35TH ANNUAL RESEARCHERS MEETING

OF THE

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM
AND
SAN JUAN RIVER BASIN RECOVERY IMPLEMENTATION PROGRAM

JANUARY 14–15, 2012

CLARION INN
HORIZON DRIVE
GRAND JUNCTION, COLORADO

Registration will occur outside the Clarion Inn Conference Room starting at 9:00 am on Tuesday 14 January 2013. A registration fee of $25 (cash preferred or check please, no credit cards accepted) will offset the costs of the meeting room and refreshments.

If you are giving an oral paper please be sure your presentation is copied from CD/DVD or portable USB drive to the laptop running the projector before your session begins. Push pins will be available to hang posters before Tuesday's evening social.

REGULAR SESSIONS

Tuesday, January 14, 2012

8:30 **Registration:** Fee is $25.00 (Cash or check) to offset costs of meeting room and refreshments.

9:30 **WELCOME/ INTRODUCTION TO THE JOINT ANNUAL RESEARCHERS MEETING.** *Tom Chart, Dave Campbell* and Angela Kantola (Information and Education Update: *Leith Edgar* and *Melanie Fischer*)

Session 1: Hydrology
(Moderator: Kevin McAbee)

9:40 **HYDROLOGIC SUMMARY FOR 2013**. *Jana Mohrman*

Session 2: Nonnative Fish Control
(Moderator: Kevin McAbee)

10:00 **POPULATION TRENDS OF SMALLMOUTH BASS IN THE UPPER COLORADO RIVER BASIN WITH AN EVALUATION OF REMOVAL EFFECTS.** *André R. Breton,* Dana L. Winkelman, John A. Hawkins, and Kevin R. Bestgen

10:20 **SMALLMOUTH BASS OTOLITH MICROSTRUCTURE ANALYSES AND IMPLICATIONS FOR GREEN RIVER BASIN FISH AND FLOW MANAGEMENT.** *Kevin R. Bestgen* and Angela A. Hill

10:40 **Break** (20 minutes)

Session3: Nonnative Fish Control (Continued)
(Moderator: Kevin McAbee)

11:00 **SMALLMOUTH BASS REMOVAL IN THE UPPER COLORADO RIVER BASIN: SUMMARY OF 2013 DATA AND RECOMMENDATIONS FROM THE NONNATIVE FISH WORKSHOP.** *Tildon Jones*, Kyle Battige, Jenn Logan, Lori Martin, John Hawkins, Cameron Walford, Matt Breen, Katie Creighton, Julie Howard, Ben Kiefer, Joe Skorupski, Travis Francis, and Aaron Webber.

11:30 **POPULATION DYNAMICS MODELING OF INTRODUCED SMALLMOUTH BASS IN THE UPPER COLORADO RIVER BASIN.** *André R. Breton*[1], Dana L. Winkelman[2], Kevin R. Bestgen[3], and John A. Hawkins[3]

12:00 **Lunch**

Session 4: Nonnative Fish Control – Northern Pike Walleye
(Moderator: Jerry Wilhite)

1:00 **POPULATION ABUNDANCE AND DYNAMICS OF INTRODUCED NORTHERN PIKE, YAMPA RIVER, COLORADO, 2004–2010.** *Koreen A. Zelasko*, Kevin R. Bestgen, John A. Hawkins and Gary C. White

1:20 **SUMMARY OF NORTHERN PIKE REMOVALS IN THE UPPER COLORADO RIVER BASIN.** *Kyle Battige*

1:40 **WALLEYE EXPANSION IN THE UPPER COLORADO RIVER BASIN: PREDATOR REPLACEMENT 3.0**. *Paul Badame*, Tildon Jones, Travis Francis, Joe Skorupski, Matt Breen, Katherine Creighton, Julie Howard

2:00 **WRAP-UP.** *Kevin McAbee*, Nonnative Fish Coordinator

2:15 **Break** (15 minutes)

Session 5: Nonnative Fish in Grand Canyon and other Techniques
(Moderator: Scott Durst)

2:30 **TURBIDITY EFFECTS ON SPATIAL DYNAMICS OF RAINBOW TROUT ABUNDANCE AND GROWTH, GRAND CANYON, AZ.** *Scott P. VanderKooi*, Michael D. Yard, Josh Korman, Theodore Kennedy and Charles B. Yackulic

2:50 **NON-NATIVE FISH CONTROL IN COLORADO RIVER TRIBUTARIES IN GRAND CANYON NATIONAL PARK.** Brian Healy, Clay Nelson, Emily Omana Smith, and *Melissa Trammell*

3:10 **IMPULSIVE SOUND AS AN INVASIVE AQUATIC SPECIES SUPPRESSION STRATEGY.** ***Jackson Gross***

3:30 **Break** (15 minutes)

Session 6: Other Activities
(Moderator: Tom Czapla)

3:45 **ENTRAINMENT OF NATIVE FISH IN THE MAYBELL DITCH, 2011-2012.** *D.W. Speas*, J.A. Hawkins, P.D. Mackinnon, K.R. Bestgen and C. W. Walford

4:05 **CONTAMINANTS INVESTIGATIONS IN ENDANGERED COLORADO R. FISH CRITICAL HABITAT: DETERMINATION OF SELENIUM IN FISH FROM DESIGNATED CRITICAL HABITAT IN THE GUNNISON RIVER, AND EPA STUDY OF PERSONAL CARE PRODUCTS AND PESTICIDES IN GRAND VALLEY WASHES.** *Barb Osmundson*

4:35 **RECOVERY PLANS FOR THE FOUR COLORADO RIVER ENDANGERED FISHES RECOVERY PLANNING UPDATE.** *Richard A. Valdez* and Tom Czapla

