forest Service, and KEVIN BESTGEN, Colorado State University

Abstract: Preliminary results are presented on an effort to identify important nursery habitats for razorback sucker larvae in the Green River, Utah. Neutrally buoyant beads, and marked hatchery produced razorback sucker larvae, were released at two known spawning locations during peak spring flow in 2005. Beads and larvae were released at three different river flows, and were sampled at five different floodplain sites along 83 kilometers of the river. Beads were collected in all floodplains that had river connection including the Leota site 83 kilometers down stream.

18. Retrospective of the Recovery Program, River Temperature Monitoring

Author: GEORGE SMITH, Hydrologist U.S. Fish and Wildlife Service, Denver, Colorado

Abstract: Beginning in 1997 the Fish and Wildlife Service began river temperature monitoring to build a database for a basin wide temperature model "SNTEMP". Later when the Recovery Program was established in 1988 temperature monitoring was incorporated into work to support other Recovery Program research activities. The paper will document the location of the temperature data collection network, the evolving nature of the data collection equipment and demonstrate how the data can be accessed and downloaded from the web.

The paper will also demonstrate a resent use of the temperature data in managing releases from Flaming Gorge Reservoir in an attempt to maintain temperatures in the Green River no more than 5°C colder than the Yampa River at the confluence during the summer base-flow period to prevent cold shock to drifting Colorado pikeminnow larvae. Researchers present at the meeting will be asked to comment on the usefulness of the data, collection locations, and locations which should be added or dropped.

19. Green River Fish Community Response to Flaming Gorge Dam Flow and Temperature Regimes, 2002 to 2004

Authors: KEVIN R. BESTGEN, KOREEN A. ZELASKO, and ROBERT I. COMPTON and TOM CHART

Abstract: We conducted sampling from 2002 to 2004 to evaluate fish community response to flow and temperature regimes present in the Green River, Colorado and Utah, downstream of Flaming Gorge Dam. We used raft-based electrofishing, and seine, drift, and trammel net sampling to assess fish community composition in the Green River from upstream Browns Park downstream to Island-Rainbow Park from 2002 to 2004 and compared those data to results of a similar 1994 to 1996 study. Summer flows were low, and water temperatures (up to 25 °C) were likely as warm as those present in the pre-impoundment era. Ten native fishes were collected in the Green River. When all sampling gears were combined, native fishes comprised only 10.3% of total catch and non-natives were 89.3%; the remaining 0.4% were hybrids. Fish species richness was lowest in upstream reaches where cold- or cool-water tolerant species (salmonids, white sucker, fathead minnow) were more abundant; species richness was higher downstream where warm-water tolerant taxa (sand and red shiners, channel catfish, and smallmouth bass) were more abundant. Flannelmouth sucker, bluehead sucker, and common carp were ubiquitous. Abundance of nearly all native fishes in the study area, including large-bodied adults captured by electrofishing and small-bodied fish in seine samples, declined between the 1994 to 1996 and 2002 to 2004 periods. Trammel net sampling detected a small population of humpback chub in Whirlpool Canyon and a relatively large population of roundtail chub. Hatchery-stocked bonytail were also captured. Drift net sampling failed to detect reproduction by Colorado pikeminnow in Lodore Canyon. Abundance of non-native fishes in Browns Park and Lodore Canyon in 2002 to 2004 increased since 1994 to1996 sampling, particularly in the upper portions of Lodore Canyon, where small-bodied cyprinids, channel catfish, and smallmouth bass increased greatly in abundance. Smallmouth bass reproduction, which was not observed in Lodore Canyon prior to this study, was widespread. Salmonids were temporarily reduced in 2002, but increased in 2003 and 2004, and remained similar in abundance to that observed in 1994 to 1996. Abundance of hybrid suckers and predaceous fishes in the Green River study area has increased.

The net effect of flow and temperature regimes on the native fish community, based on 2002 to 2004 sampling, was mixed mostly because of large increases in non-native fish abundance. Reliable information on the response of the fish community to flow and temperature regimes was obtained but only at the lower end of the flow spectrum and the high end of the temperature spectrum. Additional years of sampling when moderate or higher flow conditions are available are needed to fully assess the effects of pending flow and temperature recommendations for Flaming Gorge Dam on the fish community of the Green River.

20. Estimating sources of northern pike (*Esox lucius*) recruitment in the Yampa River, using otolith microchemistry

Authors: DANA L. WINKELMAN and RYAN FITZPATRICK, Colorado Cooperative Fish and Wildlife Research Unit, Colorado State University, 201 JVK Wagar Bldg., Fort Collins, CO 80523, P 970-491-1414, F 970-491-1413, dlw@cnr.colostate.edu

Abstract: Northern pike (*Esox lucius*) are an exotic predator in the Yampa River and little is known about their movements or sources of recruitment. It is thought that northern pike spawn in the river channel but it also likely that they spawn in off-channel ponds and reservoirs. The relative contribution of these areas to young-of-year northern pike recruitment is unknown. We are using otolith microchemistry to develop elemental signatures to estimate relative levels of recruitment from various potential sources in the Yampa River. Initial results indicate that elemental signatures can be used to delineate recruitment sources in the Yampa River system. We used a discriminant function to classify northern pike based on elemental signatures. Overall, reclassification rates ranged from 56-100%. Elkhead, Catamount, and Stagecoach reservoirs are thought to be important potential recruitment sources had high reclassification rates (100%, 90%, and 71.4% respectively), indicating that we should be able to identify pike coming from these sources. Ponds had somewhat lower reclassification rates, making estimates of provenance more difficult; however, we can still delineate among many of these sources. Elemental analyses appear to be an effective tool to identify major sources of recruitment and could help guide the management of northern pike in the Yampa River.