5:05 **PRESENTATION OF THE RESEARCHER OF THE YEAR AWARD**

6:00 **SOCIAL – *A RATHER SUBSTANTIAL PRIZE WILL BE DRAWN FOR A FIELD OFFICE***

Wednesday, January 15, 2012

Session 7: Native Fish
(Moderator: Tom Chart)

9:00 **RESPONSE OF THE NATIVE FISH COMMUNITIES OF THE YAMPA AND GREEN RIVERS TO NONNATIVE FISHES AND FLOWS.** *Kevin R. Bestgen*, C. Walford, A. Hill, T. Wilcox, and J. Hawkins

9:30 **USE OF COAL CREEK, WHITE RIVER DRAINAGE, CO, BY FLANNELMOUTH AND BLUEHEAD SUCKER.** *Greg Fraser*[1], Kevin R. Bestgen[2] and Dana L. Winkelman[3]

9:50 **NATIVE FISH INVENTORY AND COMMUNITY ASSESSMENT ON THE DOLORES RIVER, UT; AND FUTURE MOVEMENT STUDY USING PASSIVE INSTREAM ANTENNA.** *Daniel Keller* and David Speas

10:10 **Break** (20 minutes)

Session 8: Endangered Fish
(Moderator: Tom Czapla)

10:30 **STEWART LAKE FLOODPLAIN: ROAD TO RAZORBACK SUCKER RECOVERY?** *Joseph A. Skorupski Jr.*, Ian Harding and Matthew J. Breen

10:50 **HUMPBACK CHUB IN CATARACT CANYON.** *Julie Howard*

11:10 **ENDANGERED HUMPBACK CHUB TRANSLOCATIONS TO COLORADO RIVER TRIBUTARIES IN GRAND CANYON NATIONAL PARK.** Emily C. Omana-Smith[1], Brian D. Healy, Clay Nelson, and *Melissa Trammell*

11:30 **WAHWEAP: THE UTAH WARM WATER STATE FISH HATCHERY.** *Zane C. Olsen*

11:40 **WRAP-UP:** *Tom Czapla*

ABSTRACTS

Abstract Format (abstracts appear as they are listed in the agenda):

TITLE

Authors: If only one author contact information follows directly.
If multiple authors from the same agency, contact information follows directly.
If multiple authors from different agencies, contact information is subscripted.
Presenter's names are italicized.

Abstract (Presentations are 20 minutes, typically split into 15 minutes for the presentation and 5 minutes for follow-up questions; but the author can use the total 20 minutes for the presentation and take questions from individuals during breaks, social, etc.)

Session 1: Hydrology

HYDROLOGIC SUMMARY FOR 2013.

Jana Mohrman, Hydrologist, U.S. Fish and Wildlife Service

A review of the 2013 hydrology will be presented. A summary of how "dry year" fish flow targets were met will be presented. Despite low flow conditions there were small volumes of water carried over to 2014 in the Yampa and the 15-mile reach with the concern that dry years often come back to back. Some new issues will be showcased in the 15-mile reach.

Session 2: Nonnative Fish Control – Smallmouth Bass

POPULATION TRENDS OF SMALLMOUTH BASS IN THE UPPER COLORADO RIVER BASIN WITH AN EVALUATION OF REMOVAL EFFECTS

André R. Breton[1], Dana L. Winkelman[2], John A. Hawkins[3], and Kevin R. Bestgen[3]

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Smallmouth bass *Micropterus dolomieu* were rare in the upper Colorado River basin until the early 1990's when their abundance dramatically increased in the Yampa River sub-basin. Smallmouth bass established a self-sustaining population and eventually colonized the downstream Green River sub-basin. The rapid increase of smallmouth bass in the upper Colorado River basin overlapped with significant reductions in native fish populations in some locations. Thus, an integrated and widespread bass removal program was instituted to reduce

those negative effects. Our analyses indicated that smallmouth bass densities were substantially reduced in most years by electrofishing removal efforts. Environmental effects were also responsible for declines in smallmouth bass densities in some reaches but only in some years. Abundant year classes of young smallmouth bass produced in low flow and warm years such as 2006 and 2007 have potential to overwhelm removal efforts. Despite the potential for post-removal bass population recovery in some reaches from recruitment and immigration, recent electrofishing removal effort (ca. 2008–2011) has resulted in declining smallmouth bass population trends. We recommend that the Recovery Program (1) maintain efforts to reduce smallmouth bass in areas perceived to be production areas; (2) consider other tools such as flow and temperature management to reduce smallmouth bass reproduction; (3) prevent escapement of resident smallmouth bass and other fishes from reservoirs and other sources; (4) prevent colonization of smallmouth bass from the Duchesne River into the Green River; (5) continue use of tagged fish to obtain reliable abundance estimates to understand population dynamics; (6) evaluate switching to removal of smallmouth bass on all passes (no tagging) in reaches only when pre-determined criteria are met; (7) re-assess available capture-recapture data from reaches not integrated in analyses discussed here; and (8), integrate re-evaluations of smallmouth bass removal effectiveness into a carefully designed adaptive management strategy to assess implications for recovery of the four endangered fish species.

SMALLMOUTH BASS OTOLITH MICROSTRUCTURE ANALYSES AND IMPLICATIONS FOR GREEN RIVER BASIN FISH AND FLOW MANAGEMENT

Kevin R. Bestgen and Angela A. Hill, Larval Fish Laboratory, Department of Fish, Wildlife, and Conservation Biology, Colorado State University, Fort Collins, Colorado, 80523, (970) 491-1848, kbestgen@colostate.edu

Otolith microstructure analysis, particularly daily age estimation, has been a useful tool in fish ecology and management. Here we present results of otolith microstructure analyses and daily age estimation conducted on smallmouth bass *Micropterus dolomieu* collected in the Green and Yampa rivers, Colorado, from 2003–2012. Analyses showed that smallmouth bass spawning was usually initiated in June through mid-July, but timing and peak spawning were strongly dependent on water temperature and streamflow, with bass spawning later in cooler and higher flow years such as 2008 and 2011 and earlier in warmer and lower flow years such as 2006 and 2007. Spawning initiation and days of spring flow > 8000 cfs were highly correlated, and smallmouth bass spawning occurred over about a 4-week period. Bass TL in September and summer growth rates were strongly influenced by water temperature, timing of first spawning, and spawning cohort, with early spawned fish in warm years being the largest and fastest growing and late spawned fish in cool years the smallest and slowest growing. Otolith analyses may also enhance our understanding of smallmouth bass ecology in the Green River Basin and guide efforts to disrupt spawning and reduce recruitment of this invasive predaceous species. Appropriately timed shifts in flow, water temperature management, or other spawning disruptions to disadvantage smallmouth bass are potential management tools. Such approaches need to consider effects on native fishes as well as water availability tradeoffs to achieve goals for baseflow and spring flow peaks.

Session 3: Nonnative Fish Control – Smallmouth Bass (Continued)

SMALLMOUTH BASS REMOVAL IN THE UPPER COLORADO RIVER BASIN: SUMMARY OF 2013 DATA AND RECOMMENDATIONS FROM THE NONNATIVE FISH WORKSHOP.

Tildon Jones[1], Kyle Battige[2], Jenn Logan[2], Lori Martin[2], John Hawkins[3], Cameron Walford[3], Matt Breen[4], Katie Creighton[4], Julie Howard[4], Ben Kiefer[4], Joe Skorupski[4], Travis Francis[5], and Aaron Webber[1].

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A major component of the Upper Colorado River Endangered Fish Recovery Program is the reduction of threats posed by nonnative fishes to endangered, native fish species. As smallmouth bass (*Micropterus dolomieu*) have expanded their range in the basin and their abundance has increased, the Program has responded with an expanded removal program for this species. In 2013 the Program, through its cooperating partners, conducted smallmouth bass removal projects in nearly 400 miles of the Colorado, Green, White, and Yampa Rivers. Agency crews conducted as many as 15 passes in a given reach for a single project. This presentation will summarize the results from all smallmouth bass removal projects conducted in 2013 and will relate recommendations from the Nonnative Fish Workshop held in December 2013. Several results were similar across reaches in 2013. A large proportion of small fish was captured as a result of successful spawning and recruitment enhanced by dry conditions in 2012. Many researchers also noted successful spawning in 2013, as evidenced by the capture of large numbers of young-of-year bass. Crews from multiple agencies used similar strategies for targeting and collecting bass at the highest rates possible, primarily by conducting passes during the nesting and spawning period for bass. Recommendations from the Workshop included addressing sources of smallmouth bass, implementing additional passes and new techniques, and mitigating constraints such as river access on private lands.

POPULATION DYNAMICS MODELING OF INTRODUCED SMALLMOUTH BASS IN THE UPPER COLORADO RIVER BASIN

André R. Breton[1], Dana L. Winkelman[2], Kevin R. Bestgen[3], and John A. Hawkins[3]

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Following an extensive literature review, we combined life history and ecological information for smallmouth bass *Micropterus dolomieu* with estimates of density and exploitation from the upper Colorado River basin into a custom-built population projection model. We then ran model projections aimed at predicting bass abundance under a variety of management scenarios. We focused on projections of smallmouth bass numbers in Little Yampa Canyon, a 24-mile reach on the Yampa River where extensive removal and estimation occurred. Based on our analyses and other information, the smallmouth bass population in Little Yampa Canyon, and just upstream, appears to be the epicenter of the Yampa River smallmouth bass population. Despite our focus on smallmouth bass population dynamics in Little Yampa Canyon, insights from our projection results are applicable to reaches throughout the upper basin. Sensitivity analysis of demographic parameter estimates implemented into our projections suggested results were robust to parameter uncertainty. Model projection results suggest that , (1) early season nest disturbance was most effective because most age-0 smallmouth bass that survive the winter are from the early hatching cohorts and conversely, few from middle and late season hatching cohorts survive; (2) "the surge" is a cost effective way to further reduce smallmouth bass numbers, especially when many are reproducing (adult) fish; (3) fall age-0 bass exploitation is ineffective at reducing long-term abundance but may reduce short-term predation on native fishes; (4) spring electrofishing exploitation is preventing the smallmouth bass population from increasing exponentially; (5) immigration is preventing the smallmouth bass population from going extinct in some reaches given present levels of electrofishing effort; and (6), low frequency of detrimental environmental conditions had little impact on smallmouth bass abundance. In addition to management recommendations integrated into our smallmouth bass assessment, we recommend that the recovery program integrate the surge as a core component of the spring-summer exploitation effort and that this strategy be applied to areas of smallmouth bass reproduction responsible for significant smallmouth bass recruitment.