21. Cibola High Levee Pond and Beyond: A Native Fish Sanctuary Initiative.

Authors: GORDON MUELLER and JEANETTE CARPENTER, USGS.

Abstract: Bonytail and razorback sucker sustained a natural fish community in Cibola High Levee Pond for nearly 12 years. The absence of nonnative predators allowed natural recruitment. In 2002, the 5 acre pond contained multiple year classes and more than 1,000 razorback sucker and 10,000 bonytail. Largemouth bass was first noticed in 2003 and its suspected they were illegally introduced by anglers. Netting and electrofishing proved ineffective in their removal. Those bass spawned in 2004, producing thousands of young. By the fall of 2005, largemouth bass comprised 85% of the total fish community. The native component was reduced to large (45+cm) razorback adults (15%) and a few (<1%) large (30+cm) bonytail within 18 months.

Based on the initial success at Cibola High Levee Pond, the Bureau of Reclamation funded USGS to test Minckley's Native Fish Conservation Plan. The program is forming a coalition of land management partners to develop a native fish sanctuary system using existing ponds. The goal is to establish a minimum of ten small native fish sanctuaries where fish can reproduce naturally. It is hoped through the active management and research opportunities provided by these small faculties, we will gain the knowledge and expertise necessary to expand this approach on a larger scale.

22. Potential small-bodied predators of larval razorback sucker.

Authors: JEANETTE CARPENTER and GORDON MUELLER, U.S. Geological Survey, c/o Bureau of Reclamation, PO Box 25007 (D-8220), Denver, Colorado 80225-0007

Abstract: Razorback sucker, an endangered big-river species of the Colorado River basin (CRB), has sustained no meaningful recruitment in the past four decades despite consistent observations of spawning adults and larvae. We conducted laboratory experiments to assess the potential predatory impact of small-bodied non-native predators, such as small cyprinids and juvenile game fish, on razorback larvae. We tested ten non-native fish: adult red shiner, threadfin shad, and fathead minnow; age-1 yellow bullhead; and age-0 rainbow trout, bluegill, largemouth bass, common carp, green sunfish, and channel catfish. Every species tested ate razorback sucker larvae. The most aggressive non-native predators on razorback larvae <15 mm TL were adult red shiner (<65 mm); and age-0 rainbow trout (<51 mm), green sunfish (<62 mm), channel catfish (<86 mm), and common carp (<75 mm). Age-0 largemouth bass <80 mm TL consumed at a moderate rate razorback juveniles that were nearly half their size (range=34-39 mm TL). This study illustrates that early life stages of native fish in the CRB are highly vulnerable to small non-native predators that have easy access to shallow nursery habitats. Our results suggest that efforts to manage non-native fish for improving native fish recruitment in the CRB should target all life stages of non-native fish, not just large-bodied fishes.

23. Comments on strategic approaches to floodplain management for endangered fishes in the Green River subbasin.

Author: TIM MODDE, Colorado Fish Project, U.S. Fish and Wildlife Service,Vernal, Utah.

Abstract: A strategic approach to floodplain management is presented that outlines a systematic process identifying biological needs and a sequence of management actions. The Recovery Program has identified broad directives relative to the floodplain management, but greater specificity is needed before site action plans can be implemented. The approach I present allows a means of measuring success at individual sites and provides a more precise means of determining the value of floodplain wetlands to recovery razorback sucker and bonytail in the Green River subbasin.

Poster Abstracts

Native Cypriniform Fish Larvae of the Gila River Basin; Morphological Descriptions, Comparisons, and Computer-interactive Key

Authors: DARREL E. SNYDER, KEVIN BESTGEN and SEAN C. SEAL Larval Fish Laboratory Colorado State University Fort Collins, Colorado

Abstract: Use of collections of fish larvae and young-of-the-year juveniles to help document spawning sites and seasons or assess larval production, transport, distribution, nursery habitat, survival, and other aspects of early life history requires diagnostic criteria to accurately distinguish target species from morphologically similar taxa. To facilitate identification of the larvae and early juveniles of most native cypriniform fishes in the Gila River Basin, developmental series of reared and collected desert sucker (*Catostomus clarkii*), Sonora sucker (*C. insignis*), longfin dace (*Agosia chrysogaster*), spikedace (*Meda fugida*), and loach minnow (*Rhinichthys cobitis*) were illustrated and described to detail differences in morphology, meristics, pigmentation, and size relative to developmental state. Comparable illustrations and data were extracted from existing descriptions of flannelmouth sucker (*C. latipinnis*), razorback sucker (*Xyrauchen texanus*), bonytail (*Gila elegans*), roundtail chub (*G. robusta*), Colorado pikeminnow (*Ptychocheilus lucius*), speckled dace (*R. osculus*), and non-native cyprinids common carp (*Cyprinus carpio*), red shiner (*Cyprinella lutrensis*), and fathead minnow (*Pimephales promelas*), mostly from Upper Colorado River Basin guides (Snyder 1981, Muth 1990, and Snyder and Muth 1990 and 2004). For the cyprinids, extracted data were supplemented with original observations and, for roundtail chub and speckled dace, illustrations of protolarvae. The results are documented in detailed descriptive species accounts, comparative summary tables, and computer-interactive keys. A computer-interactive key and a pictorial guide to families of Gila River Basin larvae were also prepared using data from previously published keys and descriptions.