Session 4: Nonnative Fish Control – Northern Pike Walleye

POPULATION ABUNDANCE AND DYNAMICS OF INTRODUCED NORTHERN PIKE, YAMPA RIVER, COLORADO, 2004 – 2010

Koreen A. Zelasko[1], Kevin R. Bestgen[1], John A. Hawkins[1] and Gary C. White[2]

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[2]Department of Fish, Wildlife, & Conservation Biology. Colorado State University, Fort Collins, Colorado

We modeled demographic parameters of invasive Northern Pike (*Esox lucius*) in the Yampa River, Colorado, 2004–2010, using tag-recapture data. Sampling occurred in three regions: "Hayden to Craig", a buffer zone upstream of endangered species habitat in the next two regions; "South Beach, Little Yampa Canyon, Juniper"; and most-downstream "Maybell, Sunbeam". Analyses in Program MARK showed important region, time interval, and pike length effects on survival rate estimates and interacting region, year, and pass effects with additive length effects on capture probability estimates. Annual survival was lowest for pike upstream (mean: 0.25, range: 0.12–0.38), but abundance estimates were highest. Pike downstream had highest survival and lowest abundance estimates. Capture probabilities ranged from 0.03 to 0.51 for average-length Northern Pike, but over 70% of estimates were <0.20. Removal rates were variable and

relatively low, while total mortality rates (including removal and emigration) remained consistent across years. Average mortality rates in the two upstream regions were high (70–75%), but population increases due to recruitment and/or immigration offset those effects. Present removal rates may not be adequate to reduce populations of Northern Pike in the Yampa River if immigration and recruitment are not reduced. Within the Yampa and Green river basins, few Northern Pike movements spanned more than two adjacent river reaches. However, we documented movements from the most upstream sampling locations in the Yampa River basin (including in Catamount Reservoir) down to the middle Green River - a distance of more than 241 river miles. Northern Pike previously translocated to Yampa State Park Headquarters, Yampa River State Wildlife Area, and Loudy-Simpson Park were subsequently recaptured in mainstem sampling.

SUMMARY OF NORTHERN PIKE REMOVALS IN THE UPPER COLORADO RIVER BASIN

Kyle Battige, Colorado Parks and Wildlife, Meeker, Colorado

Removal of non-native northern pike has been occurring in the Upper Colorado River Basin with regularity since 2003. The focus of the most intensive removal and monitoring activities has taken place in the Yampa River, which harbors the highest densities of northern pike throughout the basin, due to favorable habitat and the presence of robust source populations contained within reservoirs, off-channel ponds and backwaters in the Yampa River Basin. In addition to Recovery Program funded projects, Colorado Parks and Wildlife is independently working to control northern pike in the Upper Yampa River basin through removals and habitat manipulations. Although Yampa River basin-wide removal efforts have not met the interim goal of reducing northern pike densities to 3 adult northern pike per mile in Critical Habitat of the Yampa River, the size structure of the population has been severely altered, trending toward a population comprised of much smaller fish. Nonetheless, exceptionally high runoff observed in 2011 undoubtedly created favorable conditions for northern pike recruitment in the Upper Colorado River Basin, as age 2 northern pike dominate the current population structure, particularly in the Yampa River. Researchers continue to document the presence of northern pike throughout the Upper Colorado River Basin, including the capture of young of year northern pike in the Brown's Park area of the Green River. Northern pike distribution in the Green River also expanded in 2013 with an angler reported catch of a northern pike just below Flaming Gorge Reservoir. Northern pike removals also continued in the Upper Colorado River including removals in a seasonally connected off channel gravel pit near Rifle, Colorado where northern pike were discovered in 2012. Wyoming Game and Fish also captured and removed six additional large northern pike in the Little Snake River downstream of Baggs, Wyoming marking the second year northern pike have been captured in the Little Snake. As a whole, northern pike removal efforts continue throughout the basin with high levels of effort being expended.

WALLEYE EXPANSION IN THE UPPER COLORADO RIVER BASIN: PREDATOR REPLACEMENT 3.0

Paul Badame[1], Tildon Jones[2], Travis Francis[3], Joe Skorupski[4], Matt Breen[4], Katherine Creighton[5], Julie Howard[5].

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The origin of walleye in the rivers of the upper Colorado River Basin is a bit cloudy, but early reports point to emigration from the Duchesne River drainage in the late 1950's. Walleye were first captured in the Green River in 1962 near Split Mountain and in 1965 they made their first appearance in Glen Canyon Reservoir as it filled. All early reports attributed their appearance to emigration from the Duchesne drainage. This year (2013) marked the highest total catch in the upper Basin with 259 walleye removed from the Colorado River and 411 removed from the Green River. Walleye were captured throughout all 345 miles of the Green River with concentrations below Split Mountain, below the Duchesne River and near the town of Green River, Utah. Walleye were found throughout the lower 112 miles of the Colorado River with concentrations near Moab, Utah. The mean TL of for Green River walleye was 463 mm and 459 mm in the Colorado River. To date, only three or four age 1+ walleye have been captured in either river, suggesting the populations are sustained by escapement and emigration. Escapement studies, chemical fingerprinting, and basin-wide catch distributions point to Starvation Reservoir and Lake Powell as the primary sources for walleye in the upper Colorado River Basin. Successful control of this species will require disconnecting these.

Session 5: Nonnative Fish in Grand Canyon and other Techniques

TURBIDITY EFFECTS ON SPATIAL DYNAMICS OF RAINBOW TROUT ABUNDANCE AND GROWTH, GRAND CANYON, AZ.

Scott P. VanderKooi[1], Michael D. Yard[1], Josh Korman[2], Theodore Kennedy[1] and Charles B. Yackulic[1]

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The Colorado River fish community in Grand Canyon has been altered by dam regulation and introductions of nonnative fish, particularly rainbow trout (*Oncorhynchus mykiss*). Rainbow trout are abundant and are likely to compete with and predate on juvenile native fish, including endangered humpback chub (*Gila cypha*), rearing near the Little Colorado River. We examined effects of seasonal changes in turbidity and invertebrate drift densities on trout abundance and vital rates. We implemented an extensive mark-recapture study, sampling five reaches (6 km/reach) quarterly (April, July, September and January) using electrofishing in a robust sampling design. Individual fish were marked with passive integrated transponder tags (about 20,000 fish per year) to estimate abundance, movement, growth, and survival of age-0 and older trout. Total rainbow trout abundance was estimated at approximately 500,000 individuals; however, trout densities were unevenly distributed between Glen Canyon Dam and the Little Colorado River (125 km), declining from 7,000 to 500 fish/km, respectively. In contrast, invertebrate drift densities increased with increasing distance downstream. Daily growth rates varied significantly among seasons and sites and were negatively correlated to turbidity levels.

Spatial dynamics observed in rainbow trout metrics corresponded strongly with invertebrate drift availability and trout densities, and differences in turbidity among sites strongly mediated these relationships.

NON-NATIVE FISH CONTROL IN COLORADO RIVER TRIBUTARIES IN GRAND CANYON NATIONAL PARK

Brian Healy, Clay Nelson, Emily Omana Smith, and *Melissa Trammell*

Grand Canyon National Park, 1824 S. Thompson Street, Suite 270, Flagstaff, AZ 86001

The construction of Glen Canyon Dam resulted in profound changes to the historically warm and turbid waters of the Colorado River within Grand Canyon National Park (GCNP). Non-native salmonids initially stocked in tributaries in the 1920's and 30's, proliferated following dam construction. Grand Canyon's native warmwater fishes, including endangered humpback chub and razorback sucker, continue to be threatened by non-native fishes and habitat alterations. To meet National Park Service (NPS) management goals for native species and to meet the intent of non-native fish control conservation measures included in various U.S. Fish and Wildlife Biological Opinions for the operation of Glen Canyon Dam, GCNP, in cooperation with the Bureau of Reclamation and others, is implementing non-native fish control efforts in Colorado River tributaries. The objectives of these efforts is to improve survival of translocated humpback chub, to minimize predation upon humpback chub and other natives species in both tributaries and the Colorado River, and to restore native fish communities to the extent possible. Mechanical removal methods are the primary focus of control efforts, and abundance and survival estimates calculated using mark-recapture and depletion analysis methodology are used to evaluate the projects, including the evaluation of potential harmful effects of sampling gear upon native species. Preliminary results indicate that changes in size structure and abundance of non-native trout have occurred following removal efforts, as well as improvement of humpback chub survival. Negative effects of control methods (electro-fishing) upon native fish survival were not apparent. Analysis of data collected during a stream-wide (approximately 13 miles) multiple-pass backpack electro-fishing removal effort in Bright Angel Creek is ongoing.

IMPULSIVE SOUND AS AN INVASIVE AQUATIC SPECIES SUPPRESSION STRATEGY.

Jackson Gross MSPH PhD, Smith-Root Inc, Vancouver WA 98686

Control of aquatic nuisance or invasive species has high economic and ecological value. We are developing the use of continuous and impulsive sounds to cost effectively manage nuisance fish species to the benefit of indigenous species or to solve a condition impacting an industrial activity. Sound is an attractive alternative to the use of chemicals and similar approaches that can be difficult to control and can persistent in the environment. Studies have been conducted to determine the effects of sound energy technologies on both invasive and native fishes. Initial studies of the exposure of species including cutthroat trout, northern pike, Asian carp and pallid sturgeon to various sounds have provided valuable information aiding design of invasive species control measures. The investigative approach focuses on: identification of lethal exposure levels or behavioral response thresholds, the design of sound production devices that can produce the required sound at levels with characteristics found to be effective, and the development of control treatment strategies that optimize effectiveness. This research differs from the traditional

goals to identify exposure thresholds that are safe for identified species, to inform regulatory measures, and the design of mitigation to protect exposed animals. Recently completed management actions have resulted in the successful clearing of Asian carp with water guns operated effectively in the Chicago Sanitary and Shipping Canal. Extensions of sound based measures found effective to modify the behavior of shad species are being investigated alone and integrated with other technologies to affect the behavior of additional fish species.

Session 6: Other Activities

ENTRAINMENT OF NATIVE FISH IN THE MAYBELL DITCH, 2011-2012.

D.W. Speas[1], J.A. Hawkins[2], P.D. Mackinnon[3], K.R. Bestgen[2] and C. W. Walford[2]

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[3]Fish Ecology Lab, Department of Watershed Sciences, Utah State University, 5210 Old Main Hill Logan, Utah, 84321

We assessed potential for entrainment of Colorado pikeminnow into the Maybell Ditch, a gravity-fed irrigation ditch on the Yampa River near Maybell, Colorado during the 2011 and 2012 irrigation seasons (April through October of each year). To detect entrained fish implanted with 134.2 kHz passive integrated transponder tags, we installed a solar-powered passive interrogation array about 2.6 km below the ditch head gates in April 2011. Based on preliminary tests and system internal diagnostics, detection efficiency of the system was reasonably high and no electrical problems were encountered during the course of the study; however, high levels of ambient electrical interference may have caused occasional lapses in detection efficiency. During both 2011 and 2012, the Maybell Ditch operated from late April through the end of October. Yampa River discharge was the greatest on record (1916-2012) in 2011 but unusually low in 2012 (99% exceedence). We detected no fish entrainment during the 2011 irrigation season but detected entrainment of one roundtail chub in July of 2012 and one Colorado pikeminnow in August of 2012. Considering all available data, entrainment of large-bodied (450 – 500 mm TL) native fish in the Maybell Ditch can occur over a range of river flow levels during or immediately following the peak-flow period or during the late summer low-flow period. A number of factors (less than perfect detection efficiency, potential entrainment of untagged fish) suggest that this estimate of pikeminnow entrainment (0-1 fish/irrigation year) should be considered a minimum estimate. An understanding what the observed entrainment rates of Colorado pikeminnow are in relation to population size may be gained when 2011 and 2012 abundance estimates become available.

CONTAMINANTS INVESTIGATIONS IN ENDANGERED COLORADO R. FISH CRITICAL HABITAT: DETERMINATION OF SELENIUM IN FISH FROM DESIGNATED CRITICAL HABITAT IN THE GUNNISON RIVER, AND EPA STUDY OF PERSONAL CARE PRODUCTS AND PESTICIDES IN GRAND VALLEY WASHES.

Barb Osmundson, U.S. Fish and Wildlife Service, Ecological Services, Grand Junction, Colorado

Part 1: The Aspinall Programmatic Biological Opinion (BO) was finalized in 2010. A Selenium Reduction Program was formed in conjunction with the BO, to implement remediation projects associated with selenium exceedences in the Uncompahgre Project area and downstream (including the Gunnison River between Delta and Grand Junction, CO). The Grand Junction EC staff has been an active member in the Selenium Management Program since 2012, and has been involved in Gunnison Basin Selenium Task Force for over 20 years..

Grand Junction EC staff submitted an off-refuge proposal in 2010 which was accepted for 2011 funding, to determine selenium concentrations in endangered fish in the Gunnison River, as well as surrogate fish species in the Gunnison River. While Colorado Parks & Wildlife and CRFP staff conducted endangered fish population surveys, muscle plug samples were collected for selenium analysis. Results from this selenium study will be used in the new Selenium Management Program (SMP) to determine baseline selenium concentrations and evaluate effectiveness of past, present, and future selenium remediation efforts. Until this study, selenium concentrations in endangered fish in the Gunnison River had not yet been determined. Selenium concentrations in surrogate fish species (roundtail chub, carp, and speckled dace) collected in 2010, 2011, and 2012 are compared to the same species collected back in 1992, to investigate any changes over the last 20 years resulting in part from remediation efforts undertaken thus far by the selenium task force.

Part 2: Beginning in 2009, EPA Region 8 has been supporting the Colorado Water Quality Control Division (WQCD) in the sampling and analyses of pesticides data. In 2009-to present, along with the pesticide analyses, the EPA Region 8 Laboratory analyzed for a suite of pharmaceuticals, personal care products (PPCPs), and waste water indicators. As more is learned about the health and aquatic life effects those parameters have and at what concentrations, the WQCD can address the adoption of new criteria in a meaningful way. The focus of the 2011&12 projects were on the Denver Metro Area streams. During 2013, the study added other project areas, including the Grand Valley. Pesticides are of particular interest because of the Grand Valley's irrigated agricultural drainage into several washes. These washes empty into critical habitat in the 18-mile reach of the Colorado River. The Grand Junction, CO EC staff has been collecting monthly samples from four Grand Valley tributaries from March-November, 2013. Sampling will continue in 2014, hopefully with the addition of more sites. Thus far, results have shown an interesting variety of chemicals, including the presence of the herbicide 2,4D in the tributaries, and an array of pharmaceuticals below wastewater treatment facilities.

RECOVERY PLANS FOR THE FOUR COLORADO RIVER ENDANGERED FISHES RECOVERY PLANNING UPDATE

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Region 6 of the U.S. Fish and Wildlife Service (Service) is responsible for recovery planning of the four Colorado River endangered fishes. The Colorado Pikeminnow Recovery Team was convened November 29, 2012, with 4 face-to-face meetings and 2 webinars held by December 2013. An agency review draft is expected by mid-February 2014. The Recovery Teams for

humpback chub, razorback sucker, and bonytail are expected to be convened individually and sequentially after the agency review draft of the Colorado Pikeminnow Recovery Plan is released.

The following process was used to develop a draft Colorado Pikeminow Recovery Plan:

1. The 2002 Recovery Goals were redrafted into a recovery plan format.
2. Species experts were included on the recovery team to ensure that recovery actions and criteria are consistent with life history.
3. State representatives were included on the recovery team to ensure that recovery actions and criteria rigorously address non-native fish management.
4. A writing team has helped the Service coordinate the recovery planning and ensure continuity among the plans.
5. An agency review draft of the plan will be reviewed by the Service Regional Director and the Solicitor for the Department of the Interior to ensure that this recovery plan is in compliance with the ESA, implementing regulations, and agency policy.

Session 7: Native Fish

RESPONSE OF THE NATIVE FISH COMMUNITIES OF THE YAMPA AND GREEN RIVERS TO NONNATIVE FISHES AND FLOWS

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Mechanical removal of several non-native fish predators has been implemented in several rivers of the Upper Colorado River Basin in an effort to restore once-abundant native fishes. From 2003-2012, we sampled small-bodied fishes in low-velocity habitat in treatment (piscivorous fish removal) and control (no removal) reaches with a variety of gears to assess whether predator removal benefited the native fish community in the Yampa River, Colorado. Through 2007, main channel fish communities were dominated by non-natives, particularly young-of-year (YOY) smallmouth bass. Native fishes were rare in main channel habitat, and were usually present only in isolated pools where smallmouth bass were uncommon. Although still relatively uncommon, higher frequencies of native fishes in main stem samples since 2008 were coincident with increased removal of YOY smallmouth bass, particularly in the treatment reach. Native fish abundance in main channel samples in the control and treatment reaches increased in 2008-2012 and was particularly high in 2011. Higher flows and relatively cool water prevailed in that period, especially in 2011, compared to earlier years. In the warmer and low flow year 2012 and 2013, native fish abundance declined from 2011 levels likely as a result of higher bass abundance and bass had large body size. Positive native fish response since 2008 was likely due to synergistic effects of smallmouth bass removal and return to a higher, more normal hydrologic regime, which delayed bass spawning, and growth and perhaps abundance of smallmouth bass in the Yampa River, Colorado. Those patterns were supported by data from 1980-1984, which also suggested higher native fish abundance in years with higher peak and baseflows.

As part of the native fish response story, we also examined trends for Colorado pikeminnow in the Green River subbasin. Adult Colorado pikeminnow have declined dramatically throughout the Green River subbasin. We examine reasons for those trends including abundance of drifting Coolorado pikeminnow larvae, young of year pikeminnow abundance in backwater habitat, and relationships of those data to flow patterns and nonnative fish abundance. Increased summer baseflow levels in nursery habitat reaches, to moderate levels, was associated with higher abundance of ago-0 pikeminnow in backwaters in autumn in the Green River. Immediate action is needed to arrest declines of adults and increase abundance of young and recruit-sized fish in both the middle and lower Green River.

USE OF COAL CREEK, WHITE RIVER DRAINAGE, CO, BY FLANNELMOUTH AND BLUEHEAD SUCKER.

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Flannelmouth sucker *Catostomus latipinnis* and bluehead sucker *Catostomus discobolus* are native fishes of the Colorado River Basin. Each species has been extirpated from over 50% of their historic range due to negative effects of habitat alteration and establishment of nonnative fishes. Strong populations persist in some river reaches such as the upper White River, Colorado, where those negative effects have been minimal. In general, our research focuses on the distribution, movement, and timing of reproduction of these species relative to streamflow and water temperature patterns in the upper White River, CO. Our presentation summarizes results of tributary use by flannelmouth and bluehead suckers. We captured suckers in Piceance and Coal creeks using fyke nets and implanted each fish with a PIT tag. We recaptured fish using fyke nets and remote RFID PIT tag antennas. Due to restricted flow in Piceance Creek, migrating suckers used only Coal Creek. Fyke net captures documented suckers entering Coal Creek to spawn as it warmed in early May, 2011-2013. Recapture data collected by three remote RFID PIT tag antennas shows that some ripe suckers are returning to Coal Creek the year after tagging, indicating spawning site fidelity. The large pulse of sucker movement into the creek began when the daily average temperature in Coal Creek reached 14° Celsius. Overall, flannelmouth suckers arrived earlier than bluehead suckers and in larger numbers. Antenna data also show that fish immediately leave Coal Creek after they have been trapped and handled. Since fish immediately emigrate after handling, they are not available for subsequent capture, thereby negating our ability to estimate demographic parameters, such as population size and survival. Our data also indicate that tributaries are important for sucker reproduction in the upper White River and protecting and enhancing these habitats should be a priority when considering conservation and management.

NATIVE FISH INVENTORY AND COMMUNITY ASSESSMENT ON THE DOLORES RIVER, UT; AND FUTURE MOVEMENT STUDY USING PASSIVE INSTREAM ANTENNA.

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The Dolores River is a tributary of the Colorado River, approximately 250 mi (402 km) long, in Colorado and Utah. The Dolores River joins the Colorado in Grand County Utah, near the former Dewey Bridge. Declines of roundtail chub *Gila robusta*, flannelmouth sucker *Catostomus latipinnis*, and bluehead sucker *Catostomus discobolus*, (collectively the "three species") are extensive throughout the basin. Declines of the "three species" have been documented in the middle Dolores River, Colorado, from near the town of Dolores downstream to the confluence with the San Miguel River. Major factors to their decline are attributed to reduced streamflows from out-of-basin water diversions, hydrologic changes due to the impoundment of the Dolores River by McPhee Dam, and the subsequent establishment of both warmwater and coldwater non-native fish species. The timing, extent, and purpose of native fish migrations from the Colorado River into the Dolores River and back out is relatively unknown. Furthermore, while "three species" have been a focus of recent research in the Colorado sections of the Dolores River, little studies have been conducted within the Utah portions of the river. The river miles in Utah represents only a small portion of the Dolores River, however its connection to the Colorado River provides the opportunity to study movement of native fish between mainstem and tributary habitats. We conducted two electrofishing trips from the Rio Mesa Center to the Colorado River in 2013. The first trip was in June, while the second trip was in late August (2-3 passes per trip). Our primary objective was to PIT tag native fish for use with the Bureau of Reclamations passive instream antenna (PIA) that was later installed in the Fall of 2013 at the Rio Mesa Center. We also investigated species composition and abundance within this section and made comparisons between the two sample dates. In the future we plan to tag "three species" both within the Colorado River and higher up the Dolores River.

Session 8: Endangered Fish

STEWART LAKE FLOODPLAIN: ROAD TO RAZORBACK SUCKER RECOVERY?

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Reproduction by razorback sucker (*Xyrauchen texanus*) occurs on the ascending limb of the spring hydrograph as an adaptation for entrainment of larvae into highly productive floodplain habitats. Recent findings by Bestgen et al. (2011) indicate that further investigations are needed regarding the timing of Flaming Gorge Dam releases and larval razorback sucker entrainment. Therefore, a study plan to examine larval razorback sucker occurrence in the Green River as a trigger for Flaming Gorge operations was completed in 2012, known as the Larval Trigger Study

Plan. Stewart Lake was one of two wetlands in the Ouray reach of the Green River to entrain flows in 2013 due to drought conditions. Through adaptive management of the wetland floodgate structures, operating a picket weir on the outlet structure and utilizing a secondary water source, wild-spawned razorback suckers were successfully entrained and reared for 54 days. Upon draining, a total of 613 (mean TL = 59 ± 7.7 mm; range = 30-89 mm) razorback sucker (including two unknown sucker spp.) emigrated over a three day period, 592 which were released alive back to the Green River. Given the high level of success at Stewart Lake, even during difficult drought years, the Larval Trigger Study Plan shows great promise for recovery of razorback sucker.

ENDANGERED HUMPBACK CHUB TRANSLOCATIONS TO COLORADO RIVER TRIBUTARIES IN GRAND CANYON NATIONAL PARK

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Historic fish communities in Grand Canyon National Park (GCNP) consisted of eight species, six of which are endemic to the Colorado River Basin. Today, reproducing populations of only four native species occur in GCNP, including humpback chub, *Gila cypha*, which is listed under the Endangered Species Act. The Colorado River in Grand Canyon contains the largest remaining population of humpback chub. Nevertheless, significant threats remain to this population and to other remaining native species, including the presence of non-native fish and parasites, and altered temperature and flow regimes. In addition, the Grand Canyon population spawns in one location, the Little Colorado River, which is threatened by watershed-wide impacts. In accordance with National Park Service native species management policies and mandates (e.g., Organic Act of 1916), GCNP, with the assistance of the Bureau of Reclamation and others, initiated a series of humpback chub translocations in Havasu and Shinumo creeks, both tributaries of the Colorado River, to contribute towards the long-term goals of establishing additional spawning aggregations and/or increasing mainstem aggregations of the humpback chub within the park. After five years of humpback chub translocations, juvenile survival and growth rates are higher or comparable to those rates found for humpback chub inhabiting the Colorado River and Little Colorado River. Emigration remains a concern for long-term success of the projects; however, initial results of an alternative release technique experiment have resulted in reduced emigration immediately following translocations. In Havasu Creek, the presence of individuals in spawning condition and of untagged juvenile humpback chub suggests that reproduction is occurring. Monitoring programs associated with translocations, along with research that examines relationships between native and non-native fish in Bright Angel and Shinumo creeks and fish population modeling will assist managers in planning and adapting fish restoration actions to meet NPS goals.

HUMPBACK CHUB IN CATARACT CANYON

Julie Howard, Utah Division of Wildlife Resources, Moab, Utah

In the upper and lower Colorado River basins there are six distinct humpback chub (*Gila cypha*) populations known to exist in the following areas: Black Rocks, Westwater Canyon,

Desolation/Gray Canyons, Yampa Canyon, Cataract Canyon and Grand Canyon. Of the five sites in the upper basin, Cataract Canyon, below the confluence of the Green and Colorado Rivers, is somewhat unique as it is a very large system with regular high discharge events and flows directly into a large reservoir (Lake Powell). Although intermittent sampling in Cataract Canyon began in 1979, population estimates did not occur until 2003 when three pass mark/recapture sampling was conducted for three consecutive years to obtain annual point estimates for adult humpback (Badame 2008). Population estimates ranged from 273 – 468 humpbacks within the canyon and due to the small size of the population and possible violations of modeling assumptions the monitoring of the population was reduced to one biennial trip to monitor fall catch rate trends. Catch rate trends show that the population remains stable and has shown no significant trend over the last 20 years fluctuating between 0.010 and 0.035 fish per hour. The humpback chub population in Cataract Canyon is important in the larger scheme of things as a potential source population for the eventual re-colonization of reaches downstream of their current range and is also important for the maintenance of genetic diversity among the remaining chubs in the basin.

WAHWEAP: THE UTAH WARM WATER STATE FISH HATCHERY

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The Wahweap State Fish Hatchery is located in Big Water, Utah and was constructed in 1972. It began production in 1974 with the sole purpose of stocking striped bass into Lake Powell.

Some 36 years later Wahweap is an integral component of the Upper Colorado Recovery Program, Virgin River Recovery Program, Least Chub Program, Utah Sportfish Program and Utah Boreal Toad Program. We have 8 fish species on station including bonytail, backup brood stock of razorback sucker, least chub, Virgin River chub, woundfin minnow, channel catfish, wiper, and tiger muskie. Along with one population of boreal toad

As part of the Upper Colorado River Recovery Program we rear bonytail fry received from Dexter National Fish Hatchery, to 250mm and stock 10,000 bonytail annually. In October 2013 Wahweap conducted its yearly PIT-tagging gathering and tagged 15,600 bonytail's that are ready for spring 2014 stocking. This exceeds our stocking quotas by 5,673 for 2014. The tagged bonytail were divided into three lots, for 3 stocking locations. Locations are unknown to date. No fish were stocked in 2013 from Wahweap due to the change of spring stockings instead of fall stockings.

The hatchery currently has 42,000 bonytail's from year class 2010 (26,900 for spring 2014 stocking) and 36,000 from year class 2011. With the high number of adult bonytail's on station, we in turn had a great year for reproduction. With 2012 and 2013 combined year classes we had 143,000 excess fry. In November 2013 we stocked/transferred 97,900 fish to Colorado (CDOT Pond), Arizona (Rocky Mountain Research Station), and Nevada (Lake Mead Fish Hatchery). Wahweap currently has an additional 6 ponds that have not been graded and will add more fry to the 2013 recruitment year that are considered excess. The excess fish will need to be stocked as soon as weather permits.

On September 27th, 2013, 675 razorback suckers were transferred from Ouray as backup brood. Fish averaged 160 – 430mm in length